15th European Conference on Ecological Restoration

SER EUROPE SOCIETY FOR ECOLOGICAL RESTORATION

UBO Université de Bretagne Occidentale

REVER Réseau d'Échanges et de Valorisation en Écologie de la Restauration

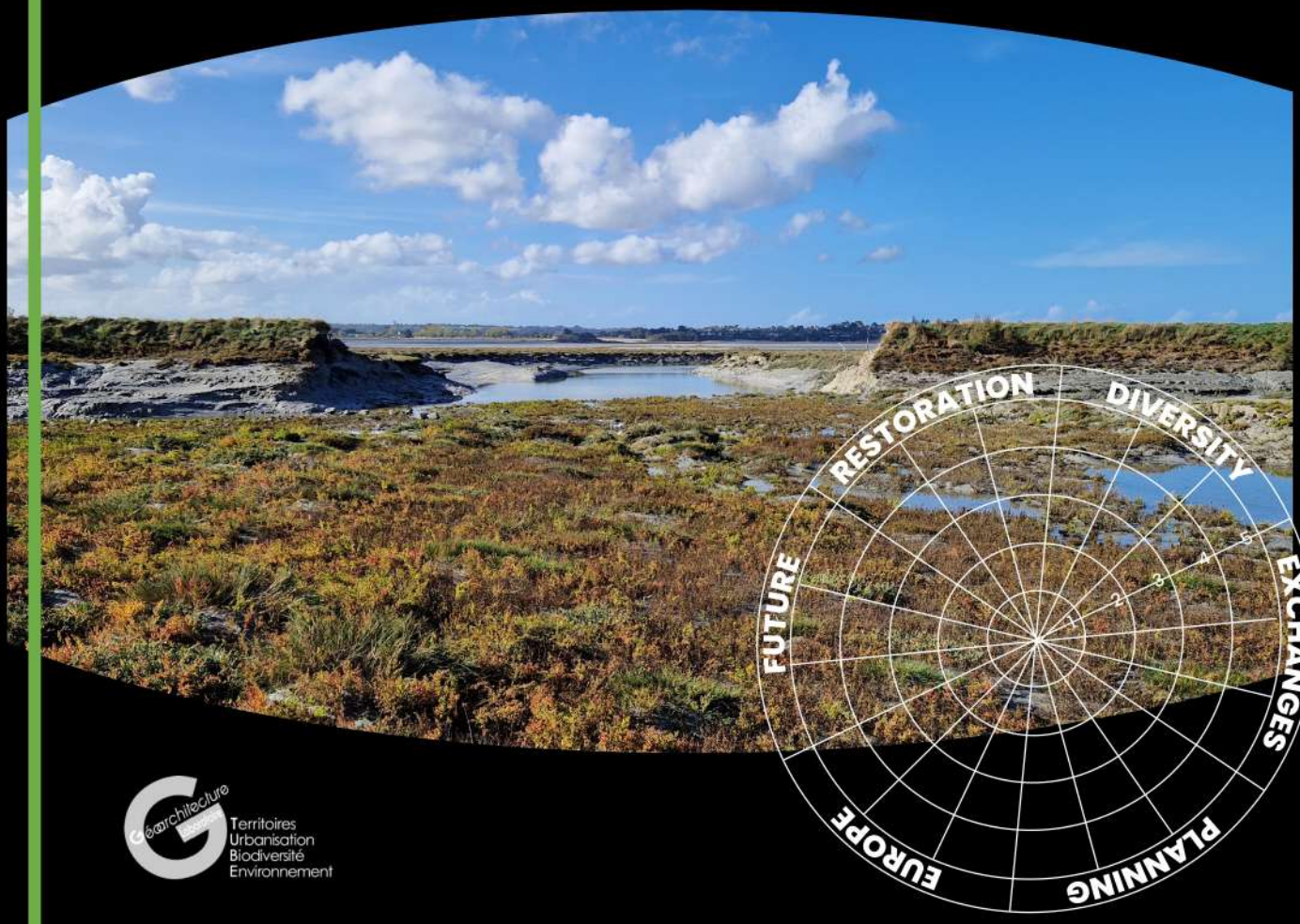
SERE BREST – FRANCE

PLAN FOR TOMORROW RESTORE NOW

24 – 28 AUGUST 2026

FROM LAND TO SEA: ACT TOGETHER, PLAN FOR 2030!

PARTICIPANTS BOOKLET



Territoires Urbanisation Biodiversité Environnement

Co-funded by the European Union

WELCOME ADRESSES

Bienvenue à Brest ! Welcome to Brest !

It is with great pleasure that we welcome you, here in Brest, in Brittany, for this 15th European conference on ecological restoration. It is a pleasure, but it is also a responsibility at the time when ecological restoration must be or should be at the heart of ecological issues. Indeed, beyond the obligations imposed by the European regulation on nature restoration, we see every day the challenge posed by biodiversity loss and climate change. We know that healthy ecosystems are not only better equipped to withstand change, but also provide solutions for regulation and mitigation. Above all, priority should be given to conserving ecosystems both inside and outside protected areas, while also enabling the recovery of those who have been degraded over centuries.

It is by sharing our knowledge and experiences that we can act as effectively as possible. We also need to raise awareness that ecological restoration (and more broadly ecosystem restoration) can meet certain challenges but that sometimes it may be difficult or even impossible to achieve. We must recognize that our activities remain largely unknown to the wider public and even by most of decision makers. thus, we must therefore improve our dialogue with policymakers and stakeholders to ensure that our knowledge informs decision-making.

What better place to exchange than Brittany, where for more than 40 years researchers and practitioners have been working to preserve and restore the diversity of ecosystems, affected by the intensification of agriculture, urbanization, and by over-frequentation long before it became a media topic!

While our discussions address serious issues, they do not exclude conviviality. We hope that your stay in Brest will be marked by moments of exchange and camaraderie, in the finest tradition of the SER-Europe Conferences.

Thank you to SER-Europe for entrusting us with this motivating mission and to REVER for the support provided!

Thank you to the members of the scientific and organization committees for their help and advice!

Thank you to the University of Brest for allowing us to organize this conference and to make its premises available (freely!) and to its technical and administrative staff for their help.

Thank you to the partners and funders without whom we would not have been able to welcome you!

Finally, more than 50 nationalities are present for this conference, so thank you for coming so far in our Far-West!

Sébastien Gallet
Chair of the Organization Committee

Welcome from the Scientific committee

On behalf of the Scientific Committee, I am delighted to welcome you to the 15th European Conference on Ecological Restoration (SERE2026) in Brest, France. This conference brings together researchers, practitioners, policymakers, students, and stakeholders from across Europe and beyond to exchange knowledge, share innovative restoration practices, and strengthen collaborations for the recovery of ecosystems. SERE2026 takes place at a particularly important moment, as ecological restoration is becoming central to addressing biodiversity loss, climate change, and the implementation of the European Nature Restoration agenda.

We warmly thank all authors, reviewers, keynote speakers, session organisers, and participants for their valuable contributions. Your enthusiasm and expertise are what make this conference a vibrant forum for scientific dialogue and collective action.

We hope that the presentations, discussions, workshops, and field experiences throughout the week will inspire new ideas, foster lasting partnerships, and contribute to advancing ecological restoration science and practice across Europe and beyond.

We wish you a stimulating, enjoyable, and memorable conference.

Elise Buisson

Kris Decleer

Chairs of the Scientific Committee

Welcome from the Chair of SER Europe

It is a great pleasure to welcome you to SERE2026 in Brest, under the timely and powerful message: Plan for tomorrow. Restore now. This theme captures both the urgency of restoration action today and the need to plan wisely for tomorrow's conditions and challenges.

Across Europe, the need for ecological restoration has never been clearer. Ecosystem degradation has serious consequences for biodiversity, climate resilience, economies, and wellbeing. At the same time, we know more than ever about how to restore nature. We are building a strong evidence and experience base, and we have a growing community ready to turn knowledge into action.

SERE2026 brings together scientists, practitioners, policymakers, students, land managers, communities, and organisations all around Europe and beyond. As Europe moves from restoration commitments towards implementation, including through National Restoration Plans, let this conference be a place to learn from each other and strengthen the connections that make restoration possible at scale.

Thank you to the organisers, contributors, and participants for making SERE2026 a place of exchange, ambition, and shared purpose.

Aveliina Helm
Chair of the Board, SER Europe

Welcome from the Chair of REVER

REVER and SERE share a common history in France. The 2010 edition of the SER's European Conference was co-organised by founding members of the REVER network, which was then in its infancy. Since then, many REVER members have taken part in international and European conferences, and REVER has established itself as the national hub for ecological restoration : bringing together scientists and practitioners in the field of ecosystem restoration. We are now very proud to be working, with the University of Brest and SER-Europe, to organise the European Conference on Ecological Restoration, and we would like to extend our warmest thanks to the Brest team for this.

We are acutely aware of the efforts required at a time when the effects of climate change and habitat destruction are accelerating. As ecosystem restoration is one of the solutions contributing to biodiversity conservation, it is particularly important that we come together to exchange ideas collectively. The SERE 2026 conference date also coincides with the submission of national restoration plans under the EU Nature Restoration Regulation. Hence the importance of us all coming together to share technical advances, our experiences of implementing restoration projects, our reflections on the concepts and our understanding of ecological, economic or social processes surrounding ecosystem restoration. All these elements will contribute to the successful implementation of restoration plans at national level.

Renaud Jaunatre
Chair of REVER

THE ORGANISERS

The University of Brest, also known as “Université de Bretagne Occidentale” (University of Western Brittany), is located in the far west of France. It is a multidisciplinary university with 23,000 students, and has numerous partnerships with local public and private stakeholders.

The university is involved in a national network and research programmes on ecological restoration, particularly through the "Laboratoire Géoarchitecture" research team, which is the main organiser of the conference.

Since the early 2000s, the **Laboratoire Géoarchitecture** has been conducting research in the field of restoration ecology and has established a broad network of academic and non-academic partners. Its research on restoration and related topics focuses particularly on heathlands, peatlands, wetlands (both continental and coastal), and urban areas.

The European Chapter of the Society for Ecological Restoration (SERE) is a pan-European network of ecological restoration scientists and practitioners, including national organisations and private companies specialising in restoration. For this 15th edition of its biannual conference, SER Europe entrusted the University of Brest with making it a memorable event.

REVER is the French network for ecological restoration and is affiliated with SER-Europe. It brings together various stakeholders in ecological restoration, including researchers, practitioners and students. REVER contributes to the dissemination of information, particularly through organising an annual conference. It also participates in national debates.

THE SERE 2026 CONFERENCE
BENEFITS FROM THE FINANCIAL SUPPORT OF

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SERE2026 COMMITTEES

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Local Organisation Committee

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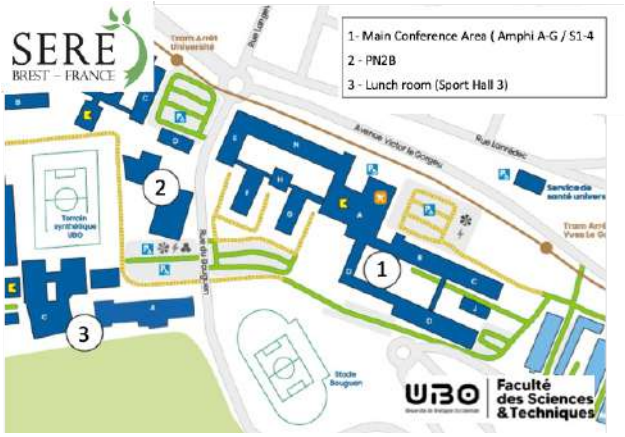
GENERAL AND PRACTICAL INFORMATIONS

VENUE

UNIVERSITY OF BREST
UFR SCIENCES ET TECHNIQUES
6 AVENUE LE GORGEU
BREST

20-25 from town center (place de la Liberté)

TRAMWAY LINE B - Stop at "UNIVERSITY" station (info on bibus.fr)
Bus/tramway tickets will be provided on demand (quantity limited to 300 per day)



All sessions and coffee breaks will take place in buildings A, D and PN2B. The latter is 5 minutes walk from the others, follow the signs!

Lunch will take place in the Sport Hall#3, located 300 m away, 5 to 10 minutes on foot... don't get lost on the way!

LANGUAGE

The official language of the conference is English but translation English/French will be available for all sessions located in Amphi A, including plenary sessions

WIFI ACCESS

Both "eduroam" and "invite" wifi network can freely be used in the whole conference site

REGISTRATION HOURS

We will welcome you for registration on the faculty forecourt:

MONDAY: 17:00-20:00 + Specific registration for courses in the morning TUESDAY 25 : 7:30 - 17:00 WEDESNAY 26 7:00 - 9:30 => before visits departure !	THURSDAY 27 : 7:30 - 17:00 FRIDAY 28 : 7:30 - 10:00

FIELD TRIPS

WEDNESDAY 26TH AUGUST

The 13 proposed visits cover a variety of environments, from urban settings to coastal landscapes. They underline the expertise of Brittany's stakeholders in ecological restoration

Field trips will leave from the University. Departure time will depend on your field trip; some will leave quite early (from 7:15). Don't be late… we won't wait !

SHORT DESCRIPTION

#1 – Carnac Megalithic Site and Quiberon Peninsula: Two Examples of Restoration of Over-Visited Sites in Morbihan (Full Day)

Organized by the University of Brest, in collaboration with the Centre des Monuments Nationaux, Dunes Sauvages de Quiberon, and the Conservatoire du Littoral.

The coastline and iconic Breton sites have been affected by overuse for several decades. Protective measures have therefore long been implemented to enable site restoration. Morbihan is particularly affected due to high tourist pressure.
During this field trip, two contrasting sites will be visited:

- The first is the Carnac megalithic site, world-famous and recently designated as a UNESCO World Heritage Site. Severely degraded in the 1980s, it has undergone restoration measures (through natural regeneration) and monitoring since the 1990s. This restoration was presented at the 2005 SER conference in Zaragoza

- The second site is the "wild coast" of the Quiberon Peninsula. This highly visited site (approximately 2 million visitors per year) is very fragile due to its cliff-top dune ecosystems. After significant degradation, restoration work began in 2007 following the Erika oil spill. The work included both natural regeneration and active restoration (using biodegradable materials). Mixed results led to more recent interventions.

#2 – Restoration of coastal Ecosystem: Ploubalay Polder and the Two Capes (Full Day)

Organized by the University of Brest, in collaboration with the Conservatoire du Littoral, Syndicat des Caps, and the Côtes d'Armor Department.

Due to the diversity of its ecosystems, the coastline of Brittany has been subjected to various types of pressure and degradation, including overuse, urbanisation and poldering. As a result, numerous restoration projects have been implemented over the past decades. Many of these have involved collaboration between researchers and natural area managers, reflecting the strong partnerships characteristic of Brittany.
This field trip will explore a rich section of Brittany's north coast, where a variety of restoration operations have taken place since the mid-1980s. Two types of restoration will be presented, linked to different contexts:
1/ Restoration of over-frequented cliff sites.
Coastal cliff degradation is a major issue in Brittany, as capes are highly attractive due to their striking landscapes and panoramic sea views. In the "Two Capes" area, Cap d'Erquy and Cap Fréhel have experienced high visitor pressure and have undergone restoration, initiated in 1984 for the former and in the early 2000s for the latter (completed in 2019).
2/ Restoration of diked salt marshes (depoldering)
Along the French Atlantic coast, many salt marshes were poldered during the last century, including both large polders (such as in the Mont-Saint-Michel Bay) and smaller ones (a few hectares). Many of these are no longer in use and offer strong restoration potential, as they no longer serve a protective function. The Ploubalay polder, which will be visited, was reconnected to the sea in 2020 through a process of accepted spontaneous depoldering under the ADAPTO LIFE programme, led by the Conservatoire du Littoral.

#3. Ouessant Island: Management and Restoration of Coastal Heathlandsand Grasslands (Full Day)

Organized by the Parc Naturel Régional d'Armorique in collaboration with the University of Brest and CEMO.

The Armorique Regional Natural Park is the State-designated manager of the inhabited terrestrial parts of the Natura 2000 site "Ouessant-Molène." As such, it implements a management strategy aimed at maintaining and restoring habitats in good ecological condition.
The visit will present management actions implemented on the island:

- Restoration of the Bouge Pep landfill
- Study of the dynamics of Ouessant's coastal moors and associated management

#4. Brest Bay: Management Aimed at Restoring Marine and Coastal Environments (Half Day)

Organized by the Parc Naturel Régional d'Armorique, in collaboration with the University of Brest, IFREMER, the National Botanical Conservatory of Brest, and CRC North Brittany.

The Armorique Regional Natural Park is the State-designated manager of the Natura 2000 sites in Brest Bay. It implements a strategy aimed at restoring the marine environment. In partnership with various stakeholders, restoration work has been carried out in this largely marine area and will continue across different marine and coastal habitats.
This field trip will provide an overview of ongoing projects in Brest Bay:

- Study of salt meadows and American spartina (Spartina alterniflora) dynamics, and measures to control invasive species and restore salt meadows, in partnership with the European Institute for Marine Studies and the National Botanical Conservatory of Brest
- Restoration of flat oyster reefs in partnership with IFREMER and the Regional Shellfish Farming Committee
- Removal of waste and abandoned boats from habitats of community interest
- Projects to restore back-shore marshes.

For organizational reasons, the number of participants in this visit will be limited.

#5. Restoration of Peat Bogs and Moorlands by Filling in Drains (Half Day)

Organized by the Parc Naturel Régional d'Armorique, in collaboration with the University of Brest, the PCAM community of communes, and Iroise Marine Natural Park

Visit to peat bogs and moorlands restored as part of the LIFE Landes d'Armorique programme (2021-2025), using drain-filling techniques – methods used and initial results (piezometric monitoring).
These environments were historically degraded by drainage ditches created to facilitate grazing and peat extraction. As these practices have now ceased, the Armorique Regional Natural Park aims to restore the ecological functions of these natural areas (biodiversity, water storage and purification, carbon storage).
The restoration work consists of using excavation and backfilling techniques to completely or partially fill in the drainage ditches (using successive plugs), in order to maximise water retention on site.
Over the duration of the LIFE project (2021–2025), approximately 5.5 km of ditches have been filled in, restoring an area of 54 hectares.
Organized by the Parc Naturel Régional d'Armorique.
For organizational reasons, the number of participants in this visit may be be limited.

#6. Restoration of Coastal Environments on the Crozon Peninsula (Full Day)

The Crozon Peninsula, located to the south of Brest Bay, hosts a wide diversity of ecosystems, particularly coastal environments that have undergone significant changes due to visitor pressure, land abandonment, and marsh management.
During this field trip, three main sites will be visited:

- Pen Hir Cape (Crozon): presentation of conservation and restoration work on a habitat of community interest—devastated moors—at an emblematic site subject to high visitor pressure.
- Aber estuary and maritime marsh (Crozon): from the construction of the first dike in the late 19th century to the development of a management plan (2020), including the removal of the Richet dam (1981), this site illustrates the interaction between human influence and natural dynamics. It was the first depoldering operation implemented in France by the Conservatoire du Littoral.
- Dinan Cape and Kersiguénou (Crozon): landscape and ecological challenges involved in site restoration, highlighting the contribution of landscape-based approaches (large site operations, landscape workshops, photographic observatories, landscape planning tools), depending on available time.

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#7. Night-time Restoration in Brest and Surrounding Areas (Half Day)

Organized by the University of Brest, in collaboration with Brest Metropole

Light pollution is a major disturbance in urban, peri-urban and rural areas, directly and indirectly affecting organisms through disruption of circadian cycles and landscape fragmentation.
Restoring night-time conditions by switching off public lighting or adapting lighting schedules can help re-establish favourable conditions for both nocturnal and diurnal species.
Within the framework of the Interreg Darker Sky project, Brest Métropole implemented two restoration actions aimed at reducing the impact of artificial lighting. These sites (Moulin Blanc and Sainte-Anne) are located along the seafront, near relatively natural valleys that form the boundary of urban area.
Surveys were conducted to assess both disturbance levels (light measurements) and impacts on biodiversity (birds, bats, arthropods, etc.).
One of the sites also underwent soil renaturation.
The visit will present lighting adaptation measures, as well as survey design and methods.

#8. Restoration of the Former Bodonnou Quarries (Half Day)

Organized by Brest Metropole, in collaboration with the National Botanical Conservatory of Brest, Bretagne Vivante, GRETIA and the GMB

The Bodonnou site, located in the municipalities of Plouzané, Guilers and Brest, was until the late 1970s an agro-natural area recognised for its ecological value (ZNIEFF of Kersquivit). From the 1980s, it was exploited for over 30 years for aggregate extraction. In May 2022, the operator transferred this 130-hectare site to Brest Métropole to enable its gradual redevelopment into an ecological area.

Today, the site is gradually regaining a level of naturalness favourable to fauna and flora, with more than 650 animal and plant species recorded. A mosaic of habitats has developed, including ponds, reedbeds, moors, wet meadows, woodlands and scrubland. This remarkable natural area provides important ecological functions (resting, breeding and feeding areas for wildlife).

Naturalist surveys carried out by expert organisations working with Brest Métropole—including the National Botanical Conservatory of Brest, Bretagne Vivante, GRETIA and the Breton Mammal Group (GMB)—confirm the site's high biodiversity value at both local and departmental levels, particularly for birdlife.

#9. Wetland and Stream Restoration in South Finistère (Full Day)

Organized by the Forum des Marais Atlantiques, in collaboration with Ouesco collectivity, the Finistère Department, and the Water Agency.

The first two sites, visited in the morning, will offer an insight into the typical restoration actions carried out by watershed managers in Brittany. The first project involves the removal of a pond located on a stream in order to restore the stream's ecological continuity and its lateral connectivity with the surrounding wetland. The second site focuses on the remeandering of a small river to restore both river and riparian wetland functionality.

The lunch break will take place at the Maison de la Baie d'Audierne, an emblematic site that plays a central role in the conservation of the coastal marshes, now included within the Baie d'Audierne Ramsar Site.

In the afternoon, we will visit an ambitious restoration project involving both a wetland and a stream on the site of a former fish farm. The project required the removal of nearly 10,000 m³ of landfill material, the recreation of wetland soils following the excavation of the concrete fish ponds, the reprofiling of 180 m of river channel, and the installation of a new fish pass. The site, owned by the Departmental Council of Finistère, is now open to the public and managed through goat grazing.

A short introductory presentation by the Loire-Bretagne Water Agency at the beginning of the day will provide an overview of wetland and river restoration policies and funding mechanisms in France.

#10. Wetland and River Restoration in North Finistère Valleys (Full Day)

Organized by the Forum des Marais Atlantiques, in collaboration with SM Horn, and An Dour.

This field trip will explore three restoration sites aimed at restoring valley-bottom functionality by reinstating rivers in their former beds and restoring associated wetlands.

The first site (Moulin du Châtel) is located on the former site of a poultry farm that occupied the full width of the valley. The river had been buried under 4 metres of landfill on which the farm buildings were constructed. The project involved removing all buildings and landfill and restoring the natural valley-bottom profile, including wetlands and the river in its original course.

If time permits, a smaller wetland restoration site—achieved through the removal of a former mill pond—will be visited on the way to the third site.

The final site focuses on restoring ecological continuity of the Pontplaincoat River through ten restoration actions, two of which will be presented. This valley was affected by tin mining until the 1970s, leading to pond creation and displacement of the river from its natural bed. Restoration involved backfilling the excavated ponds to restore the valley profile and return the river to its original course.

A brief introduction by the Loire-Bretagne Water Agency will present restoration policies and funding mechanisms in France.

#11. Form Moorland to Peatland: restoration in the Cragou-Vergam Reserve (Full Day)

Organized by Bretagne Vivante - RNR Cragou-Vergam

The Cragou-Vergam Regional Nature Reserve comprises wet heathlands and sloping peat bogs hosting exceptional biodiversity.

Hen harriers and Montagu's harriers share the skies with nightjars and Dartford warblers, while adders coexist with marsh fritillary butterflies and amphibious voles. The vegetation is also highly diverse, including several species of sphagnum moss, both species of sundew, and the rare marsh malaxis.

Bretagne Vivante has managed this site for 40 years. To maintain these open habitats, grazing is carried out using Nantes cattle and Dartmoor ponies in wetter areas, while mowing by farmers and Bretagne Vivante helps maintain drier heathlands.

In 2010, 27 hectares of Sitka spruce and Vancouver fir plantation were restored to heathland following clear-cutting. These areas now provide valuable habitats for birdlife, even if the heathland remains atypical.

The day will include a tour of the reserve and its most emblematic landscapes, followed by a visit to the restored areas after a picnic break.

#12. The Ria d'Étel - Marshes restoration (Full Day)

Organized by the University of Brest, the SMRE and the Conservatoire du Littoral.

The Ria d'Étel, located in Morbihan, is a coastal estuary shaped by the inland penetration of the sea. It is particularly known for its salt marshes, which create distinctive landscapes between land and sea.
These marshes host a wide range of wildlife, including birds, fish and specialised plant species. They also play a key ecological role in water filtration and coastal protection.
The visit will focus on two main aspects:

- Restoration of marshes invaded by Baccharis halimifolia
- A major restoration project at the Étang de Saint-Jean

Some marshes have been invaded by Baccharis halimifolia, an invasive alien species native to North America. Local stakeholders have developed a management strategy combining citizen involvement and improved ecological knowledge, leading to the restoration of large marsh areas.
The Étang de Saint-Jean, owned by the Conservatoire du Littoral, has been the focus of a major ecological restoration project aimed at restoring habitats and improving ecological functions for wildlife. Restoration actions included improving water circulation and rehabilitating surrounding wetlands and marshes.
Today, the site is regaining its role as a key ecosystem for birds, fish and other species.
A supplementary stop will allow to discover the last natural station of *Eryngium viviparum* in Brittany and restoration and management operation implemented in its favour.

#13. From Ex Situ Conservation to Ecological Restoration: the National Botanical Conservatory of Brest (Half Day)

Organized by the National Botanical Conservatory of Brest.

The National Botanical Conservatory of Brest (CBN Brest), founded in 1975 in the Stang-Alar valley, is the first institution in the world established with the exclusive primary mission of conserving threatened plants. Nestled within a 30-hectare valley on the outskirts of Brest, it holds living collections of over 1,800 threatened species, with a particular focus on the flora of Brittany, Macaronesia, and other Atlantic island ecosystems.
This half-day field trip will explore the role of ex situ conservation in supporting ecological restoration, through three complementary perspectives:

- Living collections and seed banking: presentation of the conservation strategy underpinning the CBN's collections, from wild collection protocols to long-term storage, and how these resources are mobilised for reintroduction and reinforcement programmes in the field.
- From the garden to the field: case studies illustrating the continuum between ex situ conservation and in situ restoration, including partnerships with land managers across Brittany and beyond. Selected examples will cover coastal flora, wetland species, and moorland plants.
- Restoration of the Stang-Alar valley itself: the garden's own grounds provide a living laboratory, with ongoing work to restore and manage habitats representative of Finistère's natural heritage, including wet heathlands, valley-bottom wetlands, and Atlantic woodland.

For organizational reasons, the number of participants in this visit will be limited.

THE CONFERENCE PROGRAMME

TUESDAY 25TH AUGUST

9h											
9h45	From Law to Landscapes: Making the EU Nature Restoration Regulation Work Angelika Rubin										
10h15	Restoration finance: sorting fact from fiction Sophus zum Ermgassen										
10h45	Coffee Break										
11h30	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B	S1	S2	S4
	The legal labyrinth of restoration laws for ecologists	SS17 - From small to great lakes restoration	Enabling restoration: Socioeconomic perspectives	SS19 - Assisted restoration of extractive sites across Europe	SS24 - Mini-Forest in Europe: The Miyawaki method from science to society		SS10 - Analyzing the socio-economic impacts of deep-sea marine ecosystem restoration	SS26 – Darker Sky - Restoring night conditions for biodiversity.	W8 - The role of the arts in restoration		W4 - People-centered seascape approach to conservation

LUNCH BREAK

14:00	Re-joining the blue dots – how understanding seascape connectivity has profound implications for marine restoration policy and implementation. Joanne Preston										
14:45	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B	S1	S2	S4
	SS3 - Towards coherent and effective national restoration plans in the European Union	SS16 - Restoration of river connectivity: from theory to practice	Grassland, prairie, steppe and other open ecosystem restoration	SS19 - Part #2	Forest restoration	Urban environment restoration	SS7 - Seascape restoration: From policy ambition to system-scale action	SS28 – WET HORIZONS: Policy-ready evidence and tools for Europe's wetland restoration	W6 - Teach to Restore, Restore to Teach: exchanging innovative pedagogical practices in Ecological Restoration	SS6 - Integrating best practice guidelines, community engagement and digital tools for measuring restoration outcomes in mangrove restoration	W9 - Are we barking up the wrong tree? Possibilities of social-ecological visions and references in ecological restoration
16:15	Coffee Break – poster Session #1										
17:00	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B		S2	S4
	SS3 - Part #2	SS16 - Part #2	Grassland, prairie, steppe and other open ecosystem restoration Part #2	SS20 - Extraction sites as biodiversity hotspots for research and training	Forest restoration Part #2	SS8 – Turning shared knowledge into collective action: Regional strategies for nature restoration	SS7 - Part #2	SS25 - Native seed quality for ecological restoration		SS6 – Part #2	W15 - From resistance to ownership: Building multi-stakeholder support for urban and peri-urban wetland

THURSDAY 27TH AUGUST										
8:45	The Third Edition of the International Principles & Standards for the Practice of Ecological Restoration - updates and relevance George Gann									
9:30	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B	S1-3	S4
	SS2- Supporting NRR implementation through restoration knowledge hubs: Governance, monitoring and practice	SS18 - Wetland restoration for climate mitigation, biodiversity recovery and ecosystem services	SS12 - Rewilding across gradients: choosing pathways and measuring success in a changing world	SS21 - Using Nature-Based Solutions for restoring soils of urban, industrial, traffic, mining and military areas: Sweet dreams or promising tools?	SS11 - Assisted Natural Regeneration across ecosystems: global applications, project design, and measurable outcomes	SS6 - Integrating best practice guidelines, community engagement and digital tools for measuring restoration outcomes in mangrove restoration	SS9 – Deep-sea ecosystem restoration	Education and training	W17 - Reading the language of disturbance	W3 - The Coordination Crisis: Overcoming collaborative barriers to enhance ecosystem restoration
11:00	Coffee Break – Poster Session #2									
11:45	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B	S1-S3	S4
	SS2 Part #2	SS18 Part #2	SS12 Part #2	SS21 Part #2	Landscape scale and corridor restoration	SS6 - Part #2	SS9 – Part #2	SS23 – Digital educational tools for skills development in ecological restoration	W11 - Assisted Natural Regeneration in carbon markets: field evidence, methodological integrity, and scaling pathways from tropical Latin America	W3 Part #2

LUNCH

14:30	It is time to step up a gear to meet the ambitious targets of the EU Nature Restoration Law ! Renaud Jaunatre									
15:15	SER-Europe General Meeting									
16:15	Coffee Break – Poster Session #3									
17:00	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B	S1-S3	S4
	SS4 - National Hubs and Networks for Ecological Restoration	Peatland restoration	Grassland, prairie, steppe and other open ecosystem restoration Part #3	SS27 – Advancing knowledge and cooperation in the Mediterranean region throughout the UN Decade on Ecosystem Restoration	SS14 - Connectivity in large-scale restoration	New tools and technologies	Marine restoration	Standards and indicators	W14 - Design It Yourself (DIY) - building resilient coastal ecosystems with biodegradable and biobased restoration techniques/kick start agents.	W1 - The role of botanic gardens and plant conservation organizations supporting successful implementation of the EU NRR

FRIDAY 28TH AUGUST										
8:45	Restoration in wartime: mission impossible? Bohdan Prots									
9:30	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B	S1-S3	S4
	Policy frameworks for restoration, NRR and beyond	Wetland restoration	SS13 - Grazing as a conservation and restoration tool	SS22 - Combining energy transition with the restoration of biodiversity, ecosystem services and ecological functions	SS15 - From spatial modelling to large-scale strategies	Animal species & restoration	Marine restoration Part #2	Sociological perspectives and stakeholder involvement	W16 - Monitoring long-term restoration effects on biodiversity at a national scale	W5 - Coastal Challenge: A serious video game for coastal resilience decision-making
11:00	Coffee Break – POSTER SESSION #4									
11:45	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B	S1-S3	S4
	Policy frameworks for restoration, NRR and beyond Part #2	Coastal restoration	SS13 - Part #2	SS22 - Part #2	SS15 - Part #2	Animal species & restoration Part #2	Marine restoration Part #3	Sociological perspectives and stakeholder involvement Part #2	W7 - Restoration philosophy and the is-ought dilemma	
	LUNCH									
14:30	Amphi A	Amphi B	Amphi C	Amphi D	Amphi E	Amphi F	Amphi G	PN2B	S1-S3	S4
	Nature Restoration Regulation, from planning to implementation	Invasive species & restoration	Agricultural landscape restoration	Ecosystem functioning	SS29 - Restoring Europe's Nature - Lessons and inspiration from LIFE projects across Europe	W2 - Implementing the Nature Restoration Law in marine environments	Marine restoration Part #4			W10 - Implementing the Recovery Wheel for evaluation and consultation
16:15	CLOSING CEREMONY									

Monday, August 24, 2026

TIME	EVENT
10:00 - 17:00	Courses - Hours to be precised
19:00 - 21:00	Icebreaking Party - Faculty of sciences - For your arrival in Brest (or after a hard day of courses or meeting), we will welcome you at the conference place, in the Faculty of sciences, with some drinks, food and music !

Tuesday, August 25, 2026

TIME	EVENT
09:00 - 09:45	Opening Ceremony - Welcoming speach from University, REVER, SERE, Ministry of Ecology and OFB
09:45 - 10:15	From Law to Landscapes: Making the EU Nature Restoration Regulation Work (Amphi A) - Angelika Rubin
10:15 - 10:45	Restoration finance: sorting fact from fiction (Amphi A) - Sophus zu Ermgassen
10:45 - 11:15	Break (Hall)
11:15 - 12:45	SS1 - The legal labyrinth of restoration laws for ecologists (Amphi A) - Alexandra Aragão & An Cliquet
11:15 - 11:30	› The legal devil is in the linguistic details. Deciphering the effects of word choice in the European NRR. - *Alexandra Aragao, University of Coimbra Institute for Legal Research*
11:30 - 12:00	› When Nature Sues Back: How the European Court of Justice Interprets EU Restoration Obligations - *An Cliquet, Ghent University*
11:45 - 12:00	› Agriculture as driver, problem or solution? The paradoxes of the Nature Restoration Regulation - *Enrico Mezzacapo, Scuola Universitaria Superiore Sant'Anna = Sant'Anna School of Advanced Studies [Pisa]*
12:00 - 12:15	› The Borderless Sea vs. Bordered Law: Legal Hurdles in Transboundary Marine Restoration and Tools to Overcome Them - *Elisa Cavallin, Ghent University, Hasselt University*
12:15 - 11:30	› Forest ecosystem restoration between ambition and exemptions - *Jessica Stubenrauch, Helmholtz Zentrum für Umweltforschung = Helmholtz Centre for Environmental Research*
11:15 - 12:45	Enabling restoration: Socioeconomic perspectives (Amphi C) - Sophus zu Ermgassen
11:15 - 11:30	› Biological vs socio-economic drivers of restoration site placement in Europe - *Valerio Mezzanotte, Department of Biology and Biotechnologies 'Charles Darwin', Sapienza University of Rome*
11:30 - 11:45	› The « Climatization » of peatlands: actors, timelines and funding - *Lucas Lopez Dovina, Laboratoire Interdisciplinaire Sciences, Innovations, Sociétés*
11:45 - 12:00	› Unlocking Finance for Coastal and Marine Ecosystem Restoration: Key Challenges and Opportunities - *Clara Rodrigues, WavEC Offshore Renewables - Wenting Chen, Norwegian Institute for Water Research*
12:00 - 12:15	› Cost effectiveness of European lake restoration: Insights from the EU project FutureLakes - *KAMERGI Najla, UT-SEMIDE*
12:15 - 12:30	› Sustainable Grazing and Value Addition: A Pathway to Conservation on the Iori Plateau - *Aleksandre Mikeladze, SABUKO – Society for Nature Conservation*
12:30 - 12:45	› Socioeconomic benefits of restoration - the case of Croatia's NRP - *Gábor Figeczky, International Union for Conservation of Nature, European Regional Office*
11:15 - 12:45	SS19 - Assisted restoration of extractive sites across Europe: what works where? (Amphi D) - Klara Řehounková & Miguel Ballesteros Jiménez
11:15 - 11:17	› Introduction - *Session Organiser, sere2026*
11:17 - 11:28	› Reference vs. target vegetation for post-mining sites across Europe - *Karel Prach, University of South Bohemia [České Budějovice, Czechia]*
11:28 - 11:39	› Twenty-Five Years of Grassland Restoration in Mined-Land: Lessons from a Spontaneous and Assisted Site Recovery Experiment - *Anita Kirmer, Anhalt University of Applied Sciences*
11:39 - 11:50	› Support for restoration in mineral extraction sites: Expanding efforts beyond existing protected habitats - *Klara Rehounkova, University of South Bohemia in Ceske Budejovice, Faculty of Science*
11:50 - 12:01	› How do plant and animal communities recover after sand extraction in Lanzarote? - *Aurora Torres, Universidad de Alicante*
12:01 - 12:12	› Natural recovery of vegetation and soil fungi in Mediterranean abandoned cobblestone quarries (Spain) - *Josu Alday, Universitat de Lleida*

TIME	EVENT
12:12 - 12:23	› Recovery of specialised flora in extractive sites: Restoration approaches and outcomes - *Miguel Ballesteros, Department of Botany, Faculty of Science, University of South Bohemia, Branišovská 1760, 37005 České Budějovice, Czech Republic*
12:23 - 12:34	› Assisted establishment of pioneers after metal mining: does silicification matter? - *Nina Nikolic, Institute for Multidisciplinary Research, University of Belgrade*
11:15 - 12:45	SS24 - Mini-Forests in Europe: The Miyawaki method from science to society (Amphi E) - Kazue Fujiwara, Grey Coupland & Muralee Thummarukudy
11:15 - 11:30	› Potential of European Natural Vegetation for Creation of Stable Amenity Mini-Forests - *Elgene Box, University of Georgia*
11:30 - 11:45	› The Miyawaki method for NGOs: constraints, purpose, and opportunities - How can NGOs engage diverse communities through a comprehensive and distinctive approach? How can it be made sustainable in terms of funding and community engagement ?
11:45 - 12:00	› The Miyawaki method as a scientific approach: early evidence, measurable impacts, and methodological challenges across region - *Vito Emanuele Cambria, Botanical Garden of Rome, Department of Environmental Biology, Sapienza University of Rome*
12:00 - 12:15	› The Miyawaki method for outdoor education - *Daan Bleichrodt, Institute for Environmental Education (IVN)*
12:15 - 12:30	› The Miyawaki method as landscaping. - *Adrian Wong, SUGi*
12:30 - 12:45	› Miyawaki method forest makers as a business endeavor. Can mini forests contribute to the restoration economy? - *Nicolas De Brabandere, Urban Forest Europe*
11:15 - 12:45	SS10 - Analyzing the socio-economic impacts of deep-sea marine ecosystem restoration (Amphi G) - Stephen Hynes & Silvia Gallegati
11:15 - 11:30	› A Global Bayesian Meta-Analysis of the Value of Deep-Sea Ecosystem Services - *Benjamin Blanc, UMI SOURCE*
11:30 - 11:45	› A cost-benefit analysis tool for deep-sea habitat restoration decision making - *Daniel Norton, University of Galway*
11:45 - 12:00	› How much are Cold-Water Corals worth? Public Willingness to Pay for Deep-Sea Restoration in Italy - *Silvia Gallegati, Polytechnic University of Marche, Ancona*
12:00 - 12:15	› Willingness to pay for improving ecological status of the Oslofjord - *Wenting Chen, Norwegian Institute for Water Research*
12:15 - 12:30	› Estimating the value of deep-sea ecosystem restoration in Irish waters using a stated preference approach - *Stephen Hynes, University of Galway*
11:15 - 12:45	SS26 – Darker Sky - Restoring night condition for biodiversity. (PN2B) - Sébastien Gallet
11:15 - 12:45	› Restoring night condition for biodiversity (Darker Sky) - *Sébastien Gallet, Laboratoire Géoarchitecture*
11:15 - 12:45	W13 - Counting what counts: Building consensus toward a shared, universal set of restoration outcome measures in the Anthropocene (S4) - Stephen Murphy, Holly Jones & Jens-Christian Svenning
11:15 - 12:45	W8 - The role of the arts in restoration (S1-S3)
11:15 - 12:45	SS17 - From small to great lakes restoration: an overview to promote links and collaborations (Amphi B) - Marlène Rolan-Meynard & Althaea Pangaud
11:30 - 11:45	› Dealing with invasive species in water bodies restoration projects: manipulation of environmental filters and use of priority effects. - *Isabelle Combroux, Université de Strasbourg*
11:45 - 12:00	› Divergent plant recovery along a hydrological gradient in restored Sphagnum-dominated peatland pools - *Laura Catalina Riano Pena - Department of Plant Sciences, Peatland Ecology Research Group (PERG) and Centre for Northern Studies (CEN), Université Laval, 2480 Hochelaga Boulevard, Quebec City, Quebec G1V 0A6, Canada*
12:00 - 12:15	› Improving monitoring: Reaching a compromise to better assess restoration outcomes in small lakes - *Althaea Pangaud, Pôle Écla - écosystèmes lacustres, Risques, Ecosystèmes, Vulnérabilité, Environnement, Résilience*
12:15 - 11:30	› Assessing policy coherence in European lake restoration: Insights from Lake Vesijärvi (Finland) and Lake Karla (Greece) - *KAMERGI Najla, UT-SEMIDE*
12:30 - 12:45	› Biomanipulation and restoration : an alpine lake case study - *Marlene Rolan-Meynard, Aix-Marseille Univ., INRAE, RECOVER, 13182 Aix en Provence, France, Pôle Écla - écosystèmes lacustres, Service EcoAqua, Direction de la Recherche et de l'Appui Scientifique, French Biodiversity Agency, France*
11:15 - 12:45	W4 - People-centered seascape approach to conservation
12:45 - 14:00	Lunch (Sport Hall 3)
14:00 - 14:45	Re-joining the blue dots – how understanding seascape connectivity has profound implications for marine restoration policy and implementation. (Amphi A) - Joanne Preston
14:45 - 16:15	SS3 - Towards coherent and effective national restoration plans in the European Union (Amphi A) - Aurélien Carré

TIME	EVENT
15:00 - 15:15	› National Restoration Plans: a unified framework for guiding nature recovery in Europe - *Néstor Fernandez, German Centre for Integrative Biodiversity Research*
15:15 - 15:30	› Landscape-ecological system analysis (LESA): a practical site-based approach to achieve good condition of habitat types and step-wise set an FRA rooted in local evidence - *Kris DECLEER, Research Institute for Nature and Forest*
15:30 - 15:45	› Advances in mapping habitat condition and favourable reference areas for restoration - *Jordi CORTINA-SEGARRA, Department of Ecology and IMEM, University of Alicante*
16:00 - 16:15	› Habitat mapping, assessment of habitat condition and restoration priorities: scientific knowledge supporting ecosystem restoration planning in Hungary - *Melinda Halassy, HUN-REN Centre for Ecological Research*
14:45 - 16:15	SS16 - Restoration of river connectivity: from theory to practice (Amphi B) - Andrea Mandarino, Maria Alp & Ivan Bernez
14:45 - 15:00	› Free Flowing Rivers – Lateral Data Deficiencies - up, over and out - *Brian Coghlan, Inland Fisheries Ireland*
15:00 - 15:15	› Restoring the Sélune river continuity: how big dam removal reshapes habitats, biodiversity, and landscape uses - *Laura Soissons, Station marine Dinard, Dynamique et durabilité des écosystèmes : de la source à l'océan*
15:15 - 15:30	› Reconnection alters hydro-ecological interactions in a backwater-dominated side channel of Po River - *Edoardo Cavallini, University of Parma - Department of Chemistry, Life Sciences and Environmental Sustainability [Parco Area delle Scienze 11/A, 43124 Parma, Italy]*
15:30 - 15:45	› Wetland restoration within the river corridor: the case of the Po Piemontese Natural Park (NW Italy) - *Andrea Mandarino, Department of Earth, Environment and Life Sciences, University of Genova, Management Authority of the Po Piemontese Protected Areas*
15:45 - 16:00	› Restoration of floodplain forest in the Elbe floodplain near Lenzen in Northern Germany - *Jochen Purps, Office for regional development and ecological planning (Bad Wilsnack)*
16:00 - 16:15	› Lessons learnt on river restoration projects from the demonstration sites network: understanding unfinished projects - *Rémy Rivière, AgroParisTech Innovation, Palaiseau, France, AgroParisTech, Montpellier, France*
14:45 - 16:15	Grassland, prairie, steppe and other open ecosystem restoration (Amphi C) - Christel Vidaller
14:45 - 15:00	› Assessing both sides of pastoralism from degradation to restoration : toward an experimental observatory - *Emmanuel Corcket, Institut méditerranéen de biodiversité et d'écologie marine et continentale - Christel Vidaller, Institut méditerranéen de biodiversité et d'écologie marine et continentale*
15:00 - 15:15	› Rewilding with Przewalski's horses in Mongolia can contribute to fight against desertification - *Clémentine Mutillod, Avignon Université, Laboratoire des EcoSystèmes et des Sociétés en Montagne*
15:15 - 15:30	› Neigh-borhood conservation: The potential of north Swedish horse pastures to support plant and butterfly populations - *Therese Lofroth, Swedish University of Agricultural Sciences = Sveriges lantbruksuniversitet*
15:30 - 15:45	› Comparison of soil seed bank in sand grasslands grazed by cattle or sheep - *Gergely Kovacsics-Vári, University of Debrecen, Department of Ecology*
15:45 - 16:00	› Restoration of steppe, dry and seasonally wet grasslands based on monitoring of species of Community interest and other target species distributions in north-western Bohemia. - *Roman Hamersky, Roman Hamersky*
16:00 - 16:15	› Setting Up an Advisory Service for Semi-Natural Grassland Owners: Practices from Estonia - *Kaidi Silm, Estonian Ministry of Climate, LIFE IP project "ForEst&FarmLand*
14:45 - 16:15	SS19 - Assisted restoration of extractive sites across Europe: what works where? (Amphi D) - Klara Řehounková & Miguel Ballesteros Jiménez
14:45 - 14:56	› Why do we undertake assisted restoration? - *Andy Duncan, Heidelberg Materials UK - Alexandra Hemming, Heidelberg Materials UK - Georgina Watkins, Heidelberg Materials UK*
14:56 - 15:07	› Post-quarrying restoration as an opportunity for protected plant species: the Secil-Outão case study - *Alice Nunes, CE3C - Centre for Ecology, Evolution and Environmental Changes & CHANGE – Global Change and Sustainability Institute, Departamento de Biologia, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal*
15:07 - 15:18	› Spreading harvester ant refuse piles enhances restoration success of dry Mediterranean grasslands after soil rehabilitation in former quarries and intensive cultivated sites - *Thierry Dutoit, Institut méditerranéen de biodiversité et d\'écologie marine et continentale*
15:18 - 15:29	› Turning sandpits into opportunities: Designing post-mining habitats for orchid conservation - *András Kelemen, Department of Ecology, University of Szeged, 'Lendület' Seed Ecology Research Group, Institute of Ecology and Botany, HUN-REN Centre for Ecological Research, Vácrátót, Hungary*
15:29 - 15:40	› Tailoring quarry rehabilitation across Imerys sites in Europe: Site-specific successes and barriers - *Lina Robles, Imerys - Santiago Forero, Patrinat*
15:40 - 15:45	› Landscape regeneration in natural spaces: Protected Landscape of the Mining Basins (Asturias, Spain) - *Ignacio J. Diaz-Maroto, University of Santiago de Compostela, Campus Terra s/n, E-27002 Lugo, Spain*

TIME	EVENT
15:45 - 15:56	› Applying non-expert Biodiversity Net Impact Assessment tools to an actively restored quarry: Are we getting the right answers or asking the wrong questions? - *Pedro A. Salgueiro, MED – Mediterranean Institute for Agriculture, Environment, and Development & CHANGE – Global Change and Sustainability Institute, IIFA – Institute for Advanced Studies and Research, University of Évora, Portugal*
14:45 - 16:15	Forest restoration (Amphi E)
14:45 - 15:00	› A Practical Framework for Monitoring the Impact of Forest Restoration - *Rowana Walton, UN Environment Programme World Conservation Monitoring Centre*
15:00 - 15:15	› Assessment of forest restoration projects: efficiency of cutting-edge techniques and comprehensive analysis - *Jenny Vivian, Forest Research Institute, University of the Sunshine Coast*
15:15 - 15:30	› Upscaling Post-Fire Fuel Structure from Plot to Ecosystem Scale for Restoration Monitoring: A Multi-Source Remote Sensing Framework for the Monte Morrone Massif (Italy) - *LORENZA SPIRITO, Università degli studi della Tuscia = Tuscia University [Viterbo]*
15:30 - 15:45	› Active forest restoration to promote oak regeneration: deadwood manipulation as innovative NBS - *Francesco Sforza, Department of Land, Environment, Agriculture and Forestry [Padua]*
15:45 - 16:00	› Conservation-oriented restoration triggers rapid biodiversity responses across multiple taxonomic groups in oak forests - *Réka Aszalós, HUN-REN Centre for Ecological Research, Institute of Ecology and Botany*
16:00 - 16:15	› Pathways to recovery: state-and-transition models for birch woodland restoration - *Ása L. Aradóttir, Agricultural University of Iceland*
14:45 - 16:15	Urban environment restoration (Amphi F)
14:45 - 15:00	› Night Restoration in Urban University Campuses: A Simulation-Based Engineering Approach for YTU Davutpaşa - *Kerem Açıkbaş, Yildiz Technical University*
15:00 - 15:15	› Reducing light pollution in Central Europe: early insights from transnational pilot actions on technical interventions, biodiversity monitoring, and community engagement - *Marta Polizzi, UNESCO Chair on Sustainable Management of Conservation Areas, CUAS – Carinthia University of Applied Sciences*
15:15 - 15:30	› Restoring nature in cities - *Gwendoline GRANDIN, Agence regionale de la biodiversité en Ile-de-France*
15:30 - 15:45	› Nature-Based Solutions for Climate Adaptation in Urban Coastal Areas: Integrating Remote Sensing and Vulnerability Assessment for Targeted Green Space Restoration - *Petar Petrov, University of Forestry, Sofia, Bulgaria*
15:45 - 16:00	› Strengthening Urban Biodiversity through Harit Mini Forests in Indian Cities - *Ravi Kumar Sharma, HCLFoundation, 3rd Floor, Corporate Towers, HCL Technology Hub, Plot No, 3A, Sector 126, Noida, Uttar Pradesh 201313*
16:00 - 16:15	› From mowing regimes to mindsets in UrbanLIFEcircles project: lessons from urban biodiversity restoration in Tartu, Riga and Aarhus - *Merle Karro-Kalberg, Institute of Ecology and Earth Sciences, University of Tartu*
14:45 - 16:15	SS7 - Seascape restoration: From policy ambition to system-scale action (Amphi G) - Sahar Stevenson-Jones, Joanne Preston, Philine zu Ermgassen, R.J. Lilley, Berry Mulligan & Wietse van de Werf
14:45 - 16:15	› Seascape Restoration: From Policy Ambition to System-Scale Action - *Sahar Stevenson-Jones, SER-Europe - Joanne Preston, University of Portsmouth - Wietse Van de Werf, Sea Ranger Service*
14:50 - 15:05	› The marine ecological Recovery Wheel and 5 Star System for temperate seas - *Geraldina Signa - Department of Earth and Marine Sciences (DiSTeM), University of Palermo, National Inter-University Consortium for Marine Sciences (CoNISMa), Rome*
15:05 - 15:17	› State of the world's saltmarshes - *Angus Garbutt, UK Centre for Ecology & Hydrology*
15:17 - 15:29	› The REBORN Project - *Richard. J. Lilley, European Seagrass Restoration Alliance*
15:29 - 15:41	› Restorative aquaculture for the safeguard of Ostrea edulis in southern Brittany - *Martin Perrot, Seaboost*
15:41 - 15:53	› Early ecological trajectories and barriers to recovery following kelp loss in Sussex, UK - *Sahar Stevenson-Jones, SER-Europe*
15:53 - 16:05	› REDRESS: Restoration of Deep-sea habitats to Rebuild European Seas - *Cristina Gambi, Polytechnic University of Marche, Ancona*
14:45 - 16:15	SS28 – WET HORIZONS: Policy-ready evidence and tools for Europe's wetland restoration (PN2B) - Shubiao Wu & Lorenzo Pugliese
14:45 - 16:15	W9 - Are we barking up the wrong tree? Possibilities of social-ecological visions and references in ecological restoration (S4) - Niclas Ruppert
14:45 - 16:15	W6 - Teach to Restore, Restore to Teach: exchanging innovative pedagogical practices in Ecological Restoration (S1-S3) - Patricia María Rodríguez González, Bruna Paolinelli Reis & Marine Jacq
14:45 - 16:15	SS6 - Integrating best practice guidelines, community engagement and digital tools for measuring restoration outcomes in mangrove restoration (S1-S3) - Nessrine Alzahlawi, Benjamin Christ & Dominic Wodehouse
15:00 - 15:15	› Integrating best practice guidelines, community engagement and digital tools for measuring restoration outcomes in mangrove restoration - *Nessrine Alzahlawi, Global Mangrove Alliance*

TIME	EVENT
15:15 - 15:45	› Study cases - *Session Organizer*
16:15 - 17:00	Coffee break - Poster Session #1 (Hall)
17:00 - 18:30	SS3 - Towards coherent and effective national restoration plans in the European Union (Amphi A) - Aurélien Carré
17:00 - 17:15	› Current situation for Article 4 implementation in France, and strategies to fill knowledge gaps on habitat condition and favourable reference areas - *Aurélien Carré, PatriNat - Idaline Laigle, PatriNat*
17:15 - 17:30	› Development of Habitat Action Plans in Latvia – Experience, Challenges and Results. - *Sandra Ikauniece, Nature Conservation Agency*
17:30 - 17:45	› How much semi-natural grassland is enough? Setting spatial priorities for conservation in a national context - *Liis Kasari-Toussaint, Institute of Ecology and Earth Sciences, University of Tartu, J. Liivi st. 2, Tartu, 50409, Estonia*
17:45 - 18:00	› Quantifying Restoration Needs in Finland's Raised Bogs and Aapa Mires under the EU Nature Restoration Regulation - *Antti Sallinen, Finnish Environment Institute*
18:00 - 18:15	› From a national plan to regional implementation: The case of the Grote Beek Watershed, Netherlands - *Theo Van der Sluis, Wageningen Environmental Research*
17:00 - 18:30	SS16 - Restoration of river connectivity: from theory to practice (Amphi B) - Andrea Mandarino, Maria Alp & Ivan Bernez
17:00 - 17:15	› Auto-regeneration of spontaneous pioneer plant communities of former gravel pits: restoration on the Dordogne river's floodplain - LIFE Nature Dordogne Project, France - *Baptiste POTET, Etablissement Public Territorial du Bassin de la Dordogne - EPIDOR (FRANCE)*
17:15 - 17:30	› From invasion to restoration: Case studies on mapping, control and monitoring of invasive alien flora in international basin of tagus river (Spain & Portugal) under the project LIFE Alnus Taejo. - *Ribeiro Sílvia, MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute. Departamento de Paisagem, Ambiente e Ordenamento, Escola de Ciências e Tecnologia, Universidade de Évora, Portugal.*
17:30 - 17:45	› How effective is floodplain restoration in enhancing aquatic biodiversity in running waters? - *Evelyne Tales, INRAE UR HYCAR, Antony*
17:45 - 18:00	› Methodological approaches to the successful restoration of urban streams - *Henriette John, Leibniz Institute of Ecological Urban and Regional Development*
18:00 - 18:15	› The Challenges of Restoring Urban Streams: The Case of Poznań - *Karol Mrozik, Poznań Univesrsity of Life Sciences*
18:15 - 18:30	› Solutions to flooding of the Estepona River in the urban center of Bakio (BIZKAIA, SPAIN) - *Paola Sangalli, Sangalli Coronel y Asociados SL/ EFIB*
17:00 - 18:30	Grassland, prairie, steppe and other open ecosystem restoration (Amphi C)
17:00 - 17:15	› Habitat suitability modelling of Rhinanthus angustifolius and R. minor as a decision-support tool for grassland restoration - *Solvita Rūsiņa, University of Latvia*
17:15 - 17:30	› Dispersal and clonal growth of mediterranean grasses: implication for recolonisation and resilience of semi-natural grasslands - *Baptiste Lecoq, IMBE Avignon Université, Aix-Marseille Université, IRD, CNRS, Institut Méditerranéen de Biodiversité et Ecologie, Marseille, Avignon, France*
17:30 - 17:45	› Promising biocontrol effects of a native hemiparasitic plant against a non-native C4 grass - *Hábenczyus Alida Anna, MTA-SZTE 'Momentum' Applied Ecology Research Group, University of Szeged*
17:45 - 18:00	› Restoring plant diversity in lowland grasslands: Efficacy of different seed addition and soil preparation methods - *Slodowicz Daniel, HoloSem, Division of Conservation Biology, Institute of Ecology and Evolution, University of Bern*
18:00 - 18:15	› Restoration of species rich grasslands on former arable land require restoration of healthy soil processes - *Ondřej Mudrák, Institute for Environmental Studies, Faculty of Science, Charles University, Prague, Czech Republic*
18:15 - 18:30	› Tales of the Trojan Mouse and Leapfrog Ecology: Long-term experience for making sustainable species-rich grassland and other habits in the public realm - *Richard Scott, Eden Project, National Wildflower Centre*
17:00 - 18:30	SS20 - Extraction sites as biodiversity hotspots for research and training (Amphi D) - Shane Sparg & Thomas Sebrechts
17:00 - 17:15	› Extractive sites restoration; the role of research in driving ecological restoration at scale and focused on biodiversity recovery - *Nigel Symes, BirdLife International - Europe and Central Asia*
17:15 - 17:30	› Pollinators attracting researchers to quarries - *Ludovic Pero, Heidelberg Materials France - Laurent Nachbaur, Heidelberg Materials France - Matthias Rohaut, Heidelberg Materials France*
17:30 - 17:45	› Strengthening community engagement and biodiversity through the Quarry Life Award - *Jops Hill, Heidelberg Materials UK*
17:45 - 18:00	› Using extractive sites to stimulate research on biodiversity restoration and management best practice - *Shane Sparg, Heidelberg Materials Group*
17:00 - 18:30	Forest restoration (Amphi E)

TIME	EVENT
17:00 - 17:15	› Survival of tree seedlings protected with recycled plastic tube shelters across contrasting environments in spain. - *Sandra Martin-Gomez, Grupo Sylvestris S.L., Universidad Politécnica de Madrid*
17:15 - 17:30	› The trees between the woods: Do trees outside of woodland facilitate plant colonisation to woodland creation sites in agricultural landscapes? - *Madeline Richards, Biological and Environmental Sciences [Stirling]*
17:30 - 17:45	› Transformation to climate resilient forests - *Ines Imbert, European Institute For Energy Research*
17:45 - 18:00	› Assessing the impact of land-use history on soil carbon sequestration and nitrogen across Mediterranean and temperate forests
18:00 - 18:15	› From Carbon to Biodiversity: Evaluating Agroforestry as a Nature-based Solution for Sustainable Forest Development - *Garima Mishra, Biodiversity and Climate Change Division*
18:15 - 18:30	› Progress towards Restoration of the Longterm Regreening Program in the Smelter-damaged Landscape of Sudbury Ontario, Canada - *Peter BECKETT, Laurentian University*
17:00 - 18:30	SS8 – Turning shared knowledge into collective action: Regional strategies for nature restoration (Amphi F) - Lasse Kurvinen & Petra Kääriä
17:00 - 17:15	› A call for harmonization of regional data sets allowing species distribution modelling and integrated impact assessments to better support Baltic Sea restoration planning - *Javier Lenzi, Jade University of Applied Sciences*
17:15 - 17:30	› Inventory of monitoring activities in Baltic Sea Marine Protected Areas - *Georg Martin, Tartu Ülikool = University of Tartu [Estonie]*
17:45 - 18:00	› Regional cooperation in large-scale restoration implementation - *Petra Kääriä, Baltic Marine Environment Protection Commission (HELCOM)*
17:45 - 18:00	› Regional Restoration Action Plan and Toolbox - *Lasse Kurvinen, Metsähallitus*
17:00 - 18:30	SS7 - Seascape restoration: From policy ambition to system-scale action (Amphi G) - Sahar Stevenson-Jones, Joanne Preston, Philine zu Ermgassen, R.J. Lilley, Berry Mulligan & Wietse van de Werf
17:00 - 18:30	› Seascape Restoration: From Policy Ambition to System-Scale Action - *Sahar Stevenson-Jones, SER-Europe - Joanne Preston, University of Portsmouth - Wietse Van de Werf, Sea Ranger Service*
17:00 - 17:13	› Rebuilding Sejerø Bay: From habitat loss and fisheries collapse to seascape-scale restoration - *Henrike Semmler Le, WWF-Denmark*
17:13 - 17:29	› Rosalie (Blue Marine) - *Rosalie Blue Marine, Blue marine Foundation*
17:29 - 17:48	› On the power of alliances in implementing change in marine ecosystem restoration - *Richard. J. Lilley, European Seagrass Restoration Alliance - Sahar Stevenson-Jones, Society for Ecological Restoration*
17:00 - 18:30	SS25 - Native seed quality for ecological restoration (PN2B) - Simone Pedrini, Nancy Shaw & Sandra Malaval
17:00 - 17:15	› High-quality seeds for a Europe ready for ecological restoration - *sandra malaval, Fédération des conservatoires botaniques nationaux, European native seed producers association*
17:15 - 17:30	› Building a native seed quality framework in Australia: from X-ray detection software to batch traceability systems - *Simone Pedrini, School of Molecular and Life Science, Curtin University, Bentley, WA*
17:30 - 17:45	› Seed quality of native seed produced through direct multi-species harvest - *Slodowicz Daniel, HoloSem*
17:45 - 18:00	› Towards effective ecosystem restoration in Kenya: Addressing gaps in quality native seed systems - *Victor Otieno, Centre for Ecosystem Restoration Kenya, Jomo Kenyatta University of Agriculture & Technology*
18:00 - 18:15	› Nationwide assessment of genetic variation of grassland plants as basis for the development of generalized seed transfer zones - The German RegioDiv project - *Walter Durka, Helmholtz Centre for Environmental Research GmbH - UFZ*
17:00 - 18:30	W15 - From resistance to ownership: Building multi-stakeholder support for urban and peri-urban wetland (S4) - Evelien Marlier & Sarah Verhaegen
17:00 - 18:00	W6 - Teach to Restore, Restore to Teach: exchanging innovative pedagogical practices in Ecological Restoration (S1-S3) - Patricia María Rodríguez González, Bruna Paolinelli Reis & Marine Jacq
17:00 - 18:30	SS6 - Integrating best practice guidelines, community engagement and digital tools for measuring restoration outcomes in mangrove restoration (S1-S3) - Nessrine Alzahlawi, Benjamin Christ & Dominic Wodehouse
17:00 - 17:15	› Blending community engagement and automated monitoring to report wildlife and biodiversity trends in mangrove restoration - *Rod Connolly, Global Wetlands Program (GLOW), School of Environment and Science, Griffith University*
17:15 - 17:30	› Urgent need to simplify restoration monitoring protocols in the tropics to track project goals better - *Manaswi Raghurama, University of Minnesota [Twin Cities]*
17:30 - 18:00	› Working groups - *Organizer Session*
18:30 - 19:30	Free time !
19:30 - 21:00	Welcome Party (Town Hall)

Wednesday, August 26, 2026

TIME	EVENT
07:30 - 18:00	Field Trip - See Field trip description for specific departure and return times
19:30 - 19:30	Conference Diner (on reservation) (Les Capucins)

Thursday, August 27, 2026

TIME	EVENT
08:45 - 09:30	The Third Edition of the International Principles & Standards for the Practice of Ecological Restoration - updates and relevance (Amphi A) - George Gann
09:30 - 11:00	SS2 - Supporting NRR implementation through restoration knowledge hubs: Governance, monitoring and practice. (Amphi A) - Vito Emanuele Cambria, Katalin Török & Tuula Larmola
09:30 - 09:45	› From ambition to implementation: Mapping urgent restoration knowledge gaps and missing tools - *Mario Brauns, Helmholtz Center for Environmental Research – UFZ*
09:45 - 10:00	› Rethinking Adaptive Management for ecosystem restoration: from blueprint ideals to real-world practice - *Twan Stoffers, Wageningen University and Research [Wageningen], Leibniz Institute of Freshwater Ecology and Inland Fisheries*
10:00 - 10:15	› Urgent need for EU regulation and nursery accreditation schemes to prevent spread of introduced invasive plant pathogens via restoration activities - *Thomas Jung, Mendel University in Brno, Department of Forest Protection and Wildlife Management, Phytophthora Research Centre*
10:15 - 10:30	› Challenges in securing native seeds for sustainable nature restoration - *Török Katalin, HUN-REN Centre for Ecological Research, Institute of Ecology and Botany, Restoration Ecology Research Group,*
10:30 - 10:45	› What knowledge and tools are needed most urgently for restoring wetlands and inland waters? - *Tuula Larmola, Natural Resources Institute Finland*
09:30 - 11:00	SS12 - Rewilding across gradients: choosing pathways and measuring success in a changing world (Amphi C) - Vona Meleder, Arndt Hampe & Giorgio Alberti
09:45 - 10:00	› Rewilding trajectories in coastal wetlands: assessing ecosystem recovery across intertidal habitats at Ria de Aveiro (Portugal) - *Ana I. Sousa, ECOMARE, CESAM - Centre for Environmental and Marine Research, Department of Biology, University of Aveiro, Aveiro, Portugal*
10:00 - 10:15	› Where does soil organic carbon accumulate following rewilding of abandoned lands across europe? - *Domagoj Gajski, Department of Forest Ecology, Landscape Research Institute, Lidická 25/27, 602 00, Brno, Czech Republic*
10:15 - 10:30	› Soil carbon sequestration across rewilded abandoned lands in Europe: A review of environmental gradients and research needs - *Mohammad Tahsin Karimi Nezhad, Department of Forest Ecology, Landscape Research Institute, Lidická 25/27, 602 00, Brno, Czech Republic*
10:30 - 10:45	› Defining Marine Rewilding: Progress in unifying concepts and creating pathways for marine rewilding - *Charlotte Hopkins, University of Hull*
10:45 - 11:00	› Community-Driven Approaches to Rewilding: Navigating the Space Between Intervention and Non-Intervention - *Fabio Azzolin, University of Padua*
09:30 - 11:00	SS21 - Using Nature-Based Solutions for restoring soils of urban, industrial, traffic, mining and military areas: Sweet dreams or promising tools? (Amphi D) - Thierry Dutoit, Isabelle Laffont-Schwob & Grégory Mahy
09:30 - 09:45	› Forgotten heroes in restoration: Bryophytes in post coal mining sites and their potential to facilitate succession on phytotoxic spoil heaps - *Lucie Fatková, Institute for Environmental Studies, Faculty of Science, Charles University, Prague, Czech Republic*
09:45 - 10:00	› Potential of Cuban native Morella as actinorhizal nurse plants for restoring nickel mine soils - *Daniela Aliaga-Ramos, National Botanical Garden, University of Havana*
10:00 - 10:15	› From abandoned mines to resilient ecosystems: ecological restoration and phytostabilization in Eastern Morocco (Upper Moulouya mining districts) - *BAGHDAD Bouamar, Higher School of Architecture of Casablanca*
10:15 - 10:30	› Combined effects of metal contamination and drought on vegetation recovery in a Mediterranean brownfield: insights from a long-term phytostabilisation trial - *Isabelle Laffont-Schwob, Laboratoire Population-Environnement-Développement, UMR 151*
10:30 - 10:45	› Soil Contamination and Biodiversity Impacts After Ammunition Destruction: A Phytostabilization Perspective - *Emma Leone, Institut Méditerranéen de Biodiversité et d'Ecologie (IMBE)*
10:45 - 11:00	› Can sealed soils recover? Decompaction effects on soil biodiversity after 50 years of soil sealing and prospects for nature-based restoration - *Lison DEFOSSE, Avignon Université*
09:30 - 11:00	SS11 - Assisted Natural Regeneration across ecosystems: global applications, project design, and measurable outcomes (Amphi E) - Olivia Gumbel

TIME	EVENT
09:30 - 09:45	› Assisted Natural Regeneration: Four Pathways to Restore Ecosystems - *Robin Chazdon, Tropical Forests and People Research Centre*
09:45 - 10:00	› Assisted Natural Regeneration Verification: Lessons on Project Design, Governance and Measurable Outcomes from Global Practice - *Mateo Cariño Fraisse, Senior Ecosystem Restoration Manager, Preferred by Nature*
10:00 - 10:15	› Scaling Assisted Natural Regeneration in Europe: financing models, species diversification, and multi-scale monitoring - *Sasha PINOT, Reforest'Action*
10:15 - 10:30	› Monitoring Assisted Natural Regeneration at scale in Tanzania: what works, what doesn't - *Njamasi Chiwanga, LEAD Foundation*
10:30 - 10:45	› Applying Mobile Technology and Process Rigor in a Large-Scale Implementation of Assisted Natural Regeneration in Azuero, Panama - *Ignacio Araya, Ponterra Americas*
10:45 - 11:00	› Early stage results and adaptive management in an implementation of Assisted Natural Regeneration in Antioquia, Colombia - *Eliana Molina, Université du Québec en Abitibi-Témiscamingue*
09:30 - 11:00	SS9 – Deep-sea ecosystem restoration (Amphi G) - Critina Gambi, Jordi Grinyo, Federica Foglini, Simonetta Fraschetti & Roberto Danovaro
09:30 - 09:45	› Deep Sea Ecosystem Restoration: lesson learned from REDRESS - *Cristina Gambi, Polytechnic University of Marche, Ancona*
09:45 - 10:00	› Deep-sea restoration – implementation of a pilot site in coral reef habitats of the Guilvinec canyon, Bay of Biscay - *Franck Lartaud, LECOB*
10:00 - 10:15	› Restoring the European Atlantic cold-water coral reef belt - *Anthony Grehan, University of Galway*
10:15 - 10:30	› Towards scalable cost-effective restoration of deep-sea coral gardens in the North Atlantic Ocean - *Marina Carreiro Silva, Institute of Marine Sciences - OKEANOS, University of the Azores*
10:30 - 10:45	› The one that unites all: Helping nature support humans – The role of discourses in the governance of deep-sea restoration in the European Seas - *Johanna Buerkert, Environmental Policy Group, Wageningen University - Laura M Trovão, University of Aveiro*
10:45 - 11:00	› Restoration of Mediterranean cold-water coral habitats in the Bari and Dohrn canyons: outcomes and lessons from LIFE DREAM project - *Giorgio Castellan, National Research Council, Institute of Marine Sciences CNR-ISMAR, Bologna, Italy*
09:30 - 11:00	Education and training (PN2B) - Emanuela Weidlich
09:30 - 09:45	› An educational program to train professionals in dryland restoration - *Celia De Llanos, Universidad de Alicante*
09:45 - 10:00	› An Innovative Methodology for Creating a Global MOOC on Dryland Restoration Using Artificial Intelligence and Expert Networks - *Ismael García-Sánchez, Department of Ecology, University of Alicante, San Vicente del Raspeig, Alicante, Spain*
10:00 - 10:15	› Linking Sustainability, Conservation Biology and Restoration Ecology in Higher Education - *Emanuela W. A. Weidlich, Leuphana University Lueneburg*
09:30 - 11:00	W17 - Reading the language of disturbance (S1-S3) - Darcy O'Connor & Harry Munt
09:30 - 11:00	W3 - The Coordination Crisis: Overcoming collaborative barriers to enhance ecosystem restoration (S4) - Benjamin Christ, Sahar Stevenson-Jones & Amielle DeWan
09:30 - 11:00	SS18 - Wetland restoration for climate mitigation, biodiversity recovery and ecosystem services (Amphi B) - Liisa Ukonmaanaho, Tuula Larmola, Kaido Soosaar, Ana Lillebø & Francisco Lopèz
09:30 - 09:45	› What are the hot topics in peatland restoration research in the light of the EU Nature Restoration Law? - *Anne Tolvanen, Natural Resources Institute Finland*
09:45 - 10:00	› 45 years of monitoring of fen meadow restoration in the Valley of the Zuidleie (Belgium): lessons learnt. - *Kris DECLEER, Research Institute for Nature and Forest*
10:00 - 10:15	› Peatland CO2 and CH4 under climate change and alternative restoration options: process-based simulations - *Ville Tuominen, Finnish Meteorological Institute*
10:15 - 10:30	› From degradation to recovery: peatland restoration recorded in a Holocene sequence from Central Romania - *Agnes Ruskal, a Department of Geology and Research Centre for Integrated Geological Studies, Babeş-Bolyai University, M. Kogălniceanu str, 1, 400084 Cluj-Napoca, Romania*
10:30 - 10:45	› CO2 balances of rewetted and natural peatlands in the Soomaa mire complex, Estonia - *Salla A. M. Tenhovirta, Institute of Ecology and Earth Sciences [Tartu], Finnish Meteorological Institute, Climate System Research*
10:45 - 11:00	› Tracking changes in peatland recovery using remote sensing: lessons from Ireland - *Catherine Farrell, Trinity College Dublin*
11:00 - 11:45	Coffee break - Poster Session #2 (Hall)
11:45 - 13:15	SS2 - Supporting NRR implementation through restoration knowledge hubs: Governance, monitoring and practice. (Amphi A) - Vito Emanuele Cambria, Katalin Török & Tuula Larmola
11:45 - 12:00	› EO4Nature: A national Earth observation portal for planning and monitoring nature-based restoration in Germany - *Michael Förster, LUP*

TIME	EVENT
12:00 - 12:15	› Science-based ecosystem restoration to inform the Nature Restoration Plan in Portugal - *Alice Nunes, cE3c - Centre for Ecology, Evolution and Environmental Changes & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências, Universidade de Lisboa, Portugal*
12:15 - 12:30	› The Danish Centre for Nature Restoration: An example of a national hub for marine nature restoration - *Jens Kjerulf Petersen, DTU Aqua, National Institute of Aquatic Resources*
12:30 - 12:45	› From heterogeneous marine coastal and estuarine restoration practices to decision support: insights from the Littorex platform and perspectives for large-scale implementation through LIFE Adapto+ - *Cécile Capderrey, Bureau de Recherches Géologiques et Minières (BRGM) - Isabelle Gailhard-Rocher, Office français de la biodiversité*
12:45 - 13:00	› From Barriers to Enablers: Reforming Regulatory Frameworks for Coral Reef Restoration - *Rowana Walton, UN Environment Programme World Conservation Monitoring Centre*
11:45 - 13:15	SS12 - Rewilding across gradients: choosing pathways and measuring success in a changing world (Amphi C) - Vona Meleder, Arndt Hampe & Giorgio Alberti
11:45 - 12:00	› Exploring rewilding pathways for Mediterranean landscapes under increasing wildfire and invasion pressure - *Ricardo Ceia, BIOPOLIS Program in Genomics, Biodiversity and Land Planning,Campus Vairão, Centre in Biodiversity and Genetic Resources (CIBIO/InBIO), University of Porto*
12:00 - 12:15	› A systematic review and metanalysis of nature's contributions to people by rewilding - *Alba Lázaro, Estación Biológica de Doñana (EBD-CSIC), Biodiversité, Gènes & Communautés*
12:15 - 12:30	› Indicators of Climate-Smart Rewilding - *Magali Weissgerber, Martin-Luther-Universität Halle Wittenberg - Martin-Luther-University Halle Wittenberg, German Centre for Integrative Biodiversity Research*
12:30 - 12:45	› Lessons learned from seven years of monitoring landscape-scale restoration across Europe - *Nancy Ockendon, Endangered Landscapes & Seascapes Programme*
11:45 - 13:15	SS21 - Using Nature-Based Solutions for restoring soils of urban, industrial, traffic, mining and military areas: Sweet dreams or promising tools? (Amphi D) - Thierry Dutoit, Isabelle Laffont-Schwob & Grégory Mahy
11:45 - 12:00	› From soil transfer to vegetation trajectories: 15 years of experimental restoration in a Mediterranean sub-steppic ecosystem - *Adeline BULOT, UMR IMBE-Institut Méditerranéen de Biodiversité et Ecologie, Avignon, UMR BAGAP-Biodiversité AGroécologie Aménagement du Paysage - Thierry Dutoit, UMR IMBE-Institut Méditerranéen de Biodiversité et Ecologie, Avignon*
12:00 - 12:15	› Soil rehabilitation and establishment methods drive greater reintroduction success of two dominant plants in highly degraded dry grasslands than their provenance - *Laureane Delacour, Institut méditerranéen de biodiversité et d'écologie marine et continentale, Etude et Compréhension de la biodiversité*
12:15 - 12:30	› Unpredictable beginnings: contingency and environmental filtering shape early plant communities in urban brownfields - *Justine Martoglio, Gembloux AgrobioTech*
12:30 - 12:45	› Spontaneous succession under soil and landscape constraints: dispersal filtering and urban species pools shape brownfield true bugs communities - *Chloé Dagnelie, Gembloux AgrobioTech*
12:45 - 13:00	› Riparian Zone Ecological Restoration in the Kerr Brook Watershed, New Brunswick testing novel techniques - *John Major, Natural Resources Canada*
13:00 - 13:15	› Soil and Water Bioengineering aplied to Linear infrastructures - *Paola Sangalli, Sangalli Coronel y Asociados SL/ EFIB*
11:45 - 13:15	Landscape scale and corridor restoration (Amphi E)
11:45 - 12:00	› Holistic approach in ecological restoration – what does that entail?
12:00 - 12:15	› A Realistic Multi-Criteria Approach for Conservation Prioritization in Fragmented Mediterranean Mountain Landscapes - *Marianne Fahed, Holy-Spirit University of Kaslik [Jounieh] / Université Saint-Esprit de Kaslik - Nabil Nemer, Holy-Spirit University of Kaslik [Jounieh] / Université Saint-Esprit de Kaslik - Mohamed Islem Bouacha, Université Ibn Khaldoun de Tiaret = University of Tiaret - Carla Khater, National Council for Scientific Research = Conseil national de la recherche scientifique du Liban [Lebanon]*
12:15 - 12:30	› Mapping social-ecological archetypes to guide woody perennial restoration decisions - *Yiyi Zhang, Faculty of Forestry [Vancouver]*
12:30 - 12:45	› Applying UAS technology to restoration of fire-prone forests - *Peter Fule, Peter Fule, Institut méditerranéen de biodiversité et d\'écologie marine et continentale, Nothern Arizona University, School of Forestry*
12:45 - 13:00	› Biomonitoring the Klamath River Basin Restoration: From Bees to Stakeholder Actions - *Félix Bribosia, BeeOdiversity*
13:00 - 13:15	› How protected areas connectivity modeling for current times and in the future can support restoration actions prioritization - *Léa Suarez, Patrimoine naturel*
11:45 - 13:15	SS9 – Deep-sea ecosystem restoration (Amphi G) - Critina Gambi, Jordi Grinyo, Federica Foglini, Simonetta Fraschetti & Roberto Danovaro
11:45 - 12:00	› Advancing Deep-Sea and Mesophotic Habitat Restoration: Lessons from LIFE ECOREST - *Jordi Grinyo, Institute of Marine Sciences / Institut de Ciències del Mar [Barcelona]*
12:00 - 12:15	› Benthic Community Response to Alcyonium palmatum Restoration: A Time-Lapse Comparison of Transplant and Control Sites on the Catalan Shelf - *Federico M. Gigli, Royal Netherlands Institute for Sea Research*

TIME	EVENT
12:15 - 12:30	› Development of novel techniques for the active restoration of Pennatulacean assemblages in soft-bottom habitats. - *Fabiola Maria Cecchini, Institute of Marine Science*
12:30 - 12:45	› Scaling Up Sponge Restoration in Mesophotic and Deep-Sea Ecosystems: From Experimental Trials to Operational Implementation
12:45 - 13:00	› Assessing active restoration effects on epibenthic motile assemblages in shelf environments: an experimental approach - *Sofia Faramelli, Institut de Ciències del Mar (ICM-CSIC)*
13:00 - 13:15	› Early ecological responses of bentho-demersal communities to new Fishery No-Take Zones in the NW Mediterranean: evidence of passive restoration
11:45 - 13:15	W3 - The Coordination Crisis: Overcoming collaborative barriers to enhance ecosystem restoration (S4) - Benjamin Christ, Sahar Stevenson-Jones & Amielle DeWan
11:45 - 13:15	W11 - Assisted Natural Regeneration in carbon markets: field evidence, methodological integrity, and scaling pathways from tropical Latin America (S1-S3) - Olivia Gumbel & Eliana Molina
11:45 - 13:15	SS23 – Digital educational tools for skills development in ecological restoration (PN2B) - Ryan E. Campbell, Fátima Gigante & Patricia María Rodríguez González
11:45 - 13:15	SS18 - Wetland restoration for climate mitigation, biodiversity recovery and ecosystem services (Amphi B) - Liisa Ukonmaanaho, Tuula Larmola, Kaido Soosaar, Ana Lillebø & Francisco Lopèz
11:45 - 12:00	› Mitigation potential of greenhouse gas emissions from boreal peatlands under different management and restoration regimes - *Tuula Larmola, Natural Resources Institute Finland*
12:00 - 12:15	› Seasonal variability in CO_2 and CH_4 fluxes for a restored saltmarsh chronosequence - *Charlotte M. Worrall, University of Essex*
12:15 - 12:30	› Seed-enriched sand nourishments on muddy substrate, to restore seagrass meadows in Loch Craignish, Scotland - *Roosmarijn Van Zummeren, Van Oord Dredging and Marine Contractors*
12:30 - 12:45	› Citizen and Landowner Perceptions of Wetland Restoration Across Europe: Insights from Large-Scale Surveys - *Emmi Haltia, Natural Resources Institute Finland*
12:45 - 13:00	› Unlocking Peatland Rewetting in Fragmented Agricultural Landscapes: Governance Barriers and Boundary-Organization Functions in Brandenburg, Germany - *Karoline Hemminger, Leibniz Centre for Agricultural Landscape Research (ZALF)*
13:00 - 13:15	› Restoring for biodiversity: Connecting hydrology and arthropod communities - *Peter Hambäck, Department of Ecology, Environment and Plant Sciences (DEEP), Stockholm University*
13:15 - 14:30	Lunch (Sport Hall 3)
14:30 - 15:15	It is time to step up a gear to meet the ambitious targets of the EU Nature Restoration Law ! (Amphi A) - Renaud Jaunatre
15:15 - 16:15	SER-Europe General Meeting - Presentation of The European Chapter of the International Society for Ecological Restoration, its activities and projects.
16:15 - 17:15	Coffee break - Poster Session #3 (Hall)
17:15 - 18:45	SS4 - National Hubs and Networks for Ecological Restoration (Amphi A) - Morgan Eleanor Harris, Vito Emanuele Cambria & Eleonora Ciscato
17:15 - 17:30	› RIRE as a Bottom-up National Restoration Hub Supporting Italy's National Restoration Plan - *Vito Emanuele Cambria, Botanical Garden of Rome, Department of Environmental Biology, Sapienza University of Rome - Eleonora Ciscato, Italian Network on Ecological Restoration - Marcello De Vitis, Botanic Gardens Conservation International - Rodolfo Gentili, Department of Earth and Environmental Sciences, University of Milano-Bicocca - Morgan Harris, Department of Law, University of Roma Tre*
17:30 - 17:45	› REVER, the French restoration network that dream of bringing all stakeholders together for ecological restoration - *Renaud Jaunatre, LESSEM*
17:45 - 18:00	› The Need for Ecological Restoration Guidance in Practice for the UK and Ireland - *Tim Graham, CIEEM ER SIG and RSK Wilding*
18:00 - 18:15	› From Data to Action: Establishing an eLTER European Restoration Hub to Inform Policy and Practice - *Bruna Paolinelli Reis, Centre for Ecology, Evolution and Environmental Changes*
18:15 - 18:30	› National Mission Ocean Hubs for scaling out restoration solutions - *Ida Beathe Øverjordet, SINTEF Ocean AS*
17:15 - 18:45	Peatland restoration (Amphi B)
17:15 - 17:30	› Habitat restoration, wildfire resistance and resilience in cool, humid temperate ecosystems - *Rob Hughes, Royal Society for the Protection of Birds*
17:30 - 17:45	› Hierarchical environmental filters govern alternative vegetation trajectories in peatlands restored by the moss layer transfer technique - *Gwendal Breton, Department of Plant Sciences, Peatland Ecology Research Group (PERG) and Centre for Northern Studies (CEN), Université Laval, 2480 Hochelaga Boulevard, Quebec City, Quebec G1V 0A6, Canada*
17:45 - 18:00	› Immediate impacts of peatland rewetting on environmental variables and GHG fluxes - *Annalea Lohila, Climate System Research, Finnish Meteorological Institute, Helsinki*
18:00 - 18:15	› Changes in water table depth, tree stand and vegetation are linked in restored boreal peatlands - *Aapo Jantunen, University of Jyväskylä*

TIME	EVENT
18:15 - 18:30	› Temporal emission trajectories shape the climate benefits of peatland rewetting - *Shihao Cui, Aarhus University [Aarhus]*
18:30 - 18:45	› Landscape Restoration in the UK's East Anglian Fens: Trade-offs Between Food Production, Nature Recovery, and Climate Change Mitigation - *Joshua Copping, Royal Society for the Protection of Birds*
17:15 - 18:45	Grassland, prairie, steppe and other open ecosystem restoration (Amphi C) - Thierry Dutoit
17:15 - 17:30	› A synthesis of recovery of biomass and diversity in Cerrado restoration - *Laura Simões, Wageningen University and Research [Wageningen], University of São Carlos - Araras Campus*
17:30 - 17:45	› Pathways to recovery: Drivers of long-term grassland restoration success on ex-arable fields in the Netherlands - *Inês Vicente, Copernicus Institute of Sustainable Development, Utrecht University*
17:45 - 18:00	› Restoring Estonian biodiversity hotspots: multitaxon diversity and community completeness in abandoned and resently restored wooded meadows - *Triin Reitalu, Institute of Ecology and Earth Sciences, University of Tartu*
18:00 - 18:15	› Vegetation development in a grassland restoration experiment in Germany — Key insights after 15 years - *Alina Twerski, Anhalt University of Applied Sciences*
18:15 - 18:30	› Restoring grasslands within French Natura 2000 sites: does-it really work? - *Camille Bernard, Patrimoine naturel*
18:30 - 18:45	› Biodiversity monitoring and restoration measures on German golf courses: Implementing a BACI framework to improve the ecological value of multifunctional landscapes - *Sandra Rojas-Botero, Technical University of Munich, School of Life Sciences, Restoration Ecology*
17:15 - 18:45	SS27 – Advancing knowledge and cooperation in the Mediterranean region throughout the UN Decade on Ecosystem Restoration (Amphi D) - Valentina Garavaglia, Carolina Gallo Granizo & Andrea Romero Montoya
17:15 - 17:30	› Building capacities for standards-based ecosystem restoration throughout the UN Decade and beyond - *Andrea Romero, FAO Forestry*
17:30 - 17:45	› Upscaling restoration of Mediterranean forests through regional cooperation and good practices sharing - *Christophe Besacier, Food and Agriculture Organization of the United Nations*
17:45 - 18:00	› From plant conservation to restoration delivery: GENMEDA as a Mediterranean hub for ecological restoration - *Gianluigi Bacchetta, Centro Conservazione Biodiversità (CCB), Dipartimento di Scienze della Vita e dell'Ambiente (DISVA), Università degli Studi di Cagliari. - Costantino Bonomi, Museo delle scienze*
17:15 - 18:45	SS14 - Connectivity in large-scale restoration (Amphi E) - Taylor Shaw & Nancy Ockendon
17:15 - 17:30	› Approaches and barriers to monitoring connectivity in conservation practice - *Taylor Shaw, Taylor Shaw*
17:30 - 17:45	› Connectivity assessment for the Marsican brown bear (Ursus arctos marsicanus) in the Central Apennines, Italy - *Luca Chiaverini, Rewilding Apennines*
17:45 - 18:00	› Structural connectivity analyses as a tool to plan and monitor large-scale restoration in Cumbria. - *Mo Verhoeven, ELSP - Cumbria Connect*
18:00 - 18:15	› Challenges and opportunities for monitoring connectivity in landscape restoration - *Amy Gresham, Department of Zoology, University of Cambridge*
18:15 - 18:30	› LIFE NewLIFE4BioIslands: biodiversity islands as stepping stones for pollinator recovery and landscape connectivity in degraded Mediterranean and Macaronesian lands - *Vito Emanuele Cambria, Botanic Garden of Rome, Department of Environmental Biology, Sapienza University of Rome*
17:15 - 18:45	New tools and technologies (Amphi F)
17:15 - 17:30	› The STW: A wheel for the socio-territorial assessment of restoration, designed both to facilitate dialogue and to enhance the scientific and technical scope of the assessment - *Marion Bourhis, Géoarchitecture : Territoires, Urbanisation, Biodiversité, Environnement - Sébastien Gallet, Géoarchitecture : Territoires, Urbanisation, Biodiversité, Environnement*
17:30 - 17:45	› Listening to Recovery: Passive Acoustic Monitoring as a Scalable Tool for Monitoring Ecological Restoration - *Carlos Abrahams, Wildlife Acoustics Inc*
17:45 - 18:00	› Methodological Guide for a Rapid Assessment Method to assess gain of biodiversity in mediterranean sea: MERCI-Med - *Sylvain Pioch, Université de Montpellier Paul-Valéry*
18:00 - 18:15	› Monitoring pollination in restored sand grasslands: can automation replace traditional methods? - *Katalin Torok, HUN-REN Centre for Ecological Research, Institute of Ecology and Botany, Restoration Ecology Research Group,*
18:15 - 18:30	› SeedPOD, the Seed Portal for Online Data - *Teagan Hartenthaler, Royal Botanic Gardens [Kew]*
17:15 - 18:45	Marine restoration (Amphi G)
17:15 - 17:30	› Scientific knowledge to inform the restoration Plan in France for marine habitats : where do we stand ? - *Diane Laforge, PatriNat*
17:30 - 17:45	› Implementation and scaling of marine restoration projects - insights from CLIMAREST - *Ida Beathe Øverjordet, SINTEF Ocean AS*
17:45 - 18:00	› Mechanical seagrass relocation within a coastal infrastructure project - *Charlotte Harper, Van Oord Dredging and Marine Contractors*

TIME	EVENT
18:00 - 18:15	› Why marine forest restoration may fail: hidden ecological constraints beyond technical optimization - *Annalisa Falace, Department of Life Sciences University of Trieste*
18:15 - 18:30	› Climate-smart seascape restoration is strengthened by interconnectivity among coastal blue carbon ecosystems - *Martin Gullström, Södertörn University, School of Natural Sciences, Technology and Environmental Studies*
18:30 - 18:45	› Not just carbon: biodiversity credits for restoration of the marine animal forests - *Dor Shefy, Università del Salento = University of Salento [Lecce]*
17:15 - 18:45	Standards and indicators (PN2B) - Jordi Cortina
17:15 - 17:30	› From ambition to impact: What Independent Audits Reveal About Improving Ecosystem Restoration Quality - *Nicolas Pillet, Preferred by Nature*
17:30 - 17:45	› SER principles as Ecological Restoration process indicators - a global to local perspective - *Noa Steiner, The Steinhardt Museum of Natural History, Tel Aviv University*
17:45 - 18:00	› Identifying nature restoration opportunities through GIS analyses and field assessment - *Ida Marielle Mienna, Norwegian Institute for Nature Research*
18:00 - 18:15	› Observation errors in botanical surveys: causes and implications for measuring restoration outcomes - *Jan Perret, Laboratoire des EcoSystèmes et des Sociétés en Montagne*
18:15 - 18:30	› Variable reference states: Interannual biodiversity variations within understudied subarctic peat bogs habitats. - *Axel Hacala, Laboratoire Interdisciplinaire des Environnements Continentaux*
18:30 - 18:45	› The Global Biodiversity Standard: Assessing ecosystem restoration sites for impacts on biodiversity
17:15 - 18:45	W1 - The role of botanic gardens and plant conservation organizations supporting successful implementation of the EU National Restoration Regulation (S4) - Marcello De Vitis
17:15 - 18:45	W14 - Design It Yourself (DIY) - building resilient coastal ecosystems with biodegradable and biobased restoration techniques/kickstart agents. (S1-S3) - Malenthe Teunis, Karin Didderen & Brenda Deden
18:45 - 20:00	

Friday, August 28, 2026

TIME	EVENT
08:30 - 09:30	Restoration in wartime: mission impossible? (Amphi A) - Bohdan Prots
09:30 - 11:00	Policy frameworks for restoration, NRR and beyond (Amphi A) - An Cliquet
09:30 - 09:45	› Non-governmental organisations as driving enablers for credible National Restoration Plans under EU Nature Restoration Regulation - *Sofie Ruysschaert, BirdLife Europe and Central Asia - Codruta Savu, WWF European Policy Office*
09:45 - 10:00	› Landscape Recovery Schemes - the UK's Solution to Restoring Nature at Scale? - *Martin Varley, Endangered Landscapes and Seascapes Programme*
10:00 - 10:15	› From policy ambition to local practice: Governance capacity for native birch woodland restoration in Iceland - *Jónína Sigrídur Thorláksdóttir, Agricultural University of Iceland, Land and Forest Iceland*
10:15 - 10:30	› A legal analysis of the pollinator restoration toolbox - *Siemen Kalders, Hasselt University*
09:30 - 11:00	SS13 - Grazing as a conservation and restoration tool (Amphi C) - Julia Wiese & Jan-Erik Petersen
09:30 - 09:50	› The role of extensive livestock systems in maintaining habitats on Annex I of the EU Habitats Directive - *Jan-Erik Petersen, Jan-Erik Petersen, European Environment Agency*
09:50 - 10:10	› The role of large herbivores in shaping European ecosystems - *Markus Handschuh, Naturnahe Weidelandschaften (Near-natural grazing association) e. V., Black Forest National Park*
10:10 - 10:30	› Review of available EU-level guidance for assessing habitat condition and habitat conservation targets in context of the EU Habitats Directive and the Nature Restoration Regulation - *Anton Kvarnback, European Environment Agency*
09:30 - 11:00	SS22 - Combining energy transition with the restoration of biodiversity, ecosystem services and ecological functions (Amphi D) - Sandra Dullau, Armin Bischoff & Lucas Etienne
09:30 - 09:45	› Nature-Inclusive Design in marine infrastructure: harnessing the energy transition to restore ecosystem services and ecological function - *Yaeli Rosenberg, ECOncrete*
09:45 - 10:00	› Finding where seabirds and turbines won't clash: an ecological perspective on management and development opportunities in the UK's marine environment - *Rebekka Allgayer, Royal Society for the Protection of Birds*
10:00 - 10:15	› Solar farm impact on soil carbon and plant biomass: A modelling approach - *Fabio Carvalho, Universidade de Santiago de Compostela [España] = University of Santiago de Compostela [Spain] = Université de Saint-Jacques-de-Compostelle [Espagne], Lancaster University*

TIME	EVENT
10:15 - 10:30	› Combining renewable energy and biodiversity conservation: preliminary evidence from Mediterranean photovoltaic parks. - *SILVIA ROY, Instituto Pirenaico de Ecologìa = Pyrenean Institute of Ecology [Zaragoza], Universidad de Zaragoza = University of Zaragoza [Saragossa University] = Université de Saragosse*
09:30 - 11:00	SS15 - From spatial modelling to large-scale strategies (Amphi E) - Csaba Tölgyesi
09:30 - 09:45	› Global patterns, supply-chain flows, and driving factors of forest loss footprints from 2001 to 2022 - *Zoe Liu, BIT Center for Energy and Environmental Policy Research (CEEP-BIT)*
09:45 - 10:00	› Refining European reforestation potential estimates for climate mitigation and biodiversity conservation - *Angelica Feurdean, Institute of Physical Geography, Goethe University*
10:00 - 10:15	› Optimized spatial planning in forest restoration via quantum algorithms: a proof of concept for viable plans
10:15 - 10:30	› Spatial configuration of vegetation restoration is critical to mitigating carbon-water trade-offs for dryland ecosystem sustainability - *Lyu Yihe, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences*
10:30 - 10:45	› Litter effects of an invasive grass on native species in sandy grasslands - *Patricia Elizabeth Diaz Cando, University of Debrecen*
09:30 - 11:00	Animal species & restoration (Amphi F)
09:30 - 09:45	› From roots to shoots: How the introduction of meadow ants affects grassland restoration from the soil to the pollinators - *Gabrielle Flinn, University of York*
09:45 - 10:00	› How do Field Size and Crop Type moderate the Effects of Flower Strips and Hedgerows on Pollinators – A global Meta-Analysis - *Aline Brosch, Hochschule Anhalt - University of applied sciences*
10:00 - 10:15	› Building a pollinator landscape network through participatory territorial planning : early feedback from the “Trame Pollinisateurs” (Pollinator Network) program in France - *Aurélie Jambon, Association Noé*
10:15 - 10:30	› Restoration of plant-flower visitor networks with pollinator conservation measures - *Amandine Acloque, Dynamiques et écologie des paysages agriforestiers*
10:30 - 10:45	› Knowledge of the many: Using Citizen Science data to reveal plant-pollinator interactions and pollination hotspots for butterflies (order: Lepidoptera) - *Felix Deiss, German Federal Agency for Nature Conservation (BfN)*
10:45 - 11:00	› Reduced management intensity promotes biodiversity in mountain grasslands - *Isabelle Arnold, Universität Bern = University of Bern = Université de Berne*
09:30 - 11:00	Marine restoration (Amphi G)
09:30 - 09:45	› A Meadow Reborn: One Year On - What Our Seagrass Told Us in Tunisia! - *Nada Abdelkader, University of Carthage, Faculty of Sciences of Bizerte, 7021 Jarzouna, Bizerte, Tunisia, University of Tunis El Manar, Faculty of Sciences of Tunis, Research Laboratory od Diversity, Management and Conservation of Biological Systems, LR18ES06, Tunis, Tunisia*
09:45 - 10:00	› From pilot research to national implementation: Building the evidence base for Posidonia oceanica restoration in Greece under the EU Nature Restoration Law - *Vasilis Gerakaris, Hellenic Centre for Marine Research, Institute of Oceanography, Anavyssos 19013, Attica, Greece*
10:00 - 10:15	› Early ecological recovery of epifaunal communities one year after Posidonia oceanica restoration in Tunisia. - *Salma Zribi, University of Tunis El Manar, Faculty of Sciences of Tunis, Research Laboratory of Diversity, Management and Conservation of Biological Systems, LR18ES06, Tunis, Tunisia*
10:15 - 10:30	› Enhancing Posidonia oceanica restoration with nursery-grown seedlings: a seed-based approach exploiting early life history traits - *Claudia Pezzilli, Department of Earth, Environmental and Life Sciences (DISTAV), University of Genoa, National Biodiversity Future Center*
10:30 - 10:45	› Restoring Posidonia oceanica in the Mediterranean: lessons from a pilot project in Tunisia and the need for regional integration - *Rym Zakhama-Sraieb, Institut Supérieur de Biotechnologie de Sidi Thabet, Faculté des Sciences Mathématiques, Physiques et Naturelles de Tunis*
10:45 - 11:00	› From application to adaptation: lessons from Posidonia oceanica restoration in support of a marine-adapted Ecological Recovery Wheel - *Geraldina Signa, Department of Earth and Marine Sciences (DiSTeM), University of Palermo, National Inter-University Consortium for Marine Sciences (CoNISMa), Rome*
09:30 - 11:00	Sociological perspectives and stakeholder involvement (PN2B)
09:30 - 09:45	› Do reforestation projects in Spain meet restoration standards? An assessment with recommendations - *Jordi CORTINA-SEGARRA, Department of Ecology and IMEM, University of Alicante*
09:45 - 10:00	› Applying SER Standards to Ecosystem Restoration in Iceland: The Stóratunga project - *Katrín Valsdóttir, Land and Forest Iceland*
10:00 - 10:15	› From appreciation of sustainable farming to nature restoration: an example from the Czech Republic - *Klára Čámská, Nature Conservation Agency of the Czech Republic*
10:15 - 10:30	› Climate Adaptation, Governance Fragmentation, and Socio-Ecological Restoration Pathways in Mountain Regions: Evidence from Caucasus Georgia - *Davit Sidamonidze, Caucasus University*
10:30 - 10:45	› The impact of restoration actions on ecosystem services considering ecosystem condition - *Théo Hedelin, INRAE Aix Le Tholonet - Ines Imbert, European Institute For Energy Research*
10:45 - 11:00	› Measuring the reclamation and ecological restoration economy. A practical case from western Canada - *Nicolas Mansuy, natural reosurces canada, canadian forest service*

TIME	EVENT
09:30 - 11:00	W5 - Coastal Challenge: A serious video game for coastal resilience decision-making (S4) - Paola Tanguy
09:30 - 11:00	W16 - Monitoring long-term restoration effects on biodiversity at a national scale (S1-S3) - Merlin Schaefer, Mathias Scholz & Michael Foerster
09:30 - 11:00	Wetland restoration (Amphi B)
09:30 - 09:45	› An operational framework for wetland restoration
09:45 - 10:00	› DSS-AWERE: A decision support system to structure the planning and reporting of Adaptive Wetland Restoration strategies - *Luis Santamaría, Estación Biológica de Doñana (EBD-CSIC)*
10:00 - 10:15	› From demonstration to transfer: Prioritizing Mediterranean wetlands for restoration based on carbon sequestration and flood regulation services - *Petar Petrov, University of Forestry*
10:15 - 10:30	› How can we assess the status and functions of biodiversity and the effects of ecological restoration in wetlands? A comparative analysis of three methods at Malessard (Isère, France) - *Véronique Gouraud, EDF R&D LNHE - Laboratoire National d'Hydraulique et Environnement*
10:30 - 10:45	› From carbon fluxes to conservation priorities: linking carbon cycling, hydrology and habitats in Lake Kerkini - *Anastasia Chatzimentor, Greek Biotope/Wetland Centre, National Museum of Natural History Goulandris, Thessaloniki, Greece*
11:00 - 11:45	Coffee break - Poster Session #4 (Hall)
11:45 - 13:15	Policy frameworks for restoration, NRR and beyond (Amphi A)
11:45 - 12:00	› From Projects to Restoration Trajectories: What Implementation Cases Reveal for the Nature Restoration Regulation - *Sebastian Birk, Aquatic Ecology, University of Duisburg-Essen*
12:00 - 12:15	› Normative Ethics in Ecosystem Restoration Decision-Making - *Linnea Luuppala, Department of Biological and Environmental Science [Jyväskylä Univ]*
12:15 - 12:30	› Certifying ex ante biodiversity gains: a checklist-based method for offsets and biodiversity credit schemes - *Caroline Jaugey, Laboratoire des EcoSystèmes et des Sociétés en Montagne*
12:30 - 12:45	› Restoration to shift Risk to Resilience: Certifying, Financing and Insuring Europe's Climate Ready and Biodiverse Forests - *Mateo Cariño Fraisse, Senior Ecosystem Restoration Manager, Preferred by Nature*
12:45 - 13:00	› Biodiversity-friendly Afforestation - a legal-empirical analysis of bottlenecks in administrative afforestation practice - *Edo SCHOONE, Hasselt University*
11:45 - 13:15	SS13 - Grazing as a conservation and restoration tool (Amphi C) - Julia Wiese & Jan-Erik Petersen
11:45 - 12:05	› Building a European Network for Conservation Grazing: Developing a Multilingual Online Forum for Practitioners - *Julia Wiese, European Forum on Nature Conservation and Pastoralism - Andrea Rodriguez, ACOBIJA Conservatción*
12:05 - 12:25	› Critical grazing parameters and biodiversity impact metrices to be monitored in conservation grazing – initial reflections - *Jan-Erik Petersen, Jan-Erik Petersen, European Environment Agency*
13:00 - 13:15	› Conclusion - *Organiser SERE, SERE*
11:45 - 13:15	SS22 - Combining energy transition with the restoration of biodiversity, ecosystem services and ecological functions (Amphi D) - Sandra Dullau, Armin Bischoff & Lucas Etienne
11:45 - 12:00	› Legacy effects of pre-construction habitats on solar park plant communities and interactions with solar panels - *Louison Bienvenu, CITERES, Institut méditerranéen de biodiversité et d\'écologie marine et continentale - Armin Bischoff, Institut méditerranéen de biodiversité et d\'écologie marine et continentale - Francis Isselin-Nondedeu, Institut méditerranéen de biodiversité et d\'écologie marine et continentale, CITERES*
12:00 - 12:15	› Solar panel, vegetation management and legacy effects on vegetation in European solar parks - *Lucas Etienne, IMBE*
12:15 - 12:30	› Pollinators in three German solar parks under different regional seed mixtures - *Dorottya Hajnal, Department of Agriculture, Ecotrophology and Landscape Development, Anhalt University of Applied Sciences, MTA-SZTE 'Momentum' Applied Ecology Research Group, University of Szeged*
12:30 - 12:45	› Using plant pollinator networks to evaluate regional seed-mixtures used in different photovoltaic systems - *Line Sturm, Department of Agriculture, Ecotrophology and Landscape Development, Anhalt University of Applied Sciences*
11:45 - 13:15	SS15 - From spatial modelling to large-scale strategies (Amphi E) - Csaba Tölgyesi
11:45 - 12:00	› Targeted rewetting of agricultural peatlands on acid sulfate soils: integrating spatial analysis and cost–benefit assessment - *Hanna Kekkonen, Natural Resources Institute Finland*
12:00 - 12:15	› Designing Restoration Measures to Improve Water Quality in a Degraded Peatland Catchment - *Priya Sharma, Department of Geographical and Historical Studies, University of Eastern Finland, Joensuu*
12:15 - 12:30	› Harnessing the Low-Hanging Fruit of Rewetting Drained Organic Soils to Achieve Maximized Greenhouse Gas Reduction Potential - *Shubiao Wu, Department of Agroecology, Aarhus University, Denmark*

TIME	EVENT
12:30 - 12:45	› Broad-scale restoration hotspot identification based on potential natural vegetation modelling - *Imelda Somodi, HUN-REN Centre for Ecological Research*
12:45 - 13:00	› Limited carbon sequestration potential from global ecosystem restoration - *Tölgyesi Csaba, University of Szeged, MTA-SZTE 'Momentum' Applied Ecology Research Group*
11:45 - 13:15	Animal species & restoration (Amphi F)
11:45 - 12:00	› Friends, not foes: Why invertebrate recovery starts with predators - *Sam Rogerson, Biological and Environmental Sciences [Stirling]*
12:00 - 12:15	› Ant and carabid beetle responses to restoration of species-rich temperate grasslands - *Marie Hovorková, Institute for Environmental Sciences, Faculty of Sciences, Charles University*
12:15 - 12:30	› Risks and management implications of reintroduction scenarios for European and Atlantic sturgeons in Western European rivers
12:30 - 12:45	› Keystones and flagships: white-tailed eagle reintroductions in wetland, freshwater and coastal restoration - *Duncan Halley, Norwegian Institute for Nature Research*
12:45 - 13:00	› PIGARGO´s project: the return of europe's largest eagle to the iberian peninsula - *Enrique Murciano Blanco, GREFA*
13:00 - 13:15	› Impactinvesting: lessons learned from human-wildlife coexistence in HiP, KZN South Africa - *Sandra Hoomans, Wildlife Act, Saxion UAS*
11:45 - 13:15	Marine restoration (Amphi G)
11:45 - 12:00	› Seed-based restoration of Zostera noltei in nourished coastal subtidal areas - *Gabriela Maldonado, Van Oord Dredging and Marine Contractors*
12:00 - 12:15	› Multi-species seagrass transplantation in salt-production lagoons: lessons for design, cultivation and restoration - *Sari Ponnet, Centre of Marine Sciences [Faro]*
12:15 - 12:30	› Quantifying Coastal vs. Estuarine Canopy Dynamics in Mixed Zostera Meadows: Leaf Area Index as a Seasonal Proxy for Habitat Selection and Restoration Site Assessment in the Solent, UK - *Uresha Rodrigo, University of Portsmouth, Institute of Marine Sciences*
12:30 - 12:45	› Restoring macroalgal forests in artificial coastal habitats through active seeding, habitat enhancement and sea urchin control in Monaco - *Clara Dubel Jam, SUEZ Consulting - Agence Méditerranée, Aix-en-Provence, France - Fabrice Javel, SUEZ Consulting - Agence Méditerranée, Aix-en-Provence, France*
12:45 - 13:00	› Accelerating reproductive timing in mediterranean fucales: an experimental approach for optimizing restoration strategies. - *Alessia Finini, Università degli studi di Genova = University of Genoa = Université de Gênes*
13:00 - 13:15	› Aquaculture-assisted restoration of Mediterranean macroalgal forests: a scalable approach for Ericaria amentacea - *Asnaghi Valentina, DISTAV, Department of Earth, Environmental and Life Science, University of Genoa, National Biodiversity Future Center*
11:45 - 13:15	Sociological perspectives and stakeholder involvement (PN2B)
11:45 - 12:00	› From Degraded Commons to Resilient Landscapes: Lessons from Rajasthan, India - *Bandana Sambyal, Foundation for Ecological security*
12:00 - 12:15	› Nature restoration planning in France - costs and benefits for society and climate change mitigation - *Gábor Figeczky, International Union for Conservation of Nature, European Regional Office*
12:15 - 12:30	› Including plural ways of knowing and valuing in oyster restoration in England and The Netherlands - *Annet Pauwelussen, Wageningen University and Research*
12:30 - 12:45	› Motivating and supporting semi-natural grassland managers: policy design lessons from Estonian farmers - *Rufus Trepp, Institute of Ecology and Earth Sciences, University of Tartu, Tartu, Estonia*
12:45 - 13:00	› Anchors of stewardship: Unpacking forage rationales and participant profiles of semi-natural grassland restorers in the boreo-nemoral zone - *Kristīne Estere Lūse, University of Latvia*
13:00 - 13:15	› From Seed Collection to Ecological Restoration: Forest Seed Networks and Seed Quality Challenges in Brazil - *Gabriele Cristina Vieira Pinto, Federal University of São Carlos = Universidade Federal de São Carlos*
11:45 - 13:15	W7 - Restoration philosophy and the is-ought dilemma (S1-S3) - Darcy O'Connor
11:45 - 13:15	Coastal restoration (Amphi B)
11:45 - 12:00	› In the marshes of the Atlantic coast, what operational levers can be used to restore riparian habitats?: example of a project carried out on a research farm - *Daphné Durant, Domaine expérimental de Saint-Laurent-de-la-Prée*
12:00 - 12:15	› CO-WATERS - Restoring our ocean and waters together with regional and local communities. - *Lise Guennal, NTNU (CO-WATERS project leader)*
12:15 - 12:30	› Evaluating estuarine fish assemblage trajectories under ongoing restoration efforts - *Benjamin Weigel, UR EABX, Centre de Bordeaux, 50 Avenue de Verdun, 33612, Cestas, France*
12:30 - 12:45	› Scaling Up Estuarine Recovery: Lessons from the Wilder Humber Seascape Restoration Programme - *Monika Smieja, Yorkshire Wildlife Trust*

TIME	EVENT
12:45 - 13:00	› Shore Up: Integrating root tensile strength research into nature-based coastal erosion strategies - *Rosmarie Lohnes, Helping Nature Heal Inc.*
13:15 - 14:30	Lunch (Sport Hall 3)
14:30 - 16:00	Nature Restoration Regulation, from planning to implementation (Amphi A) - Anne Vivier
14:30 - 14:45	› Providing support to local authorities for wetland restoration – The example of actions carried out by the Forum des Marais Atlantiques - *Armel Dausse, Forum des Marais Atlantiques*
14:45 - 15:00	› "Renaturons!" (Let's bring nature back!) : bridging the gap between policy and action through an integrated territorial ecological restoration framework - *Aurélie Jambon, Noé*
15:00 - 15:15	› Experience from a new regulatory regime in Biodiversity Net Gain (England) to enforce restoration standards. - *Tim Graham, RSK Wilding*
15:15 - 15:30	› Operational biodiversity indicators for prioritizing wetland restoration: a multi-scale research–action framework applied in France - *Fanny Mallard, Passages*
15:30 - 15:45	› Designing a Reproducible Open-Source Database for Ecological Restoration Interventions - *Delphine Jaymond, Institut méditerranéen de biodiversité et d\'écologie marine et continentale, Laboratoire des EcoSystèmes et des Sociétés en Montagne*
15:45 - 16:00	› Setting the baseline: Favourable Reference Area estimates for French marine habitats - *Maeva Aulay, PatriNat*
14:30 - 16:00	Invasive species & restoration (Amphi B)
14:30 - 14:45	› Emerging technologies to improve the efficiency and feasibility of restoring islands through invasive mammal eradication - *Baudouin Des monstiers, Island Conservation*
14:45 - 15:00	› Restoration has unsuspected effects on ecosystem diversity and productivity compared to alien plant invasion: insights of a multitrophic approach - *Théo Marchand, LESSEM*
15:00 - 15:15	› Balancing restoration strategy according to the context of an oceanic tropical island such as Reunion island: a multi-stakeholder partnership and an operational framework for managing plant invasion - *Emilie Cazal, Parc national de La Réunion*
15:15 - 15:30	› Expansive native and invasive alien plants in vegetation succession - *Miguel Ballesteros, Department of Botany, Faculty of Science, University of South Bohemia, Branišovská 1760, 37005 České Budějovice, Czech Republic*
15:30 - 15:45	› Suppression of Conyza canadensis is driven by priority and seeding rate, not trait similarity - *Melinda Halassy, HUN-REN Centre for Ecological Research*
15:45 - 16:00	› Monitoring riparian vegetation recovery after exotic species removal: a multi-year assessment integrating field traits and satellite data - *Arthur Cupertino, Forest Research Centre [Lisbon], Universidade de Lisboa = University of Lisbon = Université de Lisbonne [Lisboa]*
14:30 - 16:00	Agricultural landscape restoration (Amphi C)
14:30 - 14:45	› Can the EU Nature Restoration Law deliver for agricultural ecosystems? - *Karl Delauw, University of Ghent*
14:45 - 15:00	› Governance challenges in riparian restoration on agricultural land: How conceptions and valuations shape the potential for riparian zone restoration on agricultural land in Norway - *Erica Colman-Denstad, University of Oslo*
15:00 - 15:15	› Do restored agroforestry buffers still function after two decades? Preliminary evidence from the Guvrin intermittent stream, Israel - *Hussein Muklada, Department of Natural Resources, Agricultural Research Organization, Gilat Research Center, Gilat, Israel*
15:15 - 15:30	› Life After Corn! - *Gilles LECUIR, Regional Agency for Biodiversity in Paris Region*
15:30 - 15:45	› Successful green hay restoration of former arable land in Ireland – farmer-led, ignoring the guidelines, and still flower-rich! - *Maria Long, National Parks and Wildlife Service*
15:45 - 16:00	› Simulation-Informed Landscape Design for Restoring Ecological Functions in Tropical Agricultural Landscapes - *Sebastian Fiedler, Technische Universität Berlin, University of Göttingen*
14:30 - 16:00	Ecosystem functioning (Amphi D)
14:30 - 14:45	› A global synthesis of biodiversity-function recovery after hydromorphological restoration - *Ulrike Haase, Institute of Hydrobiology, Dresden University of Technology*
14:45 - 15:00	› Functional trait based selection of Mediterranean riparian vegetation for wastewater influenced stream restoration - *Adrià Casacuberta, Departament de Biologia Evolutiva, Ecologia i Ciencies Ambientals, Facultat de Biologia*
15:00 - 15:15	› The impact of restoration on plant functional traits in nutrient-poor peatlands - *Nina Kumpulainen, University of Eastern Finland*
15:15 - 15:30	› Functional strategies for native graminoid establishment: insights from a BEF experiment in the Cerrado - *Marina Reis, Institut méditerranéen de biodiversité et d\'écologie marine et continentale, Universidade Estadual de Campinas = University of Campinas*

TIME	EVENT
15:30 - 15:45	› Functional traits reorganization of urban springtail communities at night according to public lighting practices and context - *Yoann ROULET, Laboratoire Géoarchitecture. Territoires, Urbanisation, Biodiversité, Environnement*
15:45 - 16:00	› Diversity and functional composition of plant communities: A comparative study of wildflower strips and field margins in agricultural landscapes - *Georg Rieland, Anhalt University of Applied Sciences, Department of Conservation Biology [UFZ Leipzig]*
14:30 - 16:00	Marine restoration (Amphi G)
14:30 - 14:45	› Public perceptions of marine restoration - *Geraldine Doolan, University of Galway*
14:45 - 15:00	› From Pilot to Scale: Unlocking Native Oyster Restoration in Belfast Lough - *Nick Baker-Horne, Ulster Wildlife*
15:00 - 15:15	› Functional restoration of the reef forming pinnid, Atrina zelandica, using structural mimics - *Hazel Needham, School of Science, University of Waikato*
15:15 - 15:30	› Towards efficient offshore native oyster reef restoration: a contractor's perspective - *Wouter Van Broekhoven, Van Oord Dredging and Marine Contractors*
15:30 - 15:45	› Scaling native oyster reef restoration: ecological outcomes from Europe's largest Ostrea edulis habitat creation - *Brecht Stechele, Oyster Heaven*
15:45 - 16:00	› The potential for ecological restoration through blue carbon development and ecosystem services on a shallow coastal shelf off SW Tenerife (Canary Islands) - *Juan Usó Canós, Institute of Marine Sciences / Institut de Ciències del Mar [Barcelona]*
14:30 - 16:00	W10 - Implementing the Recovery Wheel for evaluation and consultation (S4) - Marion Bourhis & Sébastien Gallet
14:30 - 16:00	W2 - Implementing the Nature Restoration Law in marine environments (Amphi F) - Johanna Sophie Buerkert, Nadia Papadopoulou, Ida Beathe Overjorde & Lasse Kurvinen
14:45 - 14:50	› Implementation of marine restoration projects - insights from CLIMAREST - *Ida Beathe Øverjordet, SINTEF Ocean AS*
14:50 - 14:55	› Empowering local communities to implement restoration actions in support of the Nature Restoration Regulation. - *Ida Beathe Øverjordet, SINTEF Ocean AS*
14:55 - 15:00	› Baltic Restoration Action Plan and Toolbox - *Kurvinen Lasse, Metsähallitus Parks & Wildlife Finland*
15:00 - 15:05	› A national framework for Posidonia oceanica meadow restoration in Greece: Scientific guidance and implementation tools under the EU Nature Restoration Regulation - *Vasilis Gerakaris, Hellenic Centre for Marine Research, Institute of Oceanography, Anavyssos 19013, Attica, Greece*
15:05 - 15:10	› Equity and inclusion as key to succesful marine restoration - *Annet Pauwelussen, Wageningen University and Research*
15:10 - 15:15	› A long-term collaborative approach to sustainable deep-sea trawling: the Aristeus antennatus fishery in Palamós, Spain - *Juliana Quevedo, Instituto de Ciencias del Mar*
15:15 - 15:20	› LIFE DREAM project: Deep REef restoration And litter removal in the Mediterranean sea - *Federica Foglini, Cnr-Istituto di Scienze Marine del Consiglio Nazionale delle Ricerche = Marine Science Institute*
15:20 - 15:25	› Life MAPPER: Guidelines for MAPping, ProtEcting, and Restoring Marine Ecosystems - *Federica Foglini, Cnr-Istituto di Scienze Marine del Consiglio Nazionale delle Ricerche = Marine Science Institute*
15:25 - 15:30	› Implementing the Nature Restoration Law: insights for deep sea habitats from REDRESS - *Nadia Papadopoulou, Hellenic Centre for Marine Research*
15:30 - 15:35	› Implementing the Nature Restoration Law for Marine Environments - *Clara Rodrigues, WavEC Offshore Renewables*
14:30 - 16:00	SS29 - Restoring Europe's Nature - Lessons and inspiration from LIFE projects across Europe (Amphi E) - Joseph Van Der Stegen, Chloé Weeger & Lynne Barratt
16:00 - 16:30	Closing Ceremony - Closing Ceremony

THE ABSTRACTS

PLENARIES

From Law to Landscapes: Making the EU Nature Restoration Regulation Work

Angelika Rubin
European Commission

The EU Nature Restoration Regulation marks a turning point for restoring nature at scale across Europe. My opening talk will look at how the Regulation came into being (it's been quite a ride!), what its goals are, how it connects with other EU policies and instruments such as LIFE, and where its implementation stands today. It will also explore the crucial next steps ahead — from National Restoration Plans and so called 'stress testing' of EU's nature legislation to emerging initiatives in the pipeline — and ask how researchers can help close knowledge gaps, strengthen evidence, and support implementation on the ground. Ultimately, the talk will reflect on what is needed to turn the Regulation from a legal milestone into a lasting success for nature, people, and Europe's future.

Restoration finance: sorting fact from fiction

Sophus zu Ermgassen
University of Oxford's Nature-positive Hub.

In a world of increasing fiscal pressure, many governments and international organisations and agreements have stated the need to attract more private investment into nature conservation and restoration. But what does this really mean? What do profitable conservation projects actually look like, and is that really what we want the future to be? I have been an academic researching nature markets and private investment in nature for the last decade. I'm a conservation scientist by background who has had to learn finance, and I've made so many mistakes and had so many misconceptions on the way. In this talk I hope to share 11 things that I found particularly surprising on my journey to trying to understand what is really going on, behind all the rhetoric.

Re-joining the blue dots – how understanding seascape connectivity has profound implications for marine restoration policy and implementation.

Joanne Preston
Institute of Marine Sciences, University of Portsmouth

Temperate coastal marine ecosystems have undergone severe global loss and degradation. International goals to restore planetary resilience through climate mitigation, reversing biodiversity loss and ameliorating pollution are set out by key international policy frameworks, namely: the United Nations Framework Convention on Climate Change, Kunming-Montreal Global Biodiversity Framework and the Sustainable Development Goals. Here, a logical framework for marine ecological connectivity is presented with examples from a global synthesis of structural and functional connectivity across temperate marine habitats, framed around flows of nutrients, carbon and biodiversity. The role of connectivity in modulating maintenance and delivery of ecosystem functions and services further demonstrates its importance in achieving these international policy targets.

Based on this evidence, we define and advocate that a seascape approach to restoration that restores connectivity and optimal structure-function relationships is crucial for successful ecosystem restoration. Consequently, we provide recommendations to deliver large scale seascape restoration of coastal habitats. Acknowledging the interconnected nature of coastal ecosystems also has implications for policy, and we identify opportunities and actions to implement policy across climate and biodiversity frameworks to achieve international targets. Finally, we reflect on the effectiveness of networks in facilitating nature recovery and how we can build on momentum and awareness to achieve restoration at scale.

The Third Edition of the International Principles & Standards for the Practice of Ecological Restoration - updates and relevance

George Gann * [1],
Kris Decleer [2], An Cliquet [3], Jordi Cortina-Segarra [4],Amarizni Mosyaftiani [5], Keith Maccallum [5], Bethanie Walder [5]

[1] The Institute for Regional Conservation (IRC) and Society for Ecological Restoration (SER) – United States
[2] Research Institute for Nature and Forest – Belgium
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The International Principles and Standards for the Practice of Ecological Restoration (the SER Standards) are widely recognized as the most comprehensive and robust guidelines for the practice of ecological restoration. The SER Standards provide a critical foundation that reduces risk and enhances outcomes across all phases of ecological restoration. Recognizing the dynamic nature of restoration science, practice, and policy, the SER Standards continue to be issued as a living document. With broad global acceptance, the 2nd Edition (2019) has underpinned and supported the UN Decade on Ecosystem Restoration and many other global and regional initiatives, including the EU Nature Restoration Regulation.
This session introduces the newly released 3rd edition with updates and expanded globally rele-vant guidance for ecological restoration in any type of ecosystem - including terrestrial, inlands waters, and coastal and marine. The SER Standards provide clear, coherent, and versatile guid-ance for designing, implementing, and monitoring restoration projects and programs. Building on years of feedback from real-world experience with the first and second editions, the third edition updates the restorative continuum, improves the ecological recovery and social benefits wheels and the Five-star System, greatly expands practitioner standards of practice, and pro-vides increased guidance on financing and delivering restoration across sectors. We will explain the value of standards-based restoration, describe the global policy setting and introduce key new content, including its relevance to the European context.

It is time to step up a gear to meet the ambitious targets of the EU Nature Restoration Law

Renaud Jaunatre
INRAE, LESSEM

For decades in France, as in many other countries, an increasing number of initiatives have launched ecological restoration projects. These include experimental or applied projects, at the local or regional scales. Some have been successful, whilst others have not. All provide lessons to improve restoration practices and inform future projects. In 2024, the European Nature Restoration Regulation was adopted, leading to a significant increase in scale upon restoration implementation. Planning for such a wide variety of restoration projects is unprecedented at national level. The involvement of all stakeholders, together with their local knowledge and the diversity of ecological restoration approaches, will be essential to achieve these ambitious objectives: every level of the restorative continuum will contribute to the success of this regulation. I propose to illustrate how things are taking shape, both at the national level and within the French Alpine region. I will first describe a framework allowing the assessment of the restoration potential of habitats, based on their history and ecology,that should be taken into account when prioritizing restoration objectives. Next, I will illustrate the implementation of restoration projects at supra-local scales along the spectrum of restoration activities: from the diversification of urban green spaces to rewilding, via ecological engineering and the restoration of diverse plant communities. Finally, I will present preliminary tools to facilitate the evaluation of restoration operations at regional or national scales.

Restoration in wartime: mission impossible?

Bohdan Prots
State Museum of Natural History, National Academy of Sciences of Ukraine

The title addresses one of the most complex, urgent, and deeply challenging dilemmas in modern conservation and restoration science. It may even sound contradictory. An instinctive response may favour waiting for peace, but active ecological restoration during ongoing conflict is not a "mission impossible"—it is a critical necessity. A review of the work of national and international groups in Ukraine highlights several wartime restoration achievements. The scale of mining is the most significant obstacle to expanding restoration in areas affected by former hostilities. Wartime restoration is vital for preventing tipping points, integrating the environment into recovery, strengthening community and climate resilience, and improving nature-based defence. Ecosystems such as degraded peatlands, wetlands, or heavily damaged forests can degrade beyond the point of no return, leading to permanent biodiversity loss or massive carbon emissions. Restoring natural buffers (such as floodplains and wetlands) can secure local water supplies, mitigate climate-related disasters such as flooding and wildfires, and provide a sense of agency and tangible hope to local communities and scientists. Executing restoration in a volatile environment requires a significant shift from standard methodologies. 'Nature-based Defence' (NbD) is the strategic engineering of hostile transboundary ecosystems (wetlands, peatlands, and riverine corridors) to create terrain with a ground-bearing capacity below the operational threshold of armoured fighting vehicles. This solution resolves the investment competition between the environment and defence by delivering a single asset with dual utility. It creates a formidable military barrier that captures carbon and restores biodiversity. To keep the mission realistic in Ukraine, conservationists must constantly navigate severe bottlenecks, such as physical danger (unexploded ordnance), shifting priorities (weakened capacities), and scientific and management data gaps.
Ultimately, treating restoration in Ukraine as an ongoing process rather than a post-war luxury turns a seemingly impossible mission into a tangible defence strategy—safeguarding a country's natural heritage and ecological stability for the future.

WORKSHOPS

(Details can be found on the conference website)

W1 - The role of botanic gardens and plant conservation organizations supporting successful implementation of the EU National Restoration Regulation

Coordinator(s): Marcello De Vitis (Botanic Gardens Conservation International)
Workshop type: round table

During this workshop, the moderator will give a short presentation to the participants and then will guide conversation and discussion among the participants through short sessions of thematic questions. The goal is to highlight the expertise of plant conservation organizations that uniquely position them to support the implementation of the NRR, and discuss together how to mobilize these skills to effectively contribute to restoration goals.

W2 - Implementing the Nature Restoration Law for Marine Environments: Common and unique governance challenges and opportunities for shallow and deep sea habitats

=> SEE SPECIAL SESSIONS SECTION

W3 - The Coordination Crisis: Overcoming collaborative barriers to enhance ecosystem restoration

Coordinator(s): Benjamin Christ (Impact by Design), Sahar Stevenson-Jones (SER-Europe), Amielle DeWan (Impact by Design)
Workshop type: highly interactive (roundtables)

This highly interactive workshop explores a critical question: What does effective collaboration actually require to deliver restoration outcomes at scale? Drawing on real-world alliances such as the European Marine Restoration Working Group and the Global Mangrove Alliance, professional facilitators and program managers will share practical lessons on neutral convening, governance design, strategic alignment, facilitation, and data coordination…the often-overlooked skills that make partnerships function.
Participants will engage in structured, interactive discussions to: 1) identify coordination gaps in their own work, 2) examine common barriers across institutions and sectors, 3) define the skills and capacities needed for success, and 4) explore potential opportunities for collaboration across the community. The session will culminate in actionable guidance and best practices for building partnerships that are durable, efficient, and outcome-driven, with a focus on harnessing global ambitions towards maximum impact.

W4 - People-centered seascape approach to conservation

Coordinator(s): Robyn Morland, Amber Baker, Amelia Allerton (Association for Coastal Ecosystem Services)
Workshop type: Interactive round table discussion.

This interactive and focused session will be led by the Association for Coastal Ecosystem Services (ACES) team and enable participants to learn about how ACES and partners are developing a people centered seascape approach in Vanga Bay, Kenya. We will explore common challenges of marine conservation activities, the unknowns of the biodiversity market, and how communities can truly own pioneering projects. We will also highlight the importance of strong partnerships and networks by encouraging open dialogue between participants and a speed networking activity towards the end of the workshop for attendees to exchange contact details.
The ACES team is no stranger to pioneering projects and groundbreaking work; ACES was founded alongside the development of Mikoko Pamoja, the world's first blue carbon project to sell carbon credits on the voluntary market. Now, ACES and partners are developing Vanga Seagrass Project, one of the world's first marine biodiversity projects to be accredited on the nascent biodiversity market, and the first by the Plan Vivo Nature standard. Groundbreaking but rooted, ACES work and projects have been internationally recognised as high-quality and included in multiple best practice guides.

W5 - Coastal Challenge: a Serious Video Game for Coastal Resilience Decision-Making

Coordinator(s): Paola Tanguy (CMCC Foundation)
Workshop type: Interactive game session.

This workshop presents *Coastal Challenge*, a serious video game developed by the CMCC Foundation within the EU-funded REST-COAST project, available online at https://game.rest-coast.eu. Designed as an interactive learning experience, the game invites participants to step into the role of a coastal decision-maker responsible for guiding their community over 30 years. Participants will explore the video game's modules (a port city, a fishing and tourism town, and a coastal weltand farming area) in small groups, encouraging discussion, negotiation and peer-learning on different coastal adaptation strategies and solutions and their associated trade-offs.

W6 - Teach to Restore, Restore to Teach: exchanging innovative pedagogical practices in Ecological Restoration

Coordinator(s): Coordinator(s): Patricia María Rodríguez González (Forest Research Centre, Associate Laboratory TERRA, School of Agriculture, University of Lisbon, Portugal), Bruna Paolinelli Reis (Centre for Ecology, Evolution and Environmental Changes & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências, University of Lisbon, Portugal), Marine Jacq (Univ Brest, Univ Rennes, CREAD, France).
Workshop type: Interactive activities

A successful restoration will depend on the skills of those who plan, implement, and monitor the restoration actions. A vast amount of knowledge in ER is being produced across a wide diversity of research and education institutions, practitioners, including privates, NGO's and government agencies. Given the multidimensional character of ER, here is an urgent need to develop adequate didactic approaches to current reality to bring this knowledge to formal Educational programs.

W7 - Restoration philosophy and the is-ought dilemma

Coordinator(s): Darcy O'Connor (Northern Rivers Ecological, Derwent Catchment Project, Eden Project, CIEEM)
Workshop type: interactive forum

Science is the study of reality. We collect premises about what exists in the world, the relationships and interactions at play, and what we can expect to occur in the future. These are positive premises – claims that describe how the world is. But, as restoration ecologists, we err into the normative world. We make restoration decisions based on how we believe the world ought to be. In a light-hearted and engaging way, this workshop explores the is-ought dilemma and its implications for ecological restoration. We learn to embrace values-based decision making as a necessary aspect of good ecological restoration.

W8 - The role of the arts in restoration

Coordinator(s): Liz Ballard & Berry Mulligan (Endangered Landscapes & Seascapes Programme)
Workshop type: interactive exchange

Bringing together examples from artists residencies from across Europe, the session will explore how place-based artistic practice can be catalytic in generating connection with and support for restoration projects. It will also consider how to measure the impact of engaged arts practice on people and restoration outcomes, including learning from the Endangered Landscapes & Seascapes Programme.

W9 - Are we barking up the wrong tree? Possibilities of social-ecological visions and references in ecological restoration

Coordinator(s): Niclas Ruppert (University of Freiburg)
Workshop type: Knowledge-Café

Following a brief presentation on the topic, participants will discuss issues surrounding the limitations and possibilities of creating social-ecological visions and references in ecological restoration. This workshop is aimed at European restoration scholars and practitioners.

W10 - Implementing the Recovery Wheel for evaluation and consultation

Coordinator(s): Marion Bourhis, Sébastien Gallet (Laboratoire Géoarchitecture UBO)
Workshop type: Participants work in small groups (maximum of 6), each facilitated by a specialist in the relevant ecosystem type and overseen by a global coordinator.

After an initial phase of contextualization and presentation of the Recovery Wheel, participants will work in small groups to deepen their understanding. Using datasets from different ecosystems and types of disturbance, they will discuss, refine, and apply an evaluation grid based on the principles of the “five-star evaluation.

W11 - Assisted Natural Regeneration in carbon markets: field evidence, methodological integrity, and scaling pathways from tropical Latin America

Coordinator(s): Olivia Gumbel (NatureRe Capital), Eliana Molina (NatureRe Capital)
Workshop type: Interactive workshop combining short technical presentation and case study, breakout group exercises, and plenary synthesis.

Through facilitated discussion, participants will engage with emerging questions around Assisted Natural Regeneration (ANR)-specific methodologies, biodiversity monitoring, permanence, risk management, and collaboration with local communities. The workshop aims to foster critical dialogue between restoration scientists, practitioners, and finance actors, and to identify research gaps and best practices for advancing ANR within credible restoration and carbon frameworks.

W13 - Counting what counts: Building consensus toward a shared, universal set of restoration outcome measures in the Anthropocene

Coordinator(s): Stephen Murphy (University of Waterloo), Holly Jones (Northern Illinois University), Jens-Christian Svenning (Aarhus University)
Workshop type: A short series of lightening talks from the organizers to set the context, the bulk of the 1h30 workshop will be small-group interactive discussions & and a concluding forum for whole-workshop discussion

Maximizing the outcomes of ecological restoration and rewilding requires robust and comparable ways of quantifying those outcomes. Ideally, a shared set of outcome measures and methods would enable efficient comparison across research and practice worldwide, yet such standardized approaches remain elusive—particularly as ecosystems increasingly depart from historical reference conditions. (…) This workshop brings together researchers and practitioners to explore whether broadly applicable and flexible outcome measures can be developed that remain meaningful in an increasingly novel Anthropocene, and to identify pathways.

W14 - Design It Yourself (DIY) - building resilient coastal ecosystems with biodegradable and biobased restoration techniques/kickstart agents.

Coordinator(s): Malenthe Teunis, Karin Didderen, Brenda Deden (BESE-products)
Workshop type: Interactive activities - presentation on a screen, tables to create designs, open space to show case materials/techniques

Wetland and Coastal ecosystem restoration is challenging, success rates are low and often materials used are based on non-native, permanent materials (like plastic or concrete).
BESE consists of dedicated habitat restoration specialists who have witnessed the repeated failures of ecological restoration and are motivated to develop unique products for nature restoration to ensure the success of restoration projects worldwide.
Come join us in this workshop and explore the world of wetland habitat restoration techniques, using biodegradable and biobased materials, which are designed to effectively kickstart nature restoration and leave nothing but a thriving ecosystem behind.
Register for this interactive workshop where we combine ecosystem restoration knowledge, restoration techniques and biodegradable products to optimize restoration
design in a most effective and sustainable manner.

Note: designing restoration techniques comes with dirty hands.

Explore our methods, materials and engage in discussion on how these materials / ideas could work for your location.

W15 - From resistance to ownership: Building multi-stakeholder support for urban and peri-urban wetland

Coordinator(s): Evelien Marlier (Natuurpunt VZW), Sarah Verhaegen (City of Mechelen, Belgium)
Workshop type: Interactive workshop combining short keynote inputs, small group co-creation sessions, plenary reflection and synthesis, moderated discussion / roundtable

This interactive and interdisciplinary workshop will explore practical approaches to creating and sustaining stakeholder support for wetland restoration projects. Drawing on experiences from the LIFE project Wetlands4Cities and other European initiatives, participants will exchange knowledge on citizen science, tips and tricks, participatory processes, governance models, and collaboration with economic sectors.

W16 - Monitoring long-term restoration effects on biodiversity at a national scale

Coordinator(s): Merlin Schaefer (German Federal Agency for Nature Conservation - BfN), Mathias Scholz (Helmholtz Centre for Environmental Research - UFZ), Michael Foerster (Luftbild Umwelt Planung GmbH - LUP)
Workshop type: Live brainstorming, round tables, plenary discussion.

This workshop will focus on three practical questions: (1) Which key long-term effects of restoration and NBS measures should be measured in different terrestrial ecosystems, especially forests, floodplains and peatlands? (2) Which biodiversity indicators are suitable for tracking them at national scale? (3) To what extent can existing monitoring programs, biodiversity databases, and remote sensing be used for large-scale long-term monitoring and evaluation of these parameters?

W17 - Reading the Language of Disturbance

Coordinator(s): Darcy O'Connor (Northern Rivers Ecological, Derwent Catchment Project, Eden Project, CIEEM), Harry Munt (Symbiosis, Save the House Sparrow, Tree Council, Eden Project, CIEEM)
Workshop type: Initial lecture followed by interactive discussion activities

This workshop explores how disturbance ecology can be redefined as a friend of ecological restoration. Drawing on real-world experiences from both Australia and Europe, we unpack the incredible potential that disturbance, be it natural or human-induced, can offer assisted natural regeneration.

ORAL COMMUNICATIONS
SPECIAL SESSIONS 1 TO 28 (+ W2)

(Within session abstract order may differ from programmation)

SS1 - THE LEGAL LABYRINTH OF RESTORATION LAWS FOR ECOLOGISTS

The legal devil is in the linguistic details. Deciphering the effects of word choice in the European NRR.

Alexandra Aragao. University of Coimbra Institute for Legal Research – Portugal

In a normal conversation words matter. In law they matter even more. The choice of auxiliary verbs, adverbs or verb tense used, are minor linguistic differences that can make a huge difference in practice. The legal devil is in the linguistic details.
The classic example is the definition of ”ecological corridor” in the habitats directive. Eco-logical corridors are features of the landscape ”by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems for marking field boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species” (Article 10 §2 of the Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
https://eur-lex.europa.eu/eli/dir/1992/43/oj/eng).
Taking the EU nature restoration law (which, by the way, is a regulation), as an example, what is the difference between ”shall put in place restoration measures” (ex. article 4/7) and ”may put in place restoration measures” (ex. article 11/4)? And what does ”put in place measures which shall aim to ensure that” really mean? The drafting history shows that that this enigmatic wording was a compromise between the Council, the Commission and the Parliament, during the negotiations.
In conclusion, the European Regulation doesn’t say precisely the same in different languages. Even if the official EU languages all have the same value, considering that they are not absolutely symmetrical, there must be a solution the deadlock.

When Nature Sues Back: How the European Court of Justice Interprets EU Restoration Obligations

An Cliquet, Ghent University – Belgium

Even the best restoration law remains pointless if it is not implemented properly. Ideally, governments take the necessary restoration measures and take action to reduce or stop threats to ecosystems. Unfortunately, lack of implementation is a widespread problem, as we have seen for example with the Habitats Directive. If laws are not properly implemented, as a last resort, courts, such as the European Court of Justice, can interpret and enforce the law. Although there are no European Court rulings yet on the EU Nature Restoration Regulation, as it has only been recently adopted, there are several European Court of Justice rulings on the existing restoration obligations in the Habitats Directive. Those rulings grant important insight into the interpretation of the restoration obligations.
This presentation will address two aspects:

- The role of the European Commission and European Court of Justice in enforcing EU laws, as well as examples of European Court rulings that are relevant for restoration.
- The role of science in court: many of the legal provisions on conservation and restoration are based on ecological science. How does the European Court deal with ecological concepts and scientific information? What role can scientists have in supporting court cases on restoration

Agriculture as driver, problem or solution? The paradoxes of the Nature Restoration Regulation.

Enrico Mezzacapo, Scuola Universitaria Superiore Sant'Anna [Pisa] – Italy

This contribution examines the relationship between the Nature Restoration Regulation and agriculture, with particular attention to its internal tensions and legal implications. It argues that, although agriculture remains one of the principal drivers of ecosystem degradation and biodiversity loss in the European Union, the Regulation imposes only limited obligations with respect to the restoration of agro-ecosystems and does not establish direct duties for farmers. The analysis also considers the Regulation's interaction and potential crucial synergies with the EU Common Agricultural Policy, focusing in particular on the express exclusion of any obligation to reprogramme CAP funding in support of restoration objectives. The presentation reflects on the broader challenges of aligning nature restoration goals with the legal and financial architecture governing EU agriculture.

The Borderless Sea vs. Bordered Law: Legal Hurdles in Transboundary Marine Restoration and Tools to Overcome Them

Elisa Cavallin, Ghent University – Belgium, Hasselt University – Belgium

Ecological systems are dynamic and interconnected entities. These fundamental characteristics, reinforced by the often regional scale of environmental challenges, underscore the need for restoration approaches to extend beyond jurisdictional borders. Marine areas offer the perfect example of this.
These ecological realities have direct governance and legal implications. In the European Union (EU), the establishment of area-based restoration measures under the framework of the Nature Restoration Regulation (NRR) is bound to affect and touch upon the competences and legitimate interests of different EU Member States. Crucially, inconsistent measures across Member States, due to, e.g., different priorities and allocation of resources, can create significant challenges, likely affecting the implementation of the NRR. Accordingly, meeting environmental obligations, including the restoration targets and obligations set out in the NRR for cross-border ecosystems, will require legal and governance mechanisms that mirror the ecological continuity of ecosystems: in short, effective transboundary coordination. To achieve this, alignment of priorities and capacities between Member States and the establishment and utilisation of cross-border funding instruments are necessary, along with the creation of (EU-facilitated) working groups and the full utilisation of the tools provided by the legislation.
The proposed presentation will touch upon these issues and hurdles and offer examples of tools to overcome them, such as the instrument of the joint recommendation for the coordination of restoration measures in marine ecosystems, the establishment of cross-border protected areas and the establishment of European legal bodies of cross-border legal nature, such as European Groupings of Territorial Cooperation.

Forest ecosystem restoration between ambition and exemptions

Jessica Stubenrauch*, Moritz Hermsdorf
Helmholtz Zentrum für Umweltforschung Germany

Forest ecosystems in Europe are increasingly threatened by weather extremes which cause enhanced tree mortality and thus create an urgent need for restoration. At the same time, the intensifying impacts of climate change present a significant challenge to restoration efforts.
The EU Nature Restoration Regulation (NRR) defines specific indicator-based restoration targets for forest ecosystems, where an increasing trend has to be achieved by 2030 until *satisfactory levels* are reached. However, exemptions like *large-scale force majeure,* which includes wildfires and unavoidable habitat transformation directly caused by climate change, can justify the non-fulfilment of the restoration obligations. Besides that, outside Natura 2000 areas, the expansion of renewable energies might also easily be given priority as a *project of overriding public interest*. The presentation delves deeper into these controversies, seeking to clarify the meaning of newly introduced legal terms such as *satisfactory levels* and discusses the exemption regime of the NRR. The talk will provide answers on how to successfully address persisting insecurities due to climate change impacts within the legal labyrinth of Natura 2000 norms and newly introduced restoration obligations. Results show, that adopting a forward-looking perspective that considers latest scientific findings and integrates stakeholders' needs and knowledge is essential for securing restoration success. In contrast, *force majeure* cannot serve as a blanket excuse for failing to adopt the NRR targets. Besides, renewable energy targets must be aligned with restoration targets. Finally, further guidance is needed to ensure adequate *satisfactory levels* for forest indicators, representing resilient, biodiverse forest ecosystems.

SS2 - SUPPORTING NRR IMPLEMENTATION THROUGH RESTORATION KNOWLEDGE HUBS

The Danish Centre for Nature Restoration: An example of a national hub for marine nature restoration

Jens Kjerulf Petersen * [1], Peter A.u. Stæhr [2], Mogens R. Flindt [3], Torben B. Jørgensen [4]
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[4] Limfjorden Council – Denmark

The Danish Centre for Marine Restoration (CMR) is a collaboration between three univer-sities and the Limfjorden Council as a representative for Danish municipalities. The CMR is a virtual centre financed by both private and public funds that aims to promote knowledge-based implementation of marine restoration. CMR performs a wide range of duties including science-based advice to the Danish EPA. A major task for CMR is to provide guidance on ecological, technical, and economic factors that can improve project success and minimize failures. The knowledge is disseminated through online reports, focussed workshops and bi-annual national conferences for stakeholders. Topics of the reports are e.g., guidelines for site selection, best practice manuals, and monitoring guidelines for different nature types like seagrass meadows, boulder reefs and bivalve beds. Workshops include topics like legal and administrative barriers to nature restorations and options for coexistence between energy infrastructure and endangered species or habitats. Some of the centre achievements are presented. In a very short time span, CMN has positioned itself as a national knowledge hub and gained broad recognition as an important factor in a Danish context. On request, several of the CMN reports have also been translated and are now used in e.g. HELCOM. These achievements are due to the committing collaboration between the institutes in Denmark with most experience in marine nature restora-tion and local stakeholders thus speaking with one voice on a scene that is developing in many different directions e.g., in relation to the EU Nature Restoration Regulation.

Urgent need for EU regulation and nursery accreditation schemes to prevent spread of introduced invasive plant pathogens via restoration activities

Thomas Jung * [1], Marília Horta Jung [1], Ivan Milenkovic [3], Bruno Scanu[4], Ana Pérez-Sierra [5], Joan F. Webber [6], Clive M. Brasier [6]
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Numerous research projects have demonstrated that widespread declines and mortalities of alder, beech, chestnut, oak and other forests across Europe are primarily caused by introduced pathogens of the oomycete genus *Phytophthora* destroying root systems, infecting stem bark and interacting with climatic extremes, in particular droughts and unseasonal floodings. Europe-wide surveys of ca 2,500 nursery stands and 2,500 planting sites have revealed near-ubiquitous infestations involving > 120 mostly exotic *Phytophthora* species. In Europe, between 1990 and 2010 invasive *Phytophthora* pathogens were spread via out-planting activities to > 20 million hectares of forests. Due to the use of symptom-suppressing fungicides *Phytophthora*-infected nursery plants often appear visually healthy. Since (i) European plant biosecurity is based on visual inspections of plants for disease symptoms caused by listed pests, and (ii) phytosanitary conditions for the production of nursery plants are largely unspecified, large-scale restoration of terrestrial and wetland ecosystems involving planting of nursery-grown plants will inevitably lead to accidental introductions of invasive and often highly aggressive *Phytophthora* and other pathogens to most restoration sites, causing further decline and dieback of sensitive ecosystems and the spread of the pathogens over vast areas. Similar environmental impacts are reported from heathland restorations in California.
To prevent the EU Nature Restoration Regulation causing a phytosanitary disaster, efficient EU regulations using high biosecurity standards for the pathogen-free production of nursery plants, similar to Australian, Californian and UK nursery accreditation schemes, are urgently required. The use of molecular high-throughput detection protocols should be implemented in all phy-tosanitary inspections (including EU plant passports).

Challenges in securing native seeds for sustainable nature restoration

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For implementing the aims of the Nature Restoration Regulation, large amount of locally adapted native seeds will be required. However, the global market of available seeds of non-local origin carries the risk of introducing maladapted, or even invasive aliens to restoration sites, threatening the success of targets. Under a changing climate, the issue of propagule provenance poses further challenges, as restored plant communities should be climate-resilient. Sound scientific evidence should support decisions on seed provenance; however, in many cases practical constraints make it difficult to prioritize local provenance. Seed transfer zones, based on biogeographical knowledge, are being developed to support provenance decisions and avoid the risk of maladaptation. In a few European countries, the native seed market is evolving, but even there, supply is far below the required amount and quality. Although guidelines and examples of good practices exist for designing seed supply chains, these should be harmonized to effectively serve the aims of the Nature Restoration Regulation. The development of such chains needs multi-stakeholder involvement and includes: (i) long-term but flexible planning of seed demands, (ii) support for regional seed collection and propagation by incentives, (iii) the establishment of restoration seed banks with cleaning and storage capacity, and (iv) the development of labelling and certification systems.

From heterogeneous marine coastal and estuarine restoration practices to decision support: insights from the Littorex platform and perspectives for large-scale implementation through LIFE Adapto+

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Ecological restoration and the broader concept of Nature-based Solutions (NBS) are increas-ingly promoted to address biodiversity loss, shoreline erosion, and coastal flooding risks under climate change. However, their implementation remains constrained by fragmented knowledge, heterogeneous practices, and limited use of robust evaluation frameworks, thereby hindering their scalability and effectiveness. To address these gaps, the Littorex platform was developed as a national initiative to compile and structure feedback from ecological restoration projects across marine, coastal, and estuarine environments in both mainland France and its overseas territories. The analysis of over 70 projects documented in the first version of Littorex (V1) provides a unique overview of restoration practices in France and highlights key limitations: a lack of standardised diagnostic frameworks, heterogeneity in the definition of restoration tar-gets, insufficiently robust long-term monitoring strategies, and limited documentation of project failures. Building on these findings, the second version of Littorex (V2) expands both its scope and functionality. It integrates a wider range of ecosystems and approaches within the NBS framework, improves the consideration of ecosystem-specific processes and pressures, and in-corporates methodological frameworks developed within restoration networks (e.g. REVER, SER). It also aligns with emerging policy and requirements, including the Nature Restoration Regulation. Beyond a data platform, V2 is evolving to support the design, implementation and evaluation of NBS. Embedded within the tools of the LIFE Adapto+, promoting adaptive coastal management, it contributes to decision-support and knowledge transfer. By bridging methodological structuring and empirical feedback across diverse contexts, this work supports the operationalisation and upscaling actions.

From ambition to implementation: Mapping urgent restoration knowledge gaps and missing tools

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Ecological restoration is increasingly used to recover biodiversity and ecosystem functioning across degraded ecosystems, yet practice remains constrained by major knowledge and data gaps. Although these gaps are widely discussed, a comparative understanding of their urgency and the availability of practical tools to address them is still lacking. Here, we present results from an international expert survey conducted by the BiodivRestore Knowledge Hub, includ-ing responses from restoration researchers and practitioners across terrestrial, freshwater, and marine ecosystems. Respondents evaluated the urgency of restoration-related knowledge gaps and assessed whether essential tools, manuals, and guidelines are available to address them. Knowledge gaps were perceived as most urgent in marine ecosystems, intermediate in terrestrial systems, and least urgent in freshwater ecosystems. In contrast, the perceived availability of tools did not differ among ecosystem groups. Across ecosystems, 15–19% of respondents in-dicated that suitable tools are unavailable, while more than one-quarter reported uncertainty about tool availability. The largest differences emerged among knowledge-gap categories rather than ecosystem types. Economics, financing restoration actions, and restoration trade-offs were consistently identified as areas with comparatively poor tool availability, whereas biodiversity conservation was perceived as better supported by existing guidance. By combining urgency rankings with tool availability, we identified critical gaps where high urgency coincides with low practical support. Our results suggest that strengthening knowledge transfer, tool accessibility, and implementation-oriented guidance may be as important as generating new ecological knowl-edge for achieving large-scale restoration goals under the UN Decade on Ecosystem Restoration.

Rethinking Adaptive Management for ecosystem restoration: from blueprint ideals to real-world practice

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Adaptive Management (AM) is widely promoted as a framework for ecosystem restoration under uncertainty, yet many restoration initiatives struggle to maintain effective learning loops in practice. While AM is often described as a comprehensive cycle linking planning, implementation, monitoring, evaluation, and adjustment, many projects only partially operationalise these components. This raises an important question: which elements are truly essential for adaptive management to function under real-world restoration constraints? We conducted a comparative review of 13 restoration initiatives across freshwater, terrestrial, and marine ecosystems in Europe and the United States. Using a seven-element Learning Loop Integrity Score (LLIS), we assessed how explicitly objectives, indicators, monitoring, feedback mechanisms, triggers, roles, and documented adjustments were implemented across cases. The analysis revealed that adaptive learning depended less on methodological sophistication or monitoring intensity than on whether monitoring results could reliably inform authorised management adjustments. The most common weaknesses across cases were the absence of explicit decision triggers, unclear adjustment pathways, and limited documentation of feedback processes. By contrast, projects with relatively simple monitoring systems often maintained functional adaptive learning loops when governance structures and decision responsibilities were clearly defined. Based on these findings, we propose a Minimum-Viable Adaptive Management (MV-AM) framework that identifies the minimum governance and decision-making elements required to sustain adaptive learning in practice. We argue that embedding AM within clear roles, decision rules, and traceable feed-back structures may be more important for restoration success than increasing procedural or analytical complexity alone.

Science-based ecosystem restoration to inform the Nature Restoration Plan in Portugal

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Within the framework of the EU Nature Restoration Regulation, a working group under interministerial coordination has been established in Portugal, to develop the National Nature Restoration Plan. The Plan must be grounded in the body of scientific knowledge generated nationally and internationally over recent decades, and the notable restoration projects implemented in Portugal, ensuring ecological coherence, methodological rigor, and effectiveness in defining targets, indicators, and restoration measures. An update on the progress of the work and on scientific engagement is

provided, particularly regarding the contributions of the national expert network ”Rede de Conhecimento para o Restauro da Natureza”. This network is formed by > 200 researchers from all over the country, with the scientific and technical knowledge and research on ecosystem restoration, and is composed mostly of researchers (> 80%). These experts contributed to the different articles of the Regulation, involving: the participation in general meetings of the Network and in thematic meetings in their area of expertise; provision of biodiversity data, habitat mapping and assessment of conservation status; provision and synthesis of information on indicators and comments on the diagnostic reports produced; providing of information on restoration projects implemented in Portugal; proposing restoration measures to be implemented; proposing methodologies for defining reference areas, suggesting modeling tools for prioritizing areas to be restored, and integrating scenarios. In addition to the contributions made so far, the continued support of the Network for the works of the National Plan in the medium and long-term is critical for its successful implementation.

EO4Nature: A national Earth observation portal for planning and monitoring nature-based restoration in Germany

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Ecological restoration and nature-based climate action increasingly require spatially explicit, repeatable and policy-relevant monitoring. EO4Nature is a national Earth observation portal currently being developed in Germany to support the planning, monitoring and evaluation of measures under the Federal Action Plan on Nature-based Solutions for Climate and Biodiversity. The portal translates Copernicus Sentinel time series, complementary geodata and AI/ML methods into operational indicators and user-oriented services for different fields of action, including peatland rewetting, floodplains, forest ecosystems, soils, protected areas and urban green infrastructure.
In this contribution, we present the concept, service architecture and first implementation lessons from EO4Nature. We focus on how EO-derived indicators can support restoration planning and adaptive management across administrative levels, from national reporting to local project dashboards. Particular emphasis is placed on co-design with public authorities, NGOs and practitioners; harmonised reference areas; transparency of uncertainties; and the combination of EO4Nature products with local knowledge and user data.
Using selected pilot services, we show how multi-temporal remote sensing can help identify restoration needs, document implementation, and assess ecosystem responses in a consistent and scalable way. Beyond individual indicators, EO4Nature aims to establish a shared digital infrastructure that links monitoring, modelling, capacity building and communication. We discuss opportunities and limitations of moving from research prototypes to a permanent, free and operational platform for restoration practice, and outline how such national infrastructures can contribute to credible restoration planning, adaptive management and implementation of European restoration objectives.

What knowledge and tools are needed most urgently for restoring wetlands and inland waters?

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Sustainable management and restoration of wetlands and inland waters will be a critical nature-based solution to mitigate greenhouse gas emissions, to halt biodiversity loss, and support climate change adaptation. Wetlands also contribute to protection from drought and flooding, purify water and regulate the microclimate.
As a part of an international expert survey carried out by the BiodivRestore Knowledge Hub, re-searchers and practitioners in freshwater and wetland restoration identified the most significant knowledge gaps related to restoration actions in palustrine wetlands, lakes, rivers and streams, and whether essential tools are available to close the knowledge gap.
The respondents considered the knowledge gaps in economics and trade aspects, social and cultural aspects as well as in delivering, evaluating and monitoring restoration most urgent across the different wet ecosystems. Additionally, river

and lake restoration experts highlighted the knowledge needs in climate change mitigation and adaptation and river experts also in connectivity, migration and translocations. Overall, ecological knowledge gaps did not rank as urgent as societal ones. The experts assessed that economics and trade as well as social and cultural aspects of restoration lack essential tools more frequently than delivering, evaluating and monitoring restoration do. Recommendations to address the knowledge gaps included restoration demonstrator sites (business cases), practical guidance on governance, general and geographical knowledge of governance, economic trade-offs, costs of restoration, ecological condition and evidence of greenhouse gas emissions from certain types of wetlands to support financial instruments.

From Barriers to Enablers: Reforming Regulatory Frameworks for Coral Reef Restoration

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As many coral reef systems approach ecological tipping points, coral reef restoration is increasingly a necessary complement to conservation and ecosystem management where natural recovery alone is insufficient.
Despite rapid advances in restoration science and technology, regulatory frameworks governing coral reef restoration can remain fragmented, outdated or poorly aligned across governance scales. These limitations can constrain restoration effectiveness, inhibit uptake of innovative techniques and create barriers to implementation. Strengthening regulatory frameworks is essential not only for scaling coral reef restoration, but also for ensuring that restoration contributes to ecosystem resilience and socio-ecological recovery in a rapidly changing climate. This presentation examines regulation as a foundational facet of responsible, effective and scalable coral reef restoration.
We present a three-step approach – Collate, Review, Adapt – for evaluating and strengthening restoration-related regulatory frameworks at a national level. The approach supports governments in identifying regulatory gaps and improving coordination. It encourages adaptive frameworks that can respond to emerging techniques, as well as ecological and social challenges. We outline the relevance of national regulatory frameworks within international commitments, including the Kunming–Montreal Global Biodiversity Framework and its Target 2 on ecosystem restoration.
We identify six key principles for restoration regulatory frameworks: 1) integration with wider ecosystem management, 2) protection of ecosystem health and function, 3) stakeholder engagement, 4) incorporation of climate resilience, 5) long-term adaptive project structures, and 6) financial and institutional sustainability.
We demonstrate how coherent and adaptive regulatory frameworks can support innovation and better align ecological objectives with social and cultural priorities.

SS3 - TOWARDS COHERENT AND EFFECTIVE NATIONAL RESTORATION PLANS IN THE EUROPEAN UNION

How much semi-natural grassland is enough? Setting spatial priorities for conservation in a national context

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Semi-natural grasslands are ecologically and socio-economically vital ecosystems that de-pend on traditional management, such as grazing and mowing. In Estonia, these habitats host a significant portion of national and European biodiversity. Historically exceeding one million hectares in the early 20th century, Estonian semi-natural grasslands have declined drastically. Today, only 13% (132,000 ha) remains, with approximately 50,000 ha currently maintained under agricultural subsidies.
To halt biodiversity loss, a species accumulation analysis revealed that managing at least 80,000 ha of grasslands is essential to ensure the long-term survival of 90% of protected grassland species. Securing sustainable ecological functionality requires maintaining 100,000 ha, while a resilient long-term network should encompass 300,000 ha.
To achieve these targets, we applied the spatial conservation planning algorithm Zonation, which ranks meadow polygons based on their contribution to biodiversity preservation. The prioritization integrated four components: (1) conservation quality (expert evaluation, species presence, and historical continuity), (2) socio-economic viability (management feasibility, restoration potential, and tourism), (3) ecological connectivity, and (4) uniqueness at national and European scales. This framework optimizes restoration decisions while still encouraging the maintenance of lower-ranked sites and supplementary support areas (e.g., species-rich permanent pastures, road verges). This methodological framework provides a robust foundation for national spatial planning and can be readily adapted for other ecosystems.
To translate science into practice, we launched the publicly accessible ”Niidumeeter” (Meadow Meter) web application, designed for use by both policymakers and the general public. It visualizes spatial priorities and identifies critical zones for ecological support areas.

Development of Habitat Action Plans in Latvia – Experience, Challenges and Results.

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Habitat Action Plans (HAPs) in Latvia have been developed to improve the conservation status of habitats of European Union importance listed in Annex I of the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive), with the aim of achieving a favourable conservation status. Recommendations and guidance have been prepared for the conservation, management, and restoration of habitats both within Natura 2000 sites and at the national level for the coming 12 years. In total, 21 Habitat Action Plans have been developed covering 56 protected habitat types of EU importance, grouped into ecologically appropriate categories. The plans identify priority areas for habitat protection and management, propose the expansion of existing *Natura 2000* sites and the refinement of their boundaries, and provide recommendations for monitoring, further re-search, and public awareness activities. Habitat Action Plans also serve as a scientific basis to support future policy decisions and the preparation of the National Nature Restoration Plan in accordance with the EU Nature Restoration Regulation (Regulation (EU) 2024/1991).

Quantifying Restoration Needs in Finland’s Raised Bogs and Aapa Mires under the EU Nature Restoration Regulation

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By 2050, the EU Nature Restoration Regulation requires the restoration of 90% of Habitats Directive habitat areas that are in less than good condition. In Finland, aapa mires and raised bogs are the most extensive mire habitat types listed in the Directive, and their condition has been substantially degraded, mainly due to drainage for forestry. Often, however, only some parts of the mire complex have ditches and need actual restoration measures. This study assesses the extent of restoration measures required on Finnish aapa mires and raised bogs to meet the Regulation’s targets.
We used a national peatland delineation dataset of the Geological Survey of Finland, covering all peatlands larger than

5 hectares (126,948 sites; 61,668 km^2), each classified by naturalness based on drainage status. A stratified random sample (N = 593) was drawn by vegetation zone and naturalness class. Using multiple spatial datasets, sites were classified into Habitats Directive mire types, and their ecological condition was evaluated. Areas requiring restoration measures were delineated.
Altered peatland complexes (> 5 ha) no longer representing Directive habitat types covered 20,800 km^2. These were excluded from restoration requirements. Area of aapa mires was 26,600 km^2, of which 13,200 km^2 not in good condition. These require restoration measures on 4,900 km^2 by 2050. Raised bogs covered 8,200 km^2; 5,100 km^2 was not in good condition, requiring interventions on 2,100 km^2. Altogether, restoration of aapa mires and raised bogs through ditch blocking would involve 298,100 km of ditches, which is 20% of Finland's peatland drainage network.

Landscape-ecological system analysis (LESA): a practical site-based approach to achieve good condition of habitat types and step-wise set an FRA rooted in local evidence

Kris Decleer, Research Institute for Nature and Forest – Belgium

The LESA tool is promoted as a site-based approach for (1) cost-effective, evidence-based restoration, (2) integrated planning for the implementation of the EU Nature Restoration pro-visions, and (3) the most accurate way to define the favourable reference area for habitat types.

Habitat mapping, assessment of habitat condition and restoration priorities: scientific knowledge supporting ecosystem restoration planning in Hungary

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The implementation of the EU Nature Restoration Regulation requires robust scientific knowledge on the distribution, condition and restoration potential of habitats, particularly those of Community importance. Here, we present recent methodological developments and national-scale assessments from Hungary that support restoration planning and prioritisation. We introduce the Ecosystem Map of Hungary as a framework for identifying semi-natural and natural habitats outside the Natura 2000 network, together with country-scale approaches for ecosystem condition assessment. We highlight the importance of long-term ecological datasets and historical sources for reconstructing historical baselines and estimating favourable reference areas, thereby helping to avoid the shifting baseline syndrome in restoration planning. We further demonstrate how a green infrastructure framework can support the spatial prioritisation of ecosystem preservation, restoration and connectivity enhancement through the integration of ecological condition, multifunctionality and landscape connectivity. Finally, as a case study, we present the development of a decision-support system for the restoration of sandy habitats in Central Hungary, integrating potential natural vegetation models, abiotic constraints and land-scape context to identify sustainable restoration targets and prioritise restoration interventions.

Advances in mapping habitat condition and favourable reference areas for restoration

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The EU Nature Restoration Regulation requires all Member States to develop National Restoration Plans (NRPs) with binding targets for 2030 and 2050. Early preparation, however, reveals substantial disparities in data availability, institutional capacity, and methodological maturity, raising concerns about the coherence and ambition of plans due in 2026. We report findings from an international workshop organized by the R2D project with support from SER Europe.
Habitat mapping outside Natura 2000 sites remains a critical bottleneck. While Flanders, Czechia, and Austria have largely completed national Annex I habitat maps or comprehensive monitoring systems, countries such as Hungary, Spain, Italy, and Portugal lack fully reliable publicly accessible national coverage at the required scale, although work is ongoing. Habitat condition assessment is similarly uneven, frequently relying on expert judgment with limited spa-tial resolution. Favourable Reference Area definition is the least developed component across most Member States, with many deferring it to later NRP iterations. Austria stands as an exception, having developed a structured methodology integrating metapopulation concepts, minimum viable areas, and the precautionary principle.
Governance structures are complex and multi-layered, with weak science-policy interfaces, un-clear responsibilities across governance levels, and no dedicated funding for methodological development in most countries.
Despite these constraints, restoration knowledge and successful practice exist across all Mem-
ber States. The principal gaps lie in harmonized planning frameworks, spatially explicit data, and transparent prioritization approaches. NRPs must evolve into adaptive, landscape-scale instruments, progressively refined through improved data integration, formalized science-policy collaboration, and long-term institutional commitment.

Current situation for Article 4 implementation in France, and strategies to fill knowledge gaps on habitat condition and favourable reference areas

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PatriNat, the French center of expertise and data on nature, is providing scientific expertise to the Ministry for Ecological Transition for the drafting and implementation of the French National Restoration Plan, specifically to identify the restoration efforts and knowledge-building strategies needed to meet the EU Nature Restoration Regulation's (NRR) expectations regarding targeted habitats and species. In this presentation, we will provide an overview of the preliminary information on the state of biodiversity already collected for the preparation of the national restoration plan and its implementation until 2030, in particular under Article 4 of the NRR dedicated to continental habitats. We will also present the methodologies we adopted, in conjunction with existing frameworks, to address the new regulatory requirements under the NRR which are to characterize and spatialize restoration needs by 2030 (areas of habitats in bad condition), as well to better quantify the re-establisment needs of those habitats (Favorable Reference Areas).

National Restoration Plans: a unified framework for guiding nature recovery in Europe

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The European Union has established a legally binding framework requiring area-based restoration measures to improve species and habitat conservation status and support natural ecosystem recovery across at least 20% of European land and sea areas by 2030. However, major implementation challenges remain. Divergent interpretations of restoration objectives can lead to inconsistent implementation models and undermine restoration outcomes. Bridging the gap between legally binding restoration targets and their effective implementation is particularly difficult, as substantial discretion exists in translating EU-level targets into national restoration planning and actions. Clearly articulating the links between national-level planning and EU-level restoration outcomes is therefore critical to the success of the Regulation. The Unified Formats for the National Restoration Plans (NRP) aim to address this gap by providing a standardized framework for specifying restoration targets and implementation measures at the national level. Here, we present the co-creation process involving scientists and policy experts from the ETC BE, the EEA, the European Commission, and Member State administrations that led to the development of the National Restoration Plan formats. We then outline the rationale underpinning the planning framework embodied in these formats. We also present the first quantification of restoration area required to achieve improvements in the conservation status of Annex I terrestrial habitat types and species, highlighting the magnitude of restoration required to meet EU-level objectives. Finally, we identify key NRP implementation challenges, includ-ing linking targets to restoration measures, monitoring restoration effectiveness, and evaluating national commitments against EU-level restoration outcomes.

From a national plan to regional implementation: The case of the Grote Beek Watershed, Netherlands

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The Nature Restoration Regulation (NRR), a legally binding framework, presents unprecedented challenges and opportunities for EU Member States, regional governments, conservation organizations, and society at large. By August 2026, EU Member States must submit national nature restoration plans-a challenge, given the tight timeline and the multifaceted pressures facing European landscapes.
Yet, the greater challenge lies ahead: translating these plans into actionable, landscape-scale measures in multifunctional areas where competing land uses, diverse stakeholders, and conflicting interests converge. The Grote Beek watershed in the eastern Netherlands epitomizes this complexity. A highly productive agricultural region, it also harbors significant ecological potential but grapples with hydrological disruptions and nitrogen deposition.

This study explores how to unlock the restoration potential of such landscapes. We address critical questions: What are the area-specific opportunities for restoration? How can the NRR's concrete targets be operationalized into effective measures? Our analysis explores a range of restoration options, including:

- Hydrological restoration (watershed protection, brook revitalization)
- Forest adaptation (species composition, ecological corridors, agroforestry)
- Grassland diversification and extensified management
- Strengthening green-blue infrastructure
- Reducing pesticide and fertilizer use
- Expanding the protected area networks with areas with high biodiversity potential

We argue that successful restoration demands cross-scale governance, bridging local farmers, water boards, provinces, and national ministries. In the end our method should result in a holistic approach-integrating multiple regulations and policies- which is essential to align environmental, agricultural, and societal goals. By fostering stakeholder commitment, this method enables the development of forward-looking, synergistic restoration plans that deliver tangible benefits across sectors

SS4 - NATIONAL HUBS AND NETWORKS FOR ECOLOGICAL RESTORATION

RIRE as a Bottom-up National Restoration Hub Supporting Italy's National Restoration Plan

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The EU Nature Restoration Regulation requires Member States to translate targets by preparing and adopting National Restoration Plans (NRPs) that are technically robust and socially legitimate. In Italy, this translation is challenged by fragmented competences, legislative limitations, variable practice standards and limited capacity for stakeholder coordination. The Italian Network for Ecological Restoration (RIRE) is a bottom-up national hub created to act as a science–policy–practice interface and to support the development of a scientifically sound Italian NRP.
Since 2024, RIRE has brought together, consulted and mobilised an interdisciplinary community of researchers, practitioners and institutions through a series of activities such as a national sur-vey (130+ responses) identifying barriers, needs and opportunities; a Declaration endorsed by SER Europe, thematic working groups and conferences. Among the several topics of discussion, a dedicated stream of RIRE research links botanic gardens and germplasm banks to integrate seed sourcing, propagation protocols and quality standards for restoration material into the NRP.

RIRE has contributed to national consultations, including a parliamentary hearing, and has established a structured dialogue with the competent authorities (MASE, ISPRA, Italian Senate, EU DG ENV) to provide technical feedback on draft measures, indicators and implementation arrangements. In this presentation, we aim to share information on the

journey of this Network so far, including lessons learned on governance, resourcing and legitimacy in a volunteer-based hub, progress of key activities of the working groups, and propose transferable steps for Member States wishing to build or strengthen national restoration hubs aligned with the SERE community.

From Data to Action: Establishing an eLTER European Restoration Hub to Inform Policy and Practice

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Achieving large-scale ecological restoration to meet the targets of the European NRR requires networks that effectively connect research-practice-policy. However, restoration efforts are often constrained by fragmented knowledge, limited long-term monitoring, weak cross-sector collaboration, and unstable funding. In this context, emerging national restoration hubs and networks play a key role in facilitating knowledge exchange, aligning stakeholders, and supporting the development and implementation of National Restoration Plans(NRPs). The Long-term Ecological Research Network Europe (eLTER) presents an opportunity to support these efforts through long-term, site-based ecological research across diverse socio-ecological systems. Over recent years, substantial progress has been made in understanding and documenting restoration activities across eLTER sites. A recent survey of restoration activities within eLTER identified 62 experts and 42 projects across 18 countries, covering a wide range of habitat types, degradation levels, and restoration approaches. This survey demonstrated the potential for establishing a restoration topic center(RTC) at eLTER aimed at fostering knowledge exchange, enhancing collaboration, and promoting future activities to scale up restoration efforts. To further explore this potential, four workshops held at international conferences focused on strengthening collaboration, identifying functions and added values of a RTC withing eLTER. Building on these efforts, the first official meeting of the eLTER RTC held in Hungary in 2025 and brought together researchers from seven countries to define its main objectives, functions, conceptual design and how the RTC could contribute to the NRR. Significant and continuous efforts are being made to advance the integration of the RTC within the eLTER framework, which is still in progress.

The Need for Ecological Restoration Guidance in Practice for the UK and Ireland

Tim Graham, CIEEM ER SIG and RSK Wilding – United Kingdom

CIEEM is the professional institute representing the ecology sector across the UK and Republic of Ireland. With the rise in interest and policy around ecological restoration they have had a Special Interest Group since 2017. More recent policy and legislative drivers have increased the need to support practice with relevant guidance to support good practice and better link academic and practice communities or learning. Two highlighted mechanisms include compliance market development such as Biodiversity Net Gain in England as well as voluntary market development such as Ecosystem Restoration Code in Scotland, both compliment the institution of statutory legal targets for restoration much like across the EU. This lead to the development specific guidance, and specifically starting to fill a gap in practice as well as working on the need to develop competencies and training. The guidance is called Rebuilding Nature: Good Practice Guidance on Ecological Restoration. This talk will explore the drivers for such guidance, outline our process and future of the guidance as well as focusing in on challenges that present when ensuring we contribute to global nature recovery and nature positive goals. Overall this is a chance to understand where the guidance has come from, motivate discussion for learning between EU and non-EU approaches, as well as be part of its future and development which will continue to evolve.

REVER, the French restoration network that dream of bringing all stakeholders together for ecological restoration

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REVER, which also means "dreaming" in French, is the French restoration network that emerged in 2008, and was established as an association in 2011. Inspired by the Society for Ecological Restoration, REVER aims to organise and promote exchanges between managers, practitioners, students and scientists working in the fields of restoration ecology and/or ecological restoration. Establishing an association gives REVER legal status and enables it to be represented, in particular, at institutional meetings or working groups concerning the restoration of natural habitats. This is the case, for example, with discussions on the development of an 'Ecological Engineering' standard, on the development of certification for ecological engineering firms, on the establishment of a national database of ecological restoration projects, or on the national restoration plan. The association status also enables us to better support the organisation of annual conferences as a full partner of the organisers. The association, via a mailing list of 1,000 subscribers, also aims to facilitate dialogue among restoration stakeholders and to develop links with other French networks in the fields of ecology and restoration. We will discuss this network's future projects as well as the challenges it faces.

National Mission Ocean Hubs for scaling out restoration solutions

Ida Beathe Øverjordet, SINTEF Ocean AS – Norway

A multitude of restoration solutions have been developed in the first phase of Mission Ocean. Ecological restoration of marine and freshwater ecosystems was the primary focus in the Arctic-Atlantic and Danube-Black Sea basins in this phase. The second phase is now rolled out, in which the focus will be replication and upscaling of solutions across all sea basins. A central way to facilitate this goal is to establish national hubs as part of the four newly funded coordination and support actions (CSAs). The hubs are tailored to meet the needs and work with relevant governance structures of the respective countries. This talk will focus on the implementation of national Mission Ocean hubs in the Arctic-Atlantic basin through the BlueMission2030 project.

SS6 - INTEGRATING BEST PRACTICE GUIDELINES, COMMUNITY ENGAGEMENT AND DIGITAL TOOLS FOR MEASURING RESTORATION OUTCOMES IN MANGROVE RESTORATION

Blending community engagement and automated monitoring to report wildlife and biodiversity trends in mangrove restoration

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With accelerating investment in mangrove restoration, it is essential to evaluate outcomes for animals that underpin ecosystem functions and services, including fisheries. Yet conventional wildlife surveys in mangrove forests are costly and logistically challenging. The Global Wetlands Project (GLOW) partners with a global network of restoration practitioners to deploy networks of sensors and cameras with automated data extraction. These systems automatically monitor animals above and below water efficiently and at scale. Automation identifies, counts and measures fish, crustaceans, birds and other animals from images and videos. We showcase four applications: (1) underwater cameras

detecting recovery of fish abundance within one year of mangrove restoration; (2) above-water cameras quantifying crab abundance, activity and functional diversity in restored forests; (3) acoustic cameras tracking fish at night and in murky waters; and (4) underwater stereo-cameras estimating juvenile fish abundance and modelling enhanced fisheries production in restored habitat. We also show how integrating automated biodiversity data with information on marine and terrestrial threats and forest structure enables assessment of restored mangrove condition.

Urgent need to simplify restoration monitoring protocols in the tropics to track project goals better

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Recent decades have witnessed ambitious global commitments to restore degraded tropical forests, savannas, and mangroves. Effective monitoring of the outcomes of these efforts is crucial to ensure progress towards these goals, facilitate adaptive management, build an evidence base of successful projects, and maintain funder and community trust in projects on-the-ground. To facilitate the planning and implementation of monitoring programs worldwide, several crediting organizations, NGOs, policymakers, etc. have developed a myriad of monitoring resources (i.e., standards, protocols, frameworks, guidelines, tools). However, the landscape of monitoring resources is now vast, complex, and difficult to navigate for restoration practitioners. Here, we review ~90 monitoring resources tailored to restoration projects in tropical forests, savannas, and mangroves, and summarize their guidance based on various criteria (e.g., type of monitoring recommendations provided; provision of a list of indicators; type(s) of indicators for which the resource gives specific guidance; skills needed to use the resource). We find that there is a widespread mismatch between the stated goals of monitoring resources compared to the information present within resources. Additionally, only ~25% of the resources included recommendations for monitoring socio-economic indicators, a clear gap in guidance. Finally, while ~60% of resources give guidance on monitoring frequency, only ~40% and ~30% provide guidelines on sampling effort and design, respectively. In the coming months we will publish a freely available online tool where practitioners can find monitoring resources based on their monitoring requirements, and with this contribution we present a first draft of the tool for feedback.

SS7 - SEASCAPE RESTORATION: FROM POLICY AMBITION TO SYSTEM-SCALE ACTION

Rebuilding Sejerø Bay: From Habitat Loss and Fisheries Collapse to Seascape-Scale Restoration

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Sejerø Bay (80,000 hectares, Western Baltic Sea) has undergone severe ecological decline over the past century due to eutrophication, stone extraction, overfishing, and destructive bottom-contacting gear.
Historically, local fisheries targeted a variety of species, supporting vibrant and diverse fishing activities. Fisheries data and fishers' accounts indicate steady productivity until the late 1990s, with a notable decline thereafter. Cod landings peaked at 15,000 tons in 1996 but fell to 22 tons in 2023, reflecting a loss of ecosystem productivity. The local cod population has since collapsed. Simultaneously, key habitats degraded: eelgrass meadows, once found at depths of 13.3 m, are now confined to 7-8 m, and biogenic reefs are restricted to the western side of Nekselø at 10.5 m depth.
The Sejerø Seascape project, led by WWF Denmark in partnership with Aarhus University, Technical University of Denmark, University of Southern Denmark, and local municipalities, represents a system-scale, integrated approach to marine restoration. It combines habitat restoration (eelgrass meadows, cobble and boulder reefs, biogenic reefs) with cod restocking, stakeholder engagement, and long-term protection efforts.
A comprehensive monitoring programme, including habitat surveys (300-400×100 m transects), fish surveys with underwater cameras (20 deployed simultaneously), and hydrodynamic modeling, will assess restoration outcomes and

support adaptive management.
By operationalizing multihabitat restoration at seascape-scale, the project bridges the gap be-tween Europe's ambitious marine restoration policies and on-the-ground implementation. It fosters ecological connectivity and local stewardship through citizen science, serving as a model for translating policy ambition into measurable ecological recovery across European seascapes.

The marine ecological Recovery Wheel and 5 Star System for temperate seas

Philine Zu Ermgassen* , Valentina Asnaghi [1,2], Georgina Banfield , Elisa Bayraktarov , Ronald Baker , Marc Bouchoucha , Rod M. Connolly , Anna Cucknell , Alison Debney , D'alessandro Simone , George Gann [3], Nathan R. Geraldi , Martin Gullström [4], Richard. J. Lilley [5], Joel Lindholm , Sally Little , Zoe Morrall , Dimitris Poursanidis , Federica Ragazzola , J. Murray Roberts , Henrike Semmler Le [6], Aline Da Silva Cerqueira , Geraldina Signa [7,8], Sahar Stevenson-Jones [9], Richard K.f. Unsworth [10,11], Salvatrice Vizzini [12], Maria Vozzo , Emma Ward [13], Raymond D. Ward , Thomas Worthington , Joanne Preston [14]

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A Five-Star System for assessing the status of restoration interventions over time is set out in the SER Standards and Principles. These identify key ecosystem attributes that may be assessed against values derived from a reference model for the ecosystem of interest. While this system is grounded in ecological theory, marine restoration practitioners have struggled to utilize the approach, because of differences in terminology and because of fundamental ecological differences between terrestrial systems.
Here we present a Five-Star System and Marine Ecological Recovery Wheel for assessing the ecological restoration of marine ecosystems that has been developed by Task Force Two of the SER Marine Restoration Working Group, through a series of online workshops and through an in-person workshop hosted by the Seascape Symposium II, hosted at the Zoological Society of London in June 2025. The revised Five-Star System highlights marine examples of important ecological attributes such as absence of threats, physicochemical conditions, species composition, structural diversity, ecosystem functioning and ecological connectivity, that collectively define the status of habitats. We will also present an example of how to define reference state in a degraded marine system and application or the revised Five-Star System to current restoration.

State of the world's saltmarshes

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Saltmarshes are productive ecosystems where land, rivers and sea converge. These tidal wetlands are among the world's most under-appreciated habitats given the vital mix of benefits for climate and people.
The first State of the World's Saltmarshes report, launched at COP31 in Brazil November 2025 and integrates salt marshes into the broader blue carbon agenda – putting them at the heart of global efforts totackle climate change, restore nature and build coastal resilience. From carbon sequestration to natural flood defence to fisheries support, saltmarshes are doing heavy lifting with little recognition. The report shines a light on what we have lost and continue to lose, where the biggest opportunities lie and what needs to change. It also looks at the political tools and funding mechanisms that will help reach global biodiversity and Net Zero targets. In addition, the report makes reference to the vital role salt marshes play in the seascape.

The REBORN Project

Richard. J. Lilley.European Seagrass Restoration Alliance – Netherlands

REBORN is a collaborative project funded by Interreg North-West Europe (NWE). Through REBORN we are working together to unlock seagrass restoration at scale by simultaneously driving seagrass-related governance, practice and capacity-building. The ambition is not only to restore hectares of seagrass across the region, but to grow a more equitable, inclusive and diverse seagrass restoration community by building public involvement and civic engagement in the project. In REBORN we are deliberately placing a strong focus on the fifth of the 5Cs of seascape ecology (Context, Configuration, Connectivity, Consideration) ”Culture” since the integration of human elements, including local communities, traditional and local ecological knowledge, and cultural connections, are crucial for effective, long-term stewardship and sustainable restoration.

Restorative aquaculture for the safeguard of Ostrea edulis in southern Brittany

Martin Perrot. Seaboost, France

The European flat oyster (Ostrea edulis) has undergone a dramatic decline across its native range, resulting in the loss of important ecosystem functions and the erosion of a unique cultural and aquaculture heritage. In southern Brittany, however, one of the last major reproductive populations persists, supporting both biodiversity and the French native oyster farming sector. Safeguarding this population has therefore become a regional conservation priority.
Since 2022, the CLIMAREST project has developed and tested an innovative restorative aquaculture approach that combines ecological restoration with sustainable shellfish production. The strategy relies on deploying engineered reef structures within historical oyster grounds to enhance natural recruitment while simultaneously producing disease-free oysters for restoration and aquaculture purposes. Long-term monitoring has demonstrated exceptionally high natural recruitment, strong juvenile survival, and the successful establishment of self-sustaining reef communities. Beyond oyster production, the restored reefs provide habitat for diverse benthic fauna and contribute to the recovery of ecosystem functions.
This presentation will present the scientific rationale, restoration techniques, and first ecological outcomes of this initiative, while discussing the opportunities and challenges of integrating restorative aquaculture into conservation strategies for threatened marine habitats. The experience from southern Brittany illustrates how restoring ecosystem engineers through nature-based solutions can simultaneously support biodiversity conservation, climate resilience, and sustainable coastal economies.

Early ecological trajectories and barriers to recovery following kelp loss in Sussex, UK

George Short. Sussex Kelp Recovery Project – United Kingdom

Across Europe kelp forests are declining; undermining biodiversity and ecological connectivity. In Sussex, UK, 96% of kelp was lost due to storm disturbance, marine heatwaves and the impacts of trawling.
In 2021, a co-developed, ecosystem-based fisheries management measure excluded bottom-towed gear from 304km^2, to support recovery of the ecosystem engineers that underpin local sustainable fisheries.
Five years on, Sussex Kelp Recovery Project’s multimethod monitoring shows early shifts in benthic composition, species-specific increases in fish abundance, and identifies further barriers to recovery. Citizen science, BRUV, and eDNA surveys reveal re-establishment of mussel beds, increases in Atlantic Mackerel, Sand Eels, Mullet, and Black Seabream. However, functional redundancy in fish populations remains low. High sediment loads, poor water quality, and pollutant-mediated reductions in kelp spore motility, highlight persisting anthropogenic pres-sures.
With 98% community support for protection and 100% compliance, this cross-sector case study provides hope for the recovery potential of heavily impacted seascapes.

REDRESS: Restoration of Deep-sea habitats to Rebuild European Seas

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REDRESS project aims to provide a key contribution to the EU commitments towards restoring degraded ecosystems, especially in the deep sea. REDRESS provides solutions to prioritize future restoration actions, extend deep-sea restoration to previously neglected habitat types, and demonstrate the feasibility, potential, and value for success of deep-sea ecosystem restoration. The project focuses on habitats that have great potential to contribute to carbon sequestration and climate mitigation but have been degraded by deep-sea fishing, especially trawling. Specifically, the project will study vulnerable marine ecosystems, including sea pens and bamboo corals on soft sediments, coral gardens, cold-water coral reefs, sponge fields, and cold seeps. REDRESS will offer nature-based solutions to public authorities and operators to advance ecosystem restoration in the deep sea. Building on previous experience, REDRESS will go beyond the state of art, either developing new methodologies, using sophisticated technologies, defining success indicators, and expanding the target habitats also to cold seeps. The results will enable a significant advancement in the EU's marine restoration strategy. Here we summary the progress of the first two years of the project providing novel insights into the advantages and limits of active vs passive restoration, and related cost-benefit analysis of the actions in different deep-sea habitats supporting policies and decision makers in the future application of the Nature Restoration Regulation.

Rosalie (Blue Marine)

Rosalie Blue Marine. Blue marine Foundation – United Kingdom

The Solent Seascape Project is the UK's first seascape-scale restoration initiative. Situated within one of Europe's most heavily used estuarine systems on the south coast of England, the project is working to overcome extensive habitat degradation - including the loss of over half of saltmarsh and near-collapse of native oyster populations - by actively restoring and reconnecting four key habitats: seagrass meadows, native oyster reefs, saltmarshes and seabird nesting sites.
Moving beyond a single habitat or site focus, the project is testing a seascape-scale approach that prioritises ecological connectivity and cross-sectoral collaboration. Alongside active restoration work, the project is pioneering co-development of a long-term coastal management plans with stakeholders, regulators and local communities.
This presentation will outline key lessons on scaling restoration through effective collaboration, community engagement and a connectivity-led approach. It will highlight delivery progress alongside critical challenges (including policy constraints, historically siloed approaches and finance for restoration) and address the need for sustained ambition and systemic change to enable seascape-scale recovery.
Through these learnings, the Solent Seascape Project provides a practical model for advancing seascape-scale restoration in line with international ambitions for ecosystem recovery.

On the power of alliances in implementing change in marine ecosystem restoration

Alison Debney *, Richard. J. Lilley * [1], Sahar Stevenson-Jones * [2]
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Transforming policy ambition into on-the-water (in-field) delivery requires more than scientific knowledge or regulatory frameworks alone - it demands coordinated action across disci-plines, sectors, and organisations. This presentation reflects on the power of marine alliances as a critical enabling condition for implementing marine ecosystem restoration at seascape scale.
SERE, ESRA, NORA and emerging alliances such as the Saltmarsh Alliance, represent distinct but complementary communities spanning ecological science, restoration practice, and ocean governance both in Europe and globally. By joining forces within this session, we offer a living example of the cross-sectoral collaboration we advocate for - demonstrating how alignment between professional networks can generate shared agendas, amplify advocacy, and accelerate delivery in ways no single organisation can achieve alone.
Drawing on our collective experience, we explore how alliances function as structural enablers of systems change,

connecting science with governance innovation, spatial planning, and workforce development. We examine where fragmentation has historically constrained progress, and how coordinated network action can bridge the gap between isolated projects and the sustained, cross-sectoral strategies demanded by the EU Nature Restoration Regulation and global biodiversity targets.

We close with a call to action: invest not only in restoration projects, but in the institutional relationships and professional networks that make scaling possible. Alliances are not a soft add-on to implementation - they are its architecture.

SS8 – TURNING SHARED KNOWLEDGE INTO COLLECTIVE ACTION: REGIONAL STRATEGIES FOR NATURE RESTORATION

A call for harmonization of regional data sets allowing species distribution modelling and integrated impact assessments to better support Baltic Sea restoration planning

Javier Lenzi * [1], Edmond Sacre [2], Antti Takolander [3], Ants Kaasik¶ [4], Aino Ahvo ‖ [5,6], Ulf Bergström* [2], Charlotte Berkström [7,2], Mårten Erlandsson [2], Jannica Haldin [6], Duncan Hume [8], Jonne Kotta [4], Maren Leiz [1], Roland Pesch [9,1], Valentin Sauerbier [1], Oscar Törnqvist [8], Jasmina Uusitalo [6], Elina Virtanen [3]

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PROTECT BALTIC advances transboundary collaboration for the Baltic Sea's protection and restoration. The project developed species distribution models (SDMs) for benthic inverte-brates (n=238), macrophytes (n=178) and fish (n=91) to further map biotopes and biodiversity hotspots, assess ecosystem services, and support marine spatial planning. It also creates environmental pressure layers and impact models linking anthropogenic stressors (eutrophication, fishing, climate change) to ecological responses, enabling cumulative impact assessments and the identification of priority areas for restoration and conservation.
A key challenge throughout these workflows was the strong heterogeneity in data availability, quality, and spatial and temporal coverage across countries and taxa. Species occurrence data were often unevenly distributed, temporally biased, and collected using different protocols. These limitations directly affected model performance and highlight the need for improved coordination of monitoring efforts. For most pressures, pressure-intensity data were not available; instead, the workflows relied mainly on presence/absence maps of human activities. This makes it very challenging to robustly predict the plausible effects of single or multiple human pressures on nature.
Addressing these issues requires better harmonisation of monitoring protocols and improved data exchange across countries. Overcoming challenges in interoperability, data standards, openness, and quality control is essential to ensure comparable and scalable regional assessments.
To bridge these gaps, the workflow applies methods to standardize sampling protocols, harmonize predictors, and reducing sampling bias in species data. These techniques improve the integration of heterogeneous datasets into consistent regional products while accounting for data limitations and uncertainty.

Regional cooperation in large-scale restoration implementation

Petra Kääriä. Baltic Marine Environment Protection Commission (HELCOM) – Finland

Large-scale marine ecological restoration in shared sea basins requires coordinated action that goes beyond national boundaries. HELCOM, as the regional sea convention for the Baltic Sea, provides a practical platform for enabling coherent, efficient, and ecologically meaningful marine restoration at scale. HELCOM's established cooperation structures support alignment of national efforts with regional objectives under the Baltic Sea Action Plan and the EU Nature Restoration Regulation, ensuring that restoration measures reflect ecological processes rather than administrative borders. HELCOM provides a direct contribution to the success of restoration action through the regional

work to limit pressures on the Baltic Sea marine environment. This presentation emphasizes the value of shared knowledge and best practice, data infrastructures, and sectoral coordination of measures. Coordinated methodologies for mapping, assessment, monitoring, and reporting enable learning across countries, reduce duplication, and accelerate implementation. Finally, it demonstrates how coordinated action and aligned ob-jectives at regional level can create synergies, strengthen ecological connectivity, and facilitate harmonization of national approaches.
Overall, HELCOM has a key role as an enabler of facilitating implementation of the EU Nature Restoration Regulation on a regional level.

Regional Restoration Action Plan and Toolbox

Lasse Kurvinen. Metsähallitus – Finland

The PROTECT BALTIC project supports marine restoration in the Baltic Sea by developing a politically adopted Regional Restoration Action Plan and a Restoration Toolbox. This work is mandated by the 2021 Baltic Sea Action Plan (BSAP action B27), committing countries to create and implement these instruments.
The Action Plan focuses on restoring benthic species, biotopes, and habitats through science-based, regionally harmonised measures. It covers key areas such as knowledge exchange, data and mapping, assessments, restoration tools, marine protected areas, pressure reduction, funding, co-operation, and implementation. It also defines agreed qualitative and quantitative restoration targets.
The Restoration Toolbox complements the plan by providing general principles, workflows, and practical methods compiled from regional expertise. It includes guidance on active restoration techniques, case studies, and best-practice resources, and is designed as an adaptive, evolving tool to support implementation.
Both outputs have been developed collaboratively within HELCOM WG BioDiv and through stakeholder engagement, including cooperation with EU and ICES processes.
Key challenges addressed include alignment with the EU Nature Restoration Regulation, integration of active and passive measures, data gaps, and ensuring practical usability. Implementation is expected to begin in 2026, strengthening regional coordination and supporting long-term recovery of Baltic Sea ecosystems.

Inventory of monitoring activities in Baltic Sea Marine Protected Areas

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Marine Protected Areas (MPAs) are widely regarded as effective spatial tools for safeguard-ing marine biodiversity and reducing the pressures arising from various human activities. In the Baltic Sea, MPAs cover 18.6% of the purely marine area, substantially above the current global average of 10.1%. Baltic Sea countries are carrying out monitoring of the marine environment and biodiversity to meet different national and European reporting requirements. The current inventory aims to describe how well current monitoring meets the management needs of MPAs. The study examined a wide range of monitoring activities, from national programs to highly specific projects and surveys. In addition to traditional environmental and biodiversity variables, the inventory also includes variables describing human activities, pressures, and socioeconomic factors. The total number of described programmes was larger than 70, of which more than 10 were specifically designed for MPAs. Most of the monitoring programs described traditional environmental variables or biodiversity elements, such as species or habitats, while none were found that concentrated purely on socioeconomic variables or on management measures. Programmes monitoring levels of human activities and pressures were largely related to fisheries, hazardous oil spills, and material extraction. Large national differences in the organization of monitoring activities were noted due to differences in national approaches to the monitoring strategies as well as funding mechanisms. Preliminary conclusions from the review indicate a need for coordination and harmonization of MPA monitoring in the Baltic Sea to improve overall management and achieve higher protection effectiveness.

SS9 – DEEP-SEA ECOSYSTEM RESTORATION

Deep Sea Ecosystem Restoration: lesson learned from REDRESS

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REDRESS project aims to provide a key contribution to the EU commitments towards restoring degraded ecosystems, especially in the deep sea. REDRESS provides solutions to prioritize future restoration actions, extend deep-sea restoration to previously neglected habitat types, and demonstrate the feasibility, potential, and value for success of deep-sea ecosystem restoration. The project focuses on habitats that have great potential to contribute to carbon sequestration and climate mitigation but have been degraded by deep-sea fishing, especially trawling. Specifically, the project will study vulnerable marine ecosystems, including sea pens and bamboo corals on soft sediments, coral gardens, cold-water coral reefs, sponge fields, and cold seeps. REDRESS will offer nature-based solutions to public authorities and operators to advance ecosystem restoration in the deep sea. Building on previous experience, REDRESS will go beyond the state of art, either developing new methodologies, using sophisticated technologies, defining success indicators, and expanding the target habitats also to cold seeps. The results will enable a significant advancement in the EU's marine restoration strategy. Here we summary the progress of the first two years of the project providing novel insights into the advantages and limits of active vs passive restoration, and related cost-benefit analysis of the actions in different deep-sea habitats supporting policies and decision makers in the future application of the Nature Restoration Regulation.

The one that unites all: Helping nature support humans – The role of discourses in the governance of deep-sea restoration in the European Seas

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Deep-sea ecosystems in the European seas are degraded and damaged due to various anthropogenic activities and pressures on the ocean floor. The EU Nature Restoration Regulation (NRR), which requires Member States to restore at least 20% of land and sea by 2030 aims to remedy this problem. As part of the Horizon Europe Project REDRESS (Restoration of deep-sea habitats to rebuild European seas), we assessed the deep sea restoration governance arrangements (DSRGAs) in 5 cases (Dohrn Canyon, Azores, West of Shetland, Catalan Margin and Guilvinec Canyon). DSRGAs consist of the actors, rules, resources, and discourses that surround the restoration process. The study of these governance arrangements allows us to map the emerging deep-sea restoration landscape and identify barriers and enablers for successful restoration measures. We conducted around 50 interviews with researchers, non-governmental organisations, policymakers and industry actors on the topic of deep-sea restoration. Our findings show that *discourses* surrounding deep sea restoration may be drivers for the DSRGAs. In several cases, the potential benefits for society that

can be derived from deep-sea ecosystems are a central element of the discussion, contrasted with the lack of feel- and visibility of deep-sea ecosystems. The prospect of societal and ecological benefits has the potential to unite restoration researchers, decision-makers, NGOs and industry actors in the marine space, and make the importance of healthy deep-sea ecosystems more tangible to the wider public. However, further work is needed to make the deep sea and associated ecosystem restoration options and benefits more understood and valued.

Early ecological responses of bentho-demersal communities to new Fishery No-Take Zones in the NW Mediterranean: evidence of passive restoration.

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Fishery no-take zones (FNTZs) are increasingly implemented as spatial management measures to foster the recovery of marine habitats and support the sustainable exploitation of fishery resources. In order to assess their performance on shelf-edge and upper slope environments, we characterized sessile and motile assemblages inside eleven FNTZs established along the Cata-lan margin. Between 2023 and 2024, we carried out ROV-based video transects at two depth strata (100–300 m and > 300 m) in both protected sites and neighbouring control grounds. Sessile and motile components were examined separately to capture the contrasting responses of organisms with different life-history strategies. Protection effects were found to differ with depth and locality. Sessile assemblages generally showed higher densities and diversity in several FNTZs, particularly on the shelf edge, whereas motile fauna exhibited more variable and less clear patterns. Community-level analyses revealed compositional shifts between protected and control areas, with FNTZs supporting a greater occurrence of habitat-forming taxa, while motile species were comparatively more abundant in control sites. Although these patterns point to emerging structural differences, they also suggest that ecological recovery on soft sediments at these depths is still slow and patchy, likely constrained by the legacy of long-term trawling impacts on seabed integrity. This study represents the first regional, non-destructive evaluation of FNTZ performance on Mediterranean soft-bottom habitats and provides essential baseline information for future monitoring programmes.

Development of novel techniques for the active restoration of Pennatulacean assemblages in soft-bottom habitats.

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Sea pens (Pennatulacea) are key ecosystem engineers of deep soft-bottom habitats, enhancing benthic biodiversity, habitat complexity, and ecosystem functioning, yet they are increasingly impacted by bottom-contact fishing and other human pressures. Although interest in active restoration of marine animal forests is growing, there is still no standardized method to reimplant sea pens, which limits large-scale restoration initiatives. This is due to the fact that they live on soft sediments and rely on a burrowing peduncle and a delicate balance between anchoring, structural flexibility, and hydrodynamic exposure, for which no replicable fixation system currently exists. Within the REDRESS and LIFE-ECOREST projects, we tackle this gap by developing and testing a temporary, disaggregable anchoring system specifically designed for sea pen restoration using the ”badminton” deployment technique from vessels. The system is conceived as a clay- and sand-based anchoring device with controlled structural cohesion loss, capable of stabilising the organism after deposition and disaggregating within a short time interval, thereby avoiding the persistence of hard elements in the sediment that could alter the local ecosystem. We present a) the material and geometric design criteria, b) preliminary laboratory results on cohesion loss and sea pens survival rate, and c) the operational feasibility and upscaling potential of this approach for the replicable restoration of deep sea pen assemblages and other softbottom biogenic structures.

Benthic Community Response to Alcyonium palmatum Restoration: A Time-Lapse Comparison of Transplant and Control Sites on the Catalan Shelf

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Deep-sea benthic ecosystems remain overlooked in active ecological restoration programmes, primarily due to the logistical challenges of continuous *in situ* monitoring at depth. The soft coral *A. palmatum* is a structurally important component of upper bathyal communities in the NW Mediterranean, forming monospecific assemblages at shelf-edge and upper-slope depths, yet no active restoration test has previously been documented for this species. Here we present the first transplantation experiment of *A. palmatum*, combining colony deployment with continuous *in situ* monitoring via the ALBEX benthic lander at Cigala Barcelona (˜378 m, NW Mediter-ranean). A total of 17 colonies were attached to biodegradable bases made from glutinous rice starch and positioned within the lander's field of view. Survival declined from 100% at deployment to approximately 38% within the first ˜20 days, stabilised briefly, then declined further to a final rate of 19%. Time-series footage also recorded repeated hermit crab visits to the restoration site, with individuals observed directly interacting with the transplanted colonies. In contrast, a parallel lander deployment at Cigala Palamós (˜343 m depth) with no organisms in the field of view recorded fewer faunal visits and lower species richness.
The ALBEX lander provided continuous, non-invasive documentation of the transplanted colonies without repeated vessel or ROV intervention, demonstrating autonomous lander-based monitoring as a scalable framework for deep-sea restoration assessment. These results highlight the importance of substrate material selection in restoration design and the need to account for faunal interactions that may influence transplant survival in upper bathyal habitats.

Advancing Deep-Sea and Mesophotic Habitat Restoration: Lessons from LIFE ECOREST

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The LIFE ECOREST project (2021–2027) aims to restore 30,000 hectares of deep-sea habitats along the Catalan margin (north-eastern Iberian Peninsula). As one of the largest active benthic restoration initiatives in European waters, it focuses on the restoration of 16 fishery no-take zones through a participatory approach involving scientists and fishers. Restoration targets sessile, habitat-forming organisms incidentally caught by local fleets, including more than 30 species, primarily anthozoans, demosponges, actinians, and bryozoans. Due to the diversity and fragility of these taxa, novel methodologies were developed to support their recovery. Deployment techniques were designed to restore three-dimensional structure and generate a canopy effect, enhancing habitat complexity. Preliminary results indicate increased biodiversity and organism abundance in restored areas. Monitoring, based on a multi-level and integrative approach, has been essential to assess restoration outcomes across scales, including organism survival, community diversity, ecosystem processes, and ecosystem services. Key challenges included developing restoration protocols for multiple species and engaging fishing communities under socio-economic constraints linked to reduced fishing effort. Trust-building, communication, and capacity development proved essential for stakeholder engagement. The project has also improved understanding of benthic species distribution, highlighting widespread populations of *Paramuricea grayi* and the near absence of *Isidella elongata*. Overall, LIFE ECOREST demonstrates the feasibility of scaling up deep-sea restoration through collaborative approaches, providing a transferable framework for ecosystem recovery in heavily exploited marine systems.

Scaling Up Sponge Restoration in Mesophotic and Deep-Sea Ecosystems: From Experimental Trials to Operational Implementation

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We are currently within the framework of the UN Decade on Ecosystem Restoration, reinforced by the recent adoption of the European Union Restoration Law, both of which highlight the urgent need to restore degraded marine habitats. Active restoration in deep-sea environments has largely focused on anthozoans, particularly cold-water coral reefs and coral gardens, while sponges remain overlooked despite their key role in benthic structure and biogeochemical cycling. Within the LIFE ECOREST project and the REDRESS project, we are developing one of the first large-scale sponge culture initiatives targeting shelf and slope species in the northwestern Mediterranean. Target genera include *Geodia*, *Stelleta*, *Stryphnus*, and *Suberites*, commonly collected as bycatch by artisanal and trawl fisheries. Specimens are initially maintained in aquaria at local fishing guilds and later transferred to the Institut de Ciències del Mar (ICM-CSIC), where they are fragmented and cultured on suspended lines or different substrates in open, filtered systems. Cultures are sustained with phytoplankton, bacterial components, and dissolved organic matter. Preliminary results show promising growth, particularly for *Stelleta* and *Suberites*, with new oscula formation within two weeks and biomass doubling within 2–4 months. However, challenges remain regarding long-term attachment to substrates. Overall, this work demonstrates the feasibility of sponge-based restoration and supports their inclusion in future restoration frameworks for continental shelf and slope ecosystems.

Assessing active restoration effects on epibenthic motile assemblages in shelf environments: an experimental approach

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Marine benthic ecosystems are increasingly degraded by bottom trawling, particularly along continental shelves where biodiversity and ecosystem functioning are highly vulnerable. Within the LIFE-ECOREST project, several fishery no-take zones (FNTZs) along the Catalan continental margin (50–200 m depth) have been actively restored using the Badminton Method, reintroducing sessile by-catch organisms (e.g., corals, gorgonians, sponges) to enhance habitat complexity. These organisms provide habitat, nursery, and refuge functions for fauna due to their three-dimensional structure.
An experimental setup was deployed in the Bol de Tossa FNTZ to evaluate how restoration influences biodiversity. In December 2024, two landers were installed at 57 m depth on sandy bottoms, each monitoring a 1 m^2 glass-fiber reinforced plastic grid. One grid held 15 transplanted gorgonians (genus *Eunicella*) fixed on cobbles, while the second contained 15 cobbles without gorgonians as a control. This design disentangles the effect of biological structure from the physical presence of substrate and reflects densities observed in natural assemblages.
Image and environmental data (CTD, current velocity, fluorescence) were collected every 30 minutes over one year; analyses focus on the first six months (December 2024–May 2025) due to camera obstruction by polychaete colonization.
Preliminary results will compare treatment and control conditions in epibenthic motile diversity and community structure, and explore day-night activity rhythms, temporal variability, and species-specific behavioural responses in relation to environmental conditions.
This study provides a first assessment of how active restoration shapes early biodiversity dynamics through habitat complexity enhancement in Mediterranean FNTZs.

Restoration of Mediterranean cold-water coral habitats in the Bari and Dohrn canyons: outcomes and lessons from LIFE DREAM project

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Deep-sea ecosystem restoration presents profound logistical and ecological challenges, necessitating robust, scalable, and adaptive methodological frameworks. The LIFE DREAM project implemented a pioneering active restoration

protocol for cold-water coral (CWC) habitats in the Mediterranean Sea, targeting areas degraded by fishing activities and marine litter in the Bari and Dohrn submarine canyons.
The initiative relied on a rigorous and multidisciplinary framework to identify viable restoration sites, integrating geophysical, oceanographic, and ecological data. The intervention encompassed the deployment of 3D-printed artificial reefs (EcoReefs) and autonomous, long-term monitoring systems (e.g., cameras and oceanographic sensors) to track environmental dynamics and ecological succession. Preliminary data collected one-year post deployment confirm that the restoration process is biologically active. Early colonization by fast-growing taxa, specifically polychaetes and hydrozoans, suggests the initiation of benthic recruitment.
The LIFE DREAM experience highlights the critical need for a methodology that reconciles a rigorous ecosystem-based approach, integrating data on species presence, dispersal, and envi-ronmental settings, with the stringent logistical and operational constraints of working offshore. Given the inherent complexity of these environments, our framework was designed to be adaptive to overcome technical bottlenecks, ultimately defining a pathway for upscaling active restoration actions targeting these vulnerable marine habitats.

Restoring the European Atlantic cold-water coral reef belt

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Cold-water coral reefs, located in deep waters (> 200m) along the European Atlantic con-tinental slope, create complex 3D habitats that support an abundant and diverse reef fauna. Early maps of the distribution of these reef 'massifs' suggest that the reefs occurred further up the slope than is the case today. The cumulative impact of over 100 years of demersal trawling is considered the main contributing factor for the disappearance of reefs from these shallower slope depths. One of the objectives of the Horizon Europe 'REDRESS' project is to demonstrate the feasibility of active reef restoration in areas where corals have been damaged or removed with the longer term goal of restoring the European Atlantic coral reef belt. We have deployed 3D printed artificial reefs at several sites along the Atlantic margin: Bay of Biscay (France), Porcupine Bank (Ireland), the Darwin Mounds and Shetlands (United Kingdom) and south of Iceland. These sites were chosen for their ecological significance and differences in their environ-mental and management regimes, facilitating inter-comparison. We are actively following the Society of Ecological Restoration international principles and standards in the development of our ecological restoration plans, monitoring strategies, and audit criteria.

Deep-sea restoration – implementation of a pilot site in coral reef habitats of the Guilvinec canyon, Bay of Biscay

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Reef-building cold-water corals act as ecosystem engineers in the deep-sea, supporting rich biodiversity and various ecosystem services, including fisheries resources, carbon sequestration and paleoclimate archives. These ecosystems are protected by various national and international conventions (IUCN, Habitat Directive, Marine Framework Directive...). In submarine canyons, coral reefs face major threats: climate change, pollution (including plastics and other waste) and fishing activities (particularly trawling). In order to implement EU policies to restore degraded deep habitats, the REDRESS project aims to propose and prioritize future restoration actions and test nature-based solutions in deep-sea ecosystems. In this context, the Guilvinec canyon, situated in a protected area of the Bay of Biscay closed to fishing activities since 2022, was chosen as an ideal pilot site for testing innovative ecological restoration methods in deep coral ecosystems.
During the REDECOR 2025 cruise, to assess the effectiveness of different restoration strategies, three complementary

study areas at ˜950m were chosen:

1. Control zone, a site featuring corals in good condition, serving as an ecological reference.
2. Active restoration zone, a degraded area (bare sediments, fishing gear debris) where nine 3D-artificial reefs were deployed. *Madrepora oculata* and *Desmophyllum pertusum* transplants were installed on four of them.
3. Passive restoration zone, a degraded site left to natural regeneration, in order to observe the spontaneous evolution of the ecosystem without direct human intervention.

The sites will be revisited during the REDECOR 2026 cruise to provide a first comparative approach to identify the most effective methods for sustainably restoring these fragile habitats.

Towards scalable cost-effective restoration of deep-sea coral gardens in the North Atlantic Ocean

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Coral gardens, composed of octocorals, sponges, and hydroids, are biodiversity hotspots that provide essential ecosystem services in deep-sea environments. However, these vulnerable marine ecosystems have been increasingly degraded by human activities, particularly bottom-contact fishing. Aligned with the EU Nature Restoration Regulation, the REDRESS project is developing innovative, low-cost strategies to restore degraded deep-sea coral gardens in the North Atlantic, through scalable and economically viable approaches suitable for National Restoration Plans.

A key component of this work is being developed in the Azores in collaboration with local fishing communities. During routine longline fishing operations, benthic organisms such as octocorals and sponges, are frequently retrieved as by-catch. These organisms are recovered by the scientific team and transplanted onto suitable substrates using an enhanced ”badminton” restoration methodology. Restoration sites are monitored periodically using the Azor drift-cam, a low-cost video platform that assesses short-term transplants survival and longer-term ecological indicators including species diversity, density, and size structure, to evaluate the success of the restoration actions. These metrics support the definition of standardized restoration targets under the Nature Restoration Regulation. In parallel with in situ restoration actions, REDRESS is using by-caught octocorals in ex situ experimental trials to investigate reproductive capacity, larval and recruit rearing, and resilience to future climate-change scenarios.

The integration of transplantation, coral propagation, fisheries collaboration, and cost-effective monitoring provides a comprehensive framework for deep-sea restoration. This approach reduces costs, leverages existing fishing activities, strengthens stakeholder collaboration, and positions the fisheries sector as an active partner in ecosystem recovery.

SS10 - ANALYZING THE SOCIO-ECONOMIC IMPACTS OF DEEP-SEA MARINE ECOSYSTEM RESTORATION

Willingness to pay for improving ecological status of the Oslofjord

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The Oslofjord ecosystem is undergoing unprecedented deterioration, with poor water quality identified as one of the major causes. In response, the authorities have launched an integrated restoration plan for the Oslofjord, including measures to reduce eutrophication and improve the ecological status of coastal waters. Although many of these measures have been implemented since 2021, no study has yet quantified the benefits of the potential improvements. We use a choice experiment to elicit the willingness to pay (WTP) of residents living within the Oslofjord catchment for improved water quality. Specifically, we estimate the WTP for ecologi-cal status improvements and assess the value of place attachment. These benefit estimates can be used to compare against the costs of fjord restoration and to inform appropriate economic compensation for those who may incur losses during the restoration process.

A Global Bayesian Meta-Analysis of the Value of Deep-Sea Ecosystem Services

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This study synthesizes the economic valuation evidence on deep-sea ecosystem services and converts it into uncertainty-aware inputs for policy analysis. Using the DEEPVAL meta-database (119 estimates from 37 studies, 1990-2025), all values are harmonized to 2024 inter-national dollars per hectare per year. We implement a hierarchical Bayesian meta-regression framework to accommodate pronounced heterogeneity, unbalanced coverage across services and methods, and within-study dependence, estimating separate models for stated-preference and market-based approaches in order to maintain welfare-theoretic coherence. Results reveal systematic, method-dependent value structures and suggest that assessments focused narrowly on market-based benefits substantially understate the economic relevance of deep-sea ecosystem services, with direct implications for deep-sea governance under uncertainty. Bayesian poste-rior predictive distributions are then used to produce posterior-adjusted, study-effect-free value distributions by ecosystem service. These benchmarks provide a transparent basis for cautious benefit transfer and for the economic appraisal of deep-sea governance choices. They also offer a structured entry point for integrating deep-sea ecosystem services into ecological restoration frameworks, where uncertainty-aware valuation can help prioritize interventions while avoiding systematic underrepresentation of non-market benefits.

Estimating the value of deep-sea ecosystem restoration in Irish waters using a stated preference approach

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Europe's legal frameworks increasingly mandate protection and rehabilitation of marine habitats, including cold-water corals. In order to prioritise restoration across ecosystems when there is, inevitably, resource constraints, knowledge of the benefits associated with restoration efforts in different environments will be required. This study estimates public willingness to pay for the restoration of degraded deep-sea cold-water coral ecosystems in Irish waters using a contingent valuation survey of Irish adults. Respondents were presented with a scenario involving active intervention to restore cold-water coral habitat, funded through an annual tax over a ten-year period. Willingness to pay was elicited using a single-bounded dichotomous choice format and analysed using a logit model specification. The results provide empirical evidence of substantial non-use values for deep-sea ecosystems and show how stated preference estimates can inform policy appraisal and welfare-based interpretation within emerging marine ecosystem accounting frameworks. Survey results also suggest that the estimates may be suitable for value transfer to broader marine ecosystem types.

A cost-benefit analysis tool for deep-sea habitat restoration decision making

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Deep-sea habitat restoration, akin to other marine based restoration, is expected to be a more expensive process relative to terrestrial habitats. While some deep-sea habitats and species may recover relatively quickly and result in a resumption of ecosystem services flow, for other deep-sea habitats (e.g. cold-water corals), the restoration process will take place over a much longer time span. To help guide decisions about the restoration of deep-sea habitats an on-line cost–benefit tool is presented. The tool uses an ecosystem services approach to estimate the benefits of restoration, while costs are based on data collected during restoration research cruises.

A key feature of any cost-benefit analysis is the appropriate discount rate especially over such long time periods and how this can be integrated into such a tool. Another feature of the tool is that it considers the risk of restoration failure/success, which is important given the uncertainty around how deep-sea ecosystems recover, particularly around estimation of costs. Also explored is an examination of the economies of scale related to how costs and benefits change as projects increase in size, helping users understand whether larger restoration efforts become cost-effective.

By combining real-world cost data with estimates of ecosystem benefits, the tool fills an im-portant gap in deep-sea habitat restoration planning. It provides another tool for policymakers and practitioners to prioritise actions and allocate resources more effectively thus improving the planning and efficiency of deep-sea restoration actions.

How much are Cold-Water Corals worth? Public Willingness to Pay for Deep-Sea Restoration in Italy

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Deep-sea ecosystems are among the least visible, yet most ecologically significant compo-nents of the marine environment. Cold-water coral habitats, occurring at depths greater than 200 meters, support high levels of biodiversity and provide important ecosystem services. In the Mediterranean Sea, these habitats are increasingly threatened by human activities, particularly bottom trawling. At the same time, the recently adopted EU Nature Restoration Regulation re-quires Member States to restore degraded ecosystems across terrestrial and marine environments, highlighting the need to better understand the societal values attributed to marine restoration initiatives.
This study estimates public willingness to pay (WTP) for the restoration of cold-water coral ecosystems in Italy, focusing on the Dohrn Canyon in the Gulf of Naples as a case study. The restoration scenario involves the deployment of three-dimensional artificial reef modules designed to facilitate coral recolonization while providing habitat for associated marine species.
Societal preferences were assessed through a Discrete Choice Experiment (DCE) administered to a sample of 1,500 Italians. Respondents were asked whether they would be willing to pay an annual tax surcharge for ten years to finance the restoration. The dependent variable is a binary indicator of willingness to pay (yes/no), analyzed using a logit model. Preliminary results indicate a positive and statistically significant WTP for restoration. When aggregated across the Italian population and the targeted restoration area, the estimated values suggest that public contributions could cover a substantial share of the investment required for deep-sea restoration initiatives, providing relevant evidence to inform marine restoration policies and funding strategies.

SS11 - ASSISTED NATURAL REGENERATION ACROSS ECOSYSTEMS: GLOBAL APPLICATIONS, PROJECT DESIGN, AND MEASURABLE OUTCOMES

Assisted Natural Regeneration: Four Pathways to Restore Ecosystems

Robin Chazdon, Tropical Forests and People Research Centre – Australia

Assisted natural regeneration (ANR) is a set of practices and interventions designed to enhance and accelerate the recovery of natural and managed ecosystems with little or no planting. Under the umbrella of ecosystem restoration, four distinct ANR pathways with independent origins are now converging. The oldest pathway originated with the widespread practice of shifting cultivation by indigenous cultures around the world, who developed practices to enrich fallows, create forest gardens, accelerate recovery of soils, and enhance the diversity of local plant species, wildlife, and timber and non-timber products. The second pathway emerged as a forestry approach to both reforestation and forest management with the goal of recovering degraded forests and grasslands. This approach has strong champions in the Philippines and is supported by several FAO projects. ANR is also a central pillar of natural forest management. The third pathway is marked by the development and spread of Farmer Managed Natural Regeneration and Regreening Programs in the drylands of African Sahel, where ANR is closely aligned with sustainable farming practices that bring economic benefits for farmers. The fourth pathway involves the practice of ecological restoration across different types of ecosystems where capacity for natural regeneration is high; these ANR practices are closely aligned with conservation objectives and recovery of local biodiversity and ecosystem services. What unites all of these pathways is a focus on enhancing natural regeneration of forest and non-forest ecosystems in ways that reverse degradation and bring multiple benefits for nature and people.

Assisted Natural Regeneration Verification: Lessons on Project Design, Governance and Measurable Outcomes from Global Practice

Mateo Carinõ Fraisse, Preferred by Nature – Spain

Assisted Natural Regeneration (ANR) is increasingly promoted as a cost effective and scalable restoration approach across forests, rangelands, wetlands, and agricultural landscapes. However, its interpretation and application remain

highly context dependent. In practice, ANR is often implemented only where ecological recovery conditions are already favourable, or where limited resources are focused primarily on reducing degradation drivers, with little capacity for complementary restoration interventions. While valid in some contexts, these approaches unfortunately do not always emerge from comprehensive restoration planning frameworks with clearly defined ecological and socio economic objectives, monitoring systems, or adaptive management processes.
Preferred by Nature (PbN) is a mission driven international NGO with more than 30 years of experience assessing land use and restoration initiatives across forestry, agriculture, and ecosystem restoration sectors. Through both implementation and independent assessment of restoration projects using the PbN Ecosystem Restoration Standard across Africa, Europe, Asia, and the Americas, challenges in ANR design and implementation have been identified. These include unclear intervention thresholds, insufficient baseline and monitoring data, weak integration of local socio economic realities, and limited long term financing mechanisms.
Drawing from field implementation experience and applied research initiatives, including participation in Horizon Europe projects, this presentation explores how ANR can be strengthened through improved governance, measurable indicators, and stronger integration with Nature based Solutions objectives such as biodiversity, carbon sequestration, climate change adaptation, and wildfire resilience. The presentation will highlight enabling factors and practical recommendations to support credible, measurable, and scalable ANR outcomes across ecosystems.

Monitoring Assisted Natural Regeneration at scale in Tanzania: what works, what doesn't

Njamasi Chiwanga, LEAD Foundation – Tanzania

LEAD Foundation works with farmers across Tanzania's drylands to bring trees back through Assisted Natural Regeneration (ANR), known locally as Kisiki Hai (the living stump). Over the past decade we have worked with more than 265,000 households in over 600 villages, helping farmers regenerate more than 30 million trees by 2025. Tanzania's 2025 national AFR100 assessment credits Kisiki Hai with 289,618 ha which is around 8% of all nationally restored land towards the 5.2 Mha 2030 target and the third largest practice by size.
Three independent studies have verified these results; Face the Future (2023) sampled 72 farms in Dodoma and found booklet records under-reported trees by more than half, with verified totals reaching 30.6 million trees and over 500,000 tCOe of carbon. A satellite study of our Pembamoto landscape, where ANR and bunds operate together (van der Vliet et al., 2024, Frontiers in Environmental Science), tracked changes in soil moisture, land surface temperature and greenness. WRI used AI tree detection to verify our Singida site (2025).
This presentation shares five practical problems. Regenerated trees are scattered across farmland, not lined up in plantations. Mapping every farm at our scale is not realistic. Most farmers do not hold land certificates. Some farmers refuse enumerator visits and GPS mapping, especially where past land disputes have made formal mapping sensitive. And regrowth is uneven in early years, making results look worse than they are. The discussion closes with what we have tried, what has helped and what is still unresolved.

Scaling Assisted Natural Regeneration in Europe: financing models, species diversification, and multi-scale monitoring

Sasha Pinot, Reforest'Action – France

Reforest'Action has been developing Assisted Natural Regeneration (ANR) projects across European forests since 2010, mobilising corporate financing to support silvicultural transitions away from intensive monoculture management. To date, this model encompasses over 200 projects across Europe, approximately 150 project holders, 5,000+ hectares and the equivalent of 6 million trees. ANR - harnessing natural successional processes rather than replanting from scratch - delivers compelling co-benefits: ecosystem resilience, soil carbon preservation, biodiversity support, and integration into sustainable timber supply chains.
This presentation addresses three interconnected dimensions of ANR deployment at scale. On financing: corporate funding has proven a viable mechanism for unlocking conversions that landowners could not self-finance, turning ecological transition into a shared investment with measurable returns. On species diversification: projects are designed to maximise naturally regenerating local genotypes while selectively supporting station-adapted species, with enrichment planting where natural regeneration is insufficient - substantially increasing resilience to drought, pests, and disease compared to even-aged monocultures. On monitoring: field surveys combined with remote sensing and satellite observation track canopy evolution, species composition, and carbon stock dynamics across heterogeneous private landholdings.
The Cans et Cévennes project (Parc National des Cévennes, PEFC certified) illustrates these principles: 45 hectares, 67,500 trees across 14 species - including *Fagus sylvatica*, *Abies alba* and *Quercus petraea* - applying Continuous Cover

Mixed Silviculture (SMCC) to restructure a conifer-dominated stand. The presence of protected species (*Lobaria pulmonaria*, Black Woodpecker) and its vocation as a professional training site further embed biodiversity integrity and knowledge transfer into project design.

Early stage results and adaptive management in an implementation of Assisted Natural Regeneration in Antioquia, Colombia

Eliana Molina, Université du Québec en Abitibi-Témiscamingue – Canada

The expansion of livestock production in Colombia's rainforest has driven widespread habitat loss, with forest-to-pasture conversion and cattle emissions contributing 28.2% of the country's total CO-equivalent emissions. In Antioquia, where degraded pasture covers 45% of the landscape, NatureRe's flagship restoration project offers a scalable model for ecosystem recovery across 17,000 hectares. To date, 4,500 hectares are under project design, and 705 hectares have been restored through Assisted Natural Regeneration. The project employs a data-driven restoration framework adapted to complex landscapes of hills, mountains, and valleys. Ecological assessments, reference ecosystems, and spatial connectivity analyses guide restoration planning, with active interventions strategically limited to no more than 10% of each plot to maximize ecological impact while promoting natural regeneration. Restoration combines passive recovery with active interventions, including low- and medium-density nucleation, green corridors, enrichment planting, and the use of 23 native tree species. Maintenance is carried out every three months, with targeted replanting to ensure high survival rates. The project also pilots innovative restoration approaches, including a spatially explicit model for selecting intervention areas, improved nucleation strategies, optimized green corridors, and enhanced enrichment planting through refined species selection, timing, artificial shade, large cuttings, direct seeding, and soil and seed bank relocation techniques. Early monitoring of carbon, biodiversity, water, and landscape connectivity demonstrates promising outcomes, while continuous field data supports adaptive management, strengthening NatureRe's evidence-based approach to large-scale tropical forest restoration.

Applying Mobile Technology and Process Rigor in a Large-Scale Implementation of Assisted Natural Regeneration in Azuero, Panama

Ignacio Araya * [1]
[1] Ponterra Americas – Panama

The Azuero Peninsula of Panama is one of the most severely deforested regions in Central America, yet its degraded pastures harbor significant natural regeneration potential, with native high-value species such as *Cordia alliodora*, *Cedrela odorata*, and *Tabebuia rosea* already establishing across the landscape. The ARC1 project, led by Ponterra, demonstrates how combining mobile data collection technology with a rigorously standardized operational framework can unlock this potential at landscape scale, across more than 10,000 hectares.
The approach integrates *Restoration Scope,* a digital mobile application, at every phase of the restoration cycle. During dry-season finca assessments, field crews systematically map naturally-regenerating saplings across 0.25-ha quadrants, recording species, density, soil erosion, proximity to forest remnants, and fire risk - all GPS-stamped and uploaded in real time. This data directly feeds into spatially explicit restoration designs that prescribe four complementary planting methods (nursery stock, stake planting, transplanting, and direct seeding) calibrated to each quadrant's regeneration density and species composition. Structured training protocols, tiered across restoration leaders, field foremen, and daily laborers, ensure consistent implementation and quality control across a geographically dispersed workforce.
Post-planting maintenance - vegetation clearing, fertilization, replanting, and fence and fire-break upkeep - is governed by adaptive management thresholds tracked continuously in the app, triggering corrective action when survival rates fall below 75% or tree density drops below 500 trees per hectare.
This integrated model demonstrates that embedding digital tools within a rigorous process architecture substantially improves the cost-efficiency, reliability, scalability, and verifiability of ANR outcomes in tropical landscapes.

SS12 - REWILDING ACROSS GRADIENTS: CHOOSING PATHWAYS AND MEASURING SUCCESS IN A CHANGING WORLD

Lessons learned from seven years of monitoring landscape-scale restoration across Europe

Nancy Ockendon, Endangered Landscapes Seascapes Programme – United Kingdom

Ecosystem restoration and rewilding across large spatial areas is needed to meet the current range of ambitious regional and global restoration policy targets. However, there is a lack of empirical evidence for the outcomes of such large-scale restoration for biodiversity, climate and people. Effective monitoring is needed to bridge this gap and develop our understanding of the benefits that restoration can yield. However, monitoring restoration and rewilding at landscape and seascape scale presents significant challenges. Large-scale restoration is complex, encompassing ecological and socioeconomic dimensions, and a involving a diversity of stakeholders. In addition, the large spatial and temporal scales involved do not easily align with project management and funding cycles. Since 2018, the Endangered Landscapes & Seascapes Programme has supported 29 large-scale ecosystem restoration and rewilding projects across Europe, with a focus on the recovery of natural processes and ecosystem function. Each of these projects has designed and implemented an extensive and robust monitoring scheme according to a common framework, to assess the effects of their restoration actions. I will outline the programme's approach to monitoring, which has been refined over seven years' experience of working with projects on the ground and highlight key lessons learned and practical recommendations to strengthen future restoration monitoring efforts.

Indicators of Climate-Smart Rewilding

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Ecological restoration is essential to reverse ecosystem degradation and improve ecological integrity. It encompasses multiple approaches, including rewilding, which aims to improve ecosystem condition by reducing human pressures and restoring natural ecological processes. However, conventional rewilding approaches often overlook climate goals, prompting the recent development of a climate-smart rewilding framework. This framework explicitly integrates climate change mitigation and adaptation objectives with biodiversity recovery while incorporating socio-economic considerations. Our aim is to produce indicators of climate-smart rewilding through time (1992–2020) within this framework. Three components are crucial to rewilding success: ecosystem connectivity, trophic complexity, and stochastic disturbance regimes, reflecting the core dimensions of ecological integrity (structure, composition, and function). After reviewing potential indicators, we evaluated: 1) terrestrial landscape connectivity loss caused by human use (built-up areas, linear infrastructures, agriculture) through calculations of effective mesh size; 2) trophic complexity, focusing on large mammals, by comparing actual and natural communities using trait dissimilarity analyses; and 3) human pressures restricting stochastic disturbances (e.g. floods and fires) through forestry and agricultural (grazing) impacts on primary productivity. These three indicators were then considered within the broader context of available data. Although many datasets were identified, reconstructing spatially explicit historical trends revealed major limitations, including absent data, inadequate geographical extent, insufficient historical depth, and poor spatial or temporal resolution. Similar challenges affect broader assessments of ecological integrity, and addressing these gaps will require greater investment in long-term monitoring schemes.

A systematic review and metanalysis of nature's contributions to people by rewilding

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Rewilding is a form of ecological restoration with an emphasis on reducing human control and relying on ecosystem processes to achieve restoration goals. However, we ignore to what extent rewilding actions have so far addressed the diverse contributions of living nature to human wellbeing, biodiversity and climate mitigation ('Nature's Contributions to People' (NCP)), and whether rewilding is an effective approach for enhancing these contributions. Here we present

an exhaustive systematic review of empirical rewilding studies worldwide, linking the outcomes to NCPs. We used vote-counting and a metanalysis to (i) examine which NCPs are addressed in empirical studies of rewilding, and (ii) evaluate the benefits and losses on these NCPs related to biodiversity, ecosystem functioning, climate and social outcomes. Based on 153 original research publications from literature search, we observed a global distribution, but specially concentrated in Europe, of rewilding studies addressing NCPs. All NCP groups and 17 out of 18 NCP categories were assessed, reporting overall positive effects on ecosystems, but more on ecological than social outcomes. The two analytical approaches showed benefits and consistent results for ecological NCPs categories, such as habitat creation, pollination and soil formation. Social science articles usually tended to report more qualitative than quantitative outcomes, showing a strong positive effect on psychological experiences but also losses on supporting identities. Overall, our study provides conclusive evidence that rewilding tends to support human wellbeing in diverse ways. It also illustrates the value of integrating ecological and sociological perspectives to better understand the complex nature of rewilding outcomes.

Soil carbon sequestration across rewilded abandoned lands in Europe: A review of environmental gradients and research needs

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Passive rewilding through land abandonment provides a cost-effective strategy for increasing soil organic carbon (SOC) sequestration and climate change mitigation. While natural vegetation and microbial recovery restore soil organic carbon sinks, our ability to predict atmospheric CO2 removal across continental-scale gradients remains limited. This work synthesizes data from 36 studies across Europe to evaluate how environmental, geographic, and management gradients influence SOC dynamics following land abandonment.

Our findings reveal that post-abandonment carbon sequestration is highly influenced by ecological gradients. We observed notable SOC increases across specific environmental and structural gradients, especially within Mediterranean biogeographic region, distinct soil reference groups (Regosols, Cambisols, Calcisols), cropland-to-forest transitions (broadleaf and mixed), and specific exposition gradients (North, South, and South-West facing slopes). However, predictive modeling is limited by an uneven geographical distribution of study sites across gradients. Most studies concentrated on the Mediterranean region, with grassland data predominantly coming from higher elevations. To address these biases and gaps, we present a comprehensive gap analysis mapping of recently abandoned European croplands. We highlight important spatial data gaps in underrepresented regions including Northern Spain, Central France, the UK, Germany, Poland, the Baltic states, Hungary, and the Balkans, where rewilding outcomes remain poorly documented.

These findings reveal the critical environmental and geographic gradients where research is mostly needed. This work provides a strategic roadmap for researchers and policymakers to prioritize future SOC monitoring and rewilding initiatives to enhance soil C sequestration across Europe.

Where does soil organic carbon accumulate following rewilding of abandoned lands across europe?

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Natural rewilding of abandoned agricultural lands has the potential to contribute significantly to combating climate change by promoting soil organic carbon (SOC) sequestration over time in a passive and cost-effective manner. Despite increasing interest in natural rewilding, a large-scale assessment of its effects on SOC accumulation across Europe remains lacking. By performing soil sampling across Europe on chronosquences spanning from active agricultural lands to forests and old-growth forests, and combining these data with previously published studies, we quantified changes in SOC stocks over time. We additionally identified the environmental and land-use factors that most strongly influence SOC accumulation trajectories and evaluated where rewilding is most likely to promote SOC sequestration. Our results reveal substantial variability in SOC accumulation responses to rewilding, indicating that carbon accumulation is strongly context-dependent. Although relationships with environmental gradients were complex, SOC accumulation was generally observed in regions with higher average temperatures and was visible only on former croplands while absent on grasslands. Consequently, the clearest SOC accumulation trends were observed in Mediterranean croplands undergoing natural rewilding, whereas former grasslands showed no increase in SOC stocks. However, the high

variability among individual chronosequences suggests that SOC responses remain difficult to predict and may depend on additional local factors not captured in our analyses, highlighting the need for even broader research across Europe.

Community-Driven Approaches to Rewilding: Navigating the Space Between Intervention and Non-Intervention

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Rewilding is increasingly promoted as a strategy for restoring biodiversity and ecological processes. However, it encompasses a range of concepts and implementation approaches. Rewilding practices may generate ecological, socio-economic and cultural trade-offs, which necessitate context-specific strategies to address emerging conflicts. Although the ecological implications of rewilding have been widely examined, limited attention has been given to how local initiatives engage with rewilding across territorial contexts from socio-economic and cultural perspectives. As part of the WILDCARD project, this study examines communityled initiatives across Europe that interact with rewilding processes, focusing on three challenges: loss of cultural landscapes, human-wildlife conflicts, wildfire risk.

The identified initiatives rarely promote rewilding as a predefined objective or one-size-fits-all solution. Instead, they respond to changing territorial conditions, seeking to determine where, to what extent, and under which conditions rewilding may be appropriate, and how it can coexist with complementary management strategies. Integration into broader landscape governance is considered. Rather than treating intervention and non-intervention as fixed alternatives, stakeholders navigate rewilding adaptively, addressing consequences as they arise and integrating actions within the broader territorial context.

Rewilding trajectories therefore function as adaptive and spatially differentiated governance processes. Interventions are calibrated according to ecological and socio-economic risks, territorial identities, and governance constraints. Governing these trajectories requires addressing persistent tensions, recognising that rewilding is embedded in competing interests, values, and visions of landscape change. By focusing on local communities, this study shows that socially acceptable rewilding develops through negotiated approaches that bring ecological goals together with community values and landscape care.

Rewilding trajectories in coastal wetlands: assessing ecosystem recovery across intertidal habitats at Ria de Aveiro (Portugal)

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Coastal wetlands are increasingly targeted for restoration and rewilding as nature-based solutions (NbS) to climate change, biodiversity loss, and ecosystem degradation. However, rewilding and restoration outcomes often vary across environmental gradients, raising questions about whether rewilding or which restoration pathways are most effective. Understanding these dynamics is particularly relevant for implementing the EU Nature Restoration Regulation and scaling up ecosystem recovery initiatives. The Ria de Aveiro coastal lagoon (Portugal), one of the demonstrator sites of the REWRITE project, was evaluated for ecosystem trajectories following large-scale habitat rewilding and restoration actions. Former saltpans that underwent tidal reconnection after abandonement have naturally evolved into a mosaic of mudflats, sea-grass (*Zostera noltii*) and salt marsh (*Sporobolus maritimus*) habitats, creating a gradient of environmental conditions and rewilding stages. By combining field surveys for plant characterization, GHG flux measurements, blue carbon and benthic fauna assessments, we evaluate whether rewilded wetlands can recover ecological functions comparable to those found in natural systems. We focus on the plant biomass, carbon stocks, greenhouse gas dynamics, habitat provision, and biodiversity patterns across these intertidal habitats. Measuring rewilding and restoration success solely through species composition may underestimate broader ecosystem recovery. By integrating biodiversity, ecosystem functioning, and climate-regulation indicators, this work contributes to the development of evidence-based approaches for evaluating rewilding outcomes in dynamic coastal seascapes. In addition, this study provides insights into how rewilding and restoration trajectories can be monitored across environmental gradients to maximize ecological resilience and long-term sustainability in a changing world.

Exploring rewilding pathways for Mediterranean landscapes under increasing wildfire and invasion pressure

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Mediterranean landscapes face a challenging feedback loop driven by land abandonment, climate change, and the compounding threats of severe wildfires and invasive alien plant species (IAPS), which together can push ecosystems into alternative, degraded trajectories. Designing effective rewilding pathways in these highly vulnerable, transitional landscapes requires balancing passive recovery processes with active intervention strategies. Drawing on Portuguese case studies, we analyse the delicate balance between letting nature take the lead and deploying targeted interventions, such as managing fuel loads and restoring native trophic interactions, to prevent catastrophic wildfires and IAPS from permanently reshape ecosystem trajectories. Furthermore, we address the complex social realities of Mediterranean rural fringes, where wildfire risk perception, land-use dependencies and livelihood structures influence community acceptance. By explicitly mapping these coupled socio-ecological constraints, we explore a context-sensitive framework to enhance ecosystem multifunctionality and foster social legitimacy of Mediterranean rewilding pathways.

Defining Marine Rewilding: Progress in unifying concepts and creating pathways for marine rewilding

Charlotte Hopkins *, Esther Brooker
University of Hull – United Kingdom

Growing concern over the triple planetary crises of climate change, biodiversity loss and pollution has accelerated international efforts to restore natural ecosystems through nature-based solutions. Rewilding is a paradigm shifting conservation approach encompassing the recovery of ecological and trophic complexity through interventions such as habitat restoration and/or species reintroduction. Marine rewilding is a nascent concept, involving a diverse range of inter-ventions, showing similarities in ecological principles with terrestrial rewilding, yet it diverges from terrestrial rewilding in the scale of initiatives, predictability of outcomes, and the prominence of social inclusion. To make progress in unifying concepts and creating pathways for marine rewilding we propose a definition: a systemic process requiring deliberate human intervention that involves community participation and ocean stewardship to regenerate degraded marine ecosystems.

SS13 - GRAZING AS A CONSERVATION AND RESTORATION TOOL

Building a European Network for Conservation Grazing: Developing a Multilingual Online Forum for Practitioners

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Conservation grazing is increasingly recognised as an effective tool for maintaining and restoring species-rich grasslands and other semi-natural habitats across Europe. However, knowledge and practical experience remain fragmented between countries, disciplines and stakeholder groups. In addition, language barriers limit the exchange of knowledge and successful management approaches, reducing opportunities for collaborative learning and the wider uptake of effective conservation grazing practices.
This presentation introduces the **European Conservation Grazing Network**, established through the Erasmus+ project *Conservation Grazing Network Europe*, coordinated by Bunde Wischen (Germany) in partnership with ACOBIJA Conservación (Spain). The network brings together low-intensity livestock farmers, conservation grazing practitioners, land managers, scientists, protected area managers and other stakeholders working to conserve and restore biodiversity through grazing.
A central component of the project is an online knowledge platform supporting a growing European community of practice. The multilingual forum is operational and continues to evolve through user engagement and the addition of resources. It facilitates peer-to-peer exchange, provides practical case studies, educational resources and training materials, and promotes collaborative learning across Europe. Users can contribute in their own language, while an integrated translation function makes forum discussions accessible in English, German, Spanish and French.
The presentation will demonstrate the forum's main functions and discuss how it can strengthen collaboration between science and practice, facilitate cross-border learning and support the wider application of conservation grazing. As the forum continues to evolve, participants will be invited to share ideas, identify user needs and help shape its future as a shared European knowledge base.

The role of extensive livestock systems in maintaining habitats on Annex I of the EU Habitats Directive.

Jan-Erik Petersen, European Environment Agency – Denmark

This talk summarises key results of an EEA study on 'Managing and restoring semi-natural habitats – a review of the links with extensive grazing systems'. This focused on the 63 habitats identified by Halada et al. (2011). According to reporting by EU Member States under the EU Habitats Directive, habitats that benefit from grazing (or mowing) cover at least 35 million hectares, equivalent to about 22% of the total official EU-27 farmland area.
To estimate the grazing capacity needed for habitat maintenance, it is necessary to know the area that needs to be grazed as well as the stocking density per hectare required by different habitat types. The EEA study employed an expertled approach to produce an estimate of the best stocking density for maintaining key semi-natural habitats by consulting botanical specialists and grazing ecologists across Europe. The results are differentiated by biogeographic region and show a wide range of suitable grazing densities. These vary from 0.05 to more than 1.0 livestock units per hectare.
The share of total EU livestock required to maintain habitats of EU interest by grazing lies at around 10-15% of the EU's current total ruminant livestock herd. There is substantial variation of the required national livestock share between EU countries, ranging from a few to over 40 percent.
The potential benefit from domestic livestock for the conservation of grazing-dependent habitats relies on a range of factors. These include the livestock types and breeds available, their geographic proximity to these habitats, and the actual grazing practices employed.

The role of large herbivores in shaping European ecosystems

Markus Handschuh *, Naturnahe Weidelandschaften (Near-natural grazing association) e. V. – Germany, Black Forest National Park – Germany

Large herbivores have been key drivers of ecosystem structure, biodiversity, and ecological processes throughout Europe's evolutionary history. This presentation reviews recent advances in our understanding of their role in shaping European landscapes and discusses the implications for contemporary biodiversity conservation and ecosystem restoration.
Large herbivores function as ecosystem engineers through grazing and browsing, trampling, soil disturbance, nutrient redistribution via dung and urine, carcass provision, and seed dispersal by epi- and endozoochory. Together, these processes modify vegetation dynamics, soil properties, microclimate, successional trajectories, and species interactions, generating heterogeneous habitats across multiple spatial and temporal scales.
Recent palaeoecological syntheses and ecological meta-analyses increasingly challenge the traditional view of Europe's natural vegetation as predominantly closed-canopy forest. Instead, results indicate that diverse assemblages of wild herbivores maintained dynamic woodland–grassland mosaics composed of open, semi-open, and closed-canopy habitats. Herbivore-driven disturbance regimes generated structural complexity and supported high levels of biodiversity. After the decline and extinction of megafauna, extensive livestock grazing partly replaced these ecological processes and maintained or recreated management-dependent, species-rich, semi-natural landscapes. Research further indicates that the ecological effects of herbivores are determined primarily by their functional traits, emphasizing the importance of functionally diverse herbivore communities.
These findings highlight the importance of restoring ecological processes for the implementation of the EU Nature Restoration Law. Allowing large herbivores in the wild and in managed grazing systems to shape landscapes can help reestablish disturbance-driven habitat heterogeneity, enhance ecosystem resilience, and promote the long-term functional diversity of European landscapes under ongoing environmental change.

Review of available EU-level guidance for assessing habitat condition and habitat conservation targets in context of the EU Habitats Directive and the Nature Restoration Regulation

Anton Kvarnback, European Environment Agency – Denmark

A significant proportion of the habitat types protected under the Habitats Directive depend on agricultural practices for their maintenance and conservation. The status of these habitats is monitored and reported through obligations of the Directive, which together with the Birds Directive engage around 200,000 people across Member States in one of the world's most extensive and coherent biodiversity assessments.
This talk presents the development of a harmonised EU-wide dataset for Annex I habitats under the Habitats Directive, with a particular focus on the 2019–2024 reporting cycle. It also discusses technical guidance published by the European Commission for assessing habitat condition and determining minimum area requirements for EU habitat conservation targets, with particular attention to habitats dependent on agricultural management, including grazing.
The talk also demonstrates how data reported by Member States are transformed into policy-relevant knowledge

products, such as the State of Nature Report. Finally, it explores how these products support the implementation of the Nature Directives and inform feedback on national action plans under the NRR and the wider the restoration agenda.

Critical grazing parameters and biodiversity impact metrices to be monitored in conservation grazing – initial reflections

Jan-Erik Petersen, European Environment Agency – Denmark

There are various factors that determine the success of grazing as a nature conservation tool. The following four components of grazing management are considered important for deciding the impact of livestock on habitats:

- type of livestock used (e.g. cattle, sheep, goats, horses, wild herbivores, either alone or in combination);
- grazing period (spring, summer, autumn or winter);
- grazing regime applied (e.g. permanent or rotational grazing);
- stocking density in relation to habitat productivity and weather conditions.

Different habitat types react differently to the same grazing practices. Finding the optimal grazing regime for each habitat type requires careful consideration in dialogue with grazing experts, farmers and ecologists.

There is also a range of biodiversity impact metrices that could be monitored to measure conservation grazing success. These range from variables that relate to structural changes, e.g. typical disturbance impacts (such as areas of open soil) or the richness of vegetation structures, to variables that measure species or habitat diversity, population size of different species groups, reecording the presence of rare species etc.
This talk presents initial reflections on potential practical approaches to measuring key variables related to grazing management and biodiversity outcomes. These have to balance scientific rigour and time investment to enable regular and long-term monitoring to be established. The talk aims to lay the groundwork for an open discussion in this session.

SS14 - CONNECTIVITY IN LARGE-SCALE RESTORATION

LIFE NewLIFE4BioIslands: biodiversity islands as stepping stones for pollinator recovery and landscape connectivity in degraded Mediterranean and Macaronesian lands

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Landscape degradation and habitat fragmentation are accelerating pollinator decline across southern Europe, particularly in drylands and heavily disturbed areas. The LIFE project NewLIFE4BioIslands (2025–2031) addresses this challenge through an innovative restoration approach based on the creation of biodiversity islands: small, strategically located patches of structurally diverse native vegetation established within degraded landscapes to trigger natural regeneration at landscape level through minimal but targeted interventions, improve habitat connectivity and increase ecosystem resilience. The project is being implemented across six Natura 2000 sites in five regions of: Spain (Gran Canaria; Catalonia), Greece (Eastern Macedonia and Thrace; Crete) and Italy (Lazio), covering Mediterranean and Macaronesian contexts affected by overgrazing, mining, recurrent fire, shrub encroachment and unmanaged pine stands. The project will apply this approach across 2,358 ha, establishing 600 biodiversity islands and associated matrix restoration measures tailored to local ecological and socio-economic conditions. Interventions include native sowing and planting, assisted natural regeneration, ecological conversion of degraded stands, erosion control, grazing management and water-support systems in arid sites. The project targets improved conservation status of Annex I habitats and selected plant and insect species, while aiming to increase native pollinator diversity by 20% and abundance by 30%.

We present the conceptual framework, site-specific restoration designs, and monitoring strategy of NewLIFE4BioIslands, discussing how biodiversity islands can function as a transferable model for restoring connectivity and ecological functionality in fragmented landscapes.

Approaches and barriers to monitoring connectivity in conservation practice

Taylor Shaw * [1], Willow Leonard-Clarke , Adham Ashton-Butt , Robert J Fletcher , James Bullock , Chelsea Smith , Nancy Ockendon

Enhancing ecological connectivity is central to conservation efforts and current international conservation directives. Monitoring connectivity is important to understand if restoration actions aimed at enhancing connectivity have been effective, rather than assuming that they *de facto* enhance connectivity. However, little is known about how conservation researchers and practitioners plan for and monitor connectivity. To understand the extent and type of connectivity monitoring taking place, an online quantitative survey was distributed to anyone whose work relates to ecological connectivity in the conservation sector. I will present the results of this survey, including what gets monitored, what doesn't, and differences between practitioners and researchers in what and how they monitor. I will also present barriers identified in planning for and conducting connectivity monitoring, as well as recommendations for how to overcome them. Lastly, I will link this work to examples from applied restoration projects within the Endangered Landscapes and Seascapes Programme, which has supported 29 large-scale ecosystem restoration projects across Europe since 2018.

Connectivity assessment for the Marsican brown bear (Ursus arctos marsicanus) in the Central Apennines, Italy

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The core breeding population of the Marsican brown bear (*Ursus arctos marsicanus*) occurs in the Apennine Mountains of Central Italy, with a major factor limiting expansion of the population appearing to be a lack of safe and effective dispersal corridors.
This study presents a connectivity assessment for the population of Marsican brown bear, with three main objectives: i) to establish a baseline for long-term monitoring of connectivity; ii) to identify potential bear dispersal corridors, especially those that complement existing rewilding, and iii) to locate connectivity 'pinch points', where bear movements are expected to be especially constrained.

The analysis landscape included nine protected areas: the five currently occupied by bears and four others that could be colonized in the future if connectivity is restored. We applied resistance-based connectivity modelling. First, layers were scored for resistance and weighted using local and expert knowledge. The resistance surface was used to calculate pairwise resistance distances among protected areas, and as input for least-cost corridor modelling and circuit theory analyses using the software *Circuitscape*.
The results from this connectivity assessment are relevant to several aspects of rewilding practice in the Central Apennines, including the design of corridors, the spatial prioritization of rewilding interventions, and efforts to track the impact of rewilding actions over the long-term. Challenges remain in incorporating direct threats and disturbances (including conflict events) into models, and in identifying suitable datasets for validating the predicted corridors and pinch points.

Structural connectivity analyses as a tool to plan and monitor large-scale restoration in Cumbria.

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Cumbria Connect is restoring natural processes and improving landscape connectivity through collaboration between estates, conservation bodies, and local land managers. In our ˜35,000-hectare landscape-made up of degraded species-poor habitat and a few pockets of species-rich habitat-we are assessing which interventions will make habitats bigger, better, and more connected. Here, we present analyses to estimate the current connectivity, or 'flow', through the

landscape and to identify the greatest bottlenecks to improving this flow. These baseline analyses were performed for different habitats and species, and the resulting bottlenecks checked for overlap. This has enabled us to identify specific areas to prioritise for given interventions, such as the creation of woody habitats. This analytical framework has two additional benefits: It allows us to evidence the improved connectivity because of interventions, and it helps us to plan ahead (e.g. if we create woodland here in the next 5 years, where is the best place to create woodland in the next 10, 15, 20 years?). Mapping these scenarios and sharing their insights make the benefits of restoration efforts evident to local landowners and neighbouring projects, and is a powerful tool in developing future interventions. We also share some limitations of this framework, such as: (1) flow is species-specific because of dispersal distance and recruitment rate, and (2) increases in flow can be beneficial to some species/habitats while being detrimental to others. This approach is not a panacea; for effective use, it should be layered onto a well-designed project framework with carefully considered goals.

Challenges and opportunities for monitoring connectivity in landscape restoration

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Recent advances allow the measurement and prediction of animal movement at multiple scales and highlight how connectivity underpins species persistence, ecological function, and ecosystem services. This knowledge could guide ecological restoration, yet connectivity science remains to be fully integrated into planning and monitoring restoration success.
Connectivity monitoring is not a single methodological choice, but a series of critical decision points. Practitioners face an overabundance of connectivity metrics, each capturing different ecosystem properties, making it difficult identify those most appropriate for specific restoration contexts. Compounding this challenge, many commonly used connectivity metrics are poorly suited to detecting changes in connectivity arising from habitat quality as opposed to habitat availability, limiting their usefulness for tracking restoration success over time. Practitioners must also decide whether to prioritise structural metrics that describe land cover and spatial configuration, or functional metrics that incorporate species' movement behaviour and habitat use, as well as the spatial and temporal scales over which connectivity will be assessed.
To better understand these challenges, we engage with restoration projects within the Endangered Landscapes and Seascapes Programme. We draw on insights from the Cumbria Connect (UK) project to understand how restoration goals relate to landscape connectivity, and perceived barriers to connectivity monitoring. We then explore which approaches and metrics would be most informative and relevant for connectivity monitoring, given the ecological and management context. By framing connectivity monitoring as a structured decision-making process, this work provides a pathway towards more consistent, transparent, and meaningful application of connectivity metrics in ecological restoration.

SS15 - FROM SPATIAL MODELLING TO LARGE-SCALE STRATEGIES

Designing Restoration Measures to Improve Water Quality in a Degraded Peatland Catchment

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Peatland-dominated catchments face persistent water-quality challenges driven by long-term drainage, forestry practices, and the degradation of organic soils. Our work develops a structured framework for designing restoration strategies that reduce nutrient loads and enhance ecosystem services in these landscapes. In this context, nature-based solutions (NbS) offer promising pathways for ecological restoration and co-benefits, yet systematic, value-informed approaches for identifying and scaling NbS in complex socio-ecological settings remain limited. To address this gap, we combine hydrological modelling, spatial analysis, and stakeholder engagement to assess the feasibility of targeted restoration interventions.
Our work focuses on the Kiiminkijoki catchment in northern Finland. Baseline hydrological and nutrient dynamics were simulated using the SWAT+ model. A first expert-survey round was used to prioritise a preliminary set of NbS, e.g., wetland creation, rewetting of drained peat soils, sphagnum cultivation, buffer zones, etc., ranked according to anticipated effectiveness and sector-specific constraints. We then developed a conceptual and spatial framework to

locate potential NbS sites using multiple criteria: nutrient loading estimates from the Finnish WSFS-Vemala model, land-use patterns, peatland drainage status, peat depth, clear-cut histories, distance to water bodies, and proximity to conservation areas. A second stakeholder consultation assessed site-level feasibility and implementation considerations.
Preliminary SWAT+ simulations indicate reductions in nutrient export for several NbS configurations, though results are still developing. Future work will apply optimisation algorithms to identify the most effective NbS combinations for improving water quality in degraded peatland-dominated catchments.

Optimized spatial planning in forest restoration via quantum algorithms: a proof of concept for viable plans

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In forest ecology, restoration initiatives seek to mitigate the loss of ecosystem services following exploitation by focusing on the recovery of the original tree community and its associated ecological synergies. Still, the complex dynamics in the changing landscape often hamper the success of restoration actions, with plans usually based on models that seldom capture the numerous interactions between the planted tree species and environmental features. Classical methods struggle to account for realworld complex scenarios, such as those of forest restoration. Specifically, the incorporation of a large number of variables results in increasing degrees of freedom, often making the model intractable for classical hardware. Scarcely applied in ecology, quantum computing (QC) can potentially overcome the limitations of classical methods by efficiently processing high-dimensional scenarios. As a proof of concept, we created optimization algorithms to identify the most effective number and spatial disposition of tree species for forest restoration, while minimizing resource waste. The desired state, represented by a fixed tree diversity value (e.g., that of native forests), was targeted considering the environmental capacity, tree species-specific abiotic and biotic interactions, and their seed dispersion potential. Considering the current QC capacity, the analysis provided a practical and effective spatial map of trees to plant across scales. The well-defined disposition of trees accounted for the complex interactions among species and the environment, efficiently representing the reality in which restoration occurs. Our work illustrates that QC can be effectively applied to forest restoration, offering a more nuanced and efficient approach to the problem.

Global patterns, supply-chain flows, and driving factors of forest loss footprints from 2001 to 2022

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Monitoring forest loss is critical to keeping global warming below 1.5 ◦C, yet achieving zero deforestation remains elusive. Despite extensive national monitoring and high-resolution earth observation data, deforestation persists due to a limited understanding of the human and economic mechanisms driving forest conversion. Here, we develop a state-of-the-art analytical framework to disentangle these dynamics by linking forest loss-driven by logging, permanent agriculture, commodity production, and infrastructure expansion-through global supply chains to the consumer side, termed the forest loss footprint. This approach links fine-scale remote sensing data with aggregated economic accounts through a spatial allocation framework. We further apply machine learning techniques to identify key socioeconomic drivers behind consumption-induced forest loss. Our results indicate that 38.15% of global forest loss-equating to approximately 5.01 Mha of the 13.12 Mha total in 2022-is embodied in international final demand, with five countries (Brazil, the United States, China, Indonesia, and Russia) accounting for 48.16% of global deforestation. China and Russia exhibit polarizing trends that amplify global forest pressures. Among the evaluated socioeconomic determinants, urbanization, manufacturing intensity, and domestic economic and conservation capacities emerge as the primary factors characterizing cross-national patterns of forest loss. This integrated framework offers a robust, data-driven foundation for advancing global forest conservation and promoting equitable responsibility across international supply chains.

Limited carbon sequestration potential from global ecosystem restoration

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Ecosystem restoration is increasingly promoted as a strategy for mitigating climate change. Previous global assessments have suggested that restoring degraded ecosystems could offset a considerable share of anthropogenic carbon emissions since the Industrial Revolution. However, estimates of this potential remain highly uncertain, partly due to the tree-centric focus of many models and the challenges of representing diverse ecosystem types in restoration scenarios. Here, we implement a model-based prediction framework to quantify the carbon sequestration potential of restoring forests, shrublands, grasslands, and wetlands through to 2100. We estimate a maximum potential of 96.9Gt of carbon, corresponding to 17.6% of cumulative historical emissions, or 3.7–12.0% when accounting for projected future emissions over the century. These findings indicate that, even under optimistic assumptions and alongside a global transition to low-emission, sustainable economies, the climate mitigation capacity of ecosystem restoration is limited. Furthermore, when restoration targets are aligned with anticipated future climatic conditions and when climate-driven state transitions among existing natural ecosystems are considered, the net carbon sequestration potential of restoration approaches near zero. We therefore suggest that ecosystem restoration should be prioritized for its co-benefits, including biodiversity recovery, enhanced ecosystem service resilience, and support for human livelihoods. In this context, restoration may play a more substantial role in facilitating climate change adaptation-by strengthening ecosystem stability and buffering environmental change-than in directly mitigating atmospheric carbon emissions.

Harnessing the Low-Hanging Fruit of Rewetting Drained Organic Soils to Achieve Maximized Greenhouse Gas Reduction Potential

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Rewetting drained organic soils is widely recognized as a key nature-based climate solution, yet its implementation remains limited and its climate effectiveness contested. A major limitation in current assessments is the dominant focus on carbon sequestration, while the immediate and often larger climate benefit-avoided greenhouse gas (GHG) emissions from degraded soils-remains underrepresented. This oversight obscures opportunities to maximize near-term climate gains. Here, we synthesize experimental, observational, and global-scale evidence to identify "low-hanging fruit" rewetting targets that deliver disproportionately high and rapid GHG reductions. Across land-use gradients, unmanaged and marginal peatlands consistently exhibit the highest mitigation potential, achieving up to ˜90% reductions in net GHG emissions following rewetting. In addition, disturbance legacies such as severe wildfire create a previously overlooked class of high-priority targets, where rewetting can strongly suppress methane (CH) emissions while simultaneously reducing land-use conflict. A key constraint on rewetting effectiveness is the CO–CH trade-off. We show that methane dynamics are strongly pathway-dependent, with conventional hydrological rewetting often delaying net climate benefits due to sustained CH emissions. However, targeted strategies-such as sulfate-rich rewetting or prerewetting soil modification-can substantially suppress CH emissions and stabilize mitigation outcomes across diverse peatland types. These findings reframe peatland rewetting from a uniform restoration action to a prioritization problem. By integrating land-use intensity, disturbance history, and biogeochemical pathway, we identify a class of high-impact, low-conflict rewetting opportunities that can maximize near-term climate mitigation. This framework provides a scalable basis for aligning peatland restoration strategies with policy-relevant timelines for net-zero emissions.

Spatial configuration of vegetation restoration is critical to mitigating carbon-water trade-offs for dryland ecosystem sustainability

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Vegetation restoration in drylands can enhance carbon sequestration but also intensify the regional carbon-water trade-off (CWT) by increasing water consumption. Optimizing restoration strategies to mitigate this trade-off is important for the long-term sustainability of dry-land ecosystems. Therefore, this study presents a coupled assessment framework integrating Gross Primary Productivity (GPP) and Water Availability (WA) to quantify CWT, using the Loess Plateau (LP) in northern China as a representative case of large-scale dryland vegetation restoration. By integrating remote sensing and multi-source datasets with trend analyses and time-series diagnostics, this study quantified the spatiotemporal dynamics of CWT and used Random Forest models to identify key drivers and their thresholds, ultimately proposing

targeted adaptive management strategies. The results showed that areas with a significant increase in GPP accounted for 90.42% of the LP, whereas areas with a significant decrease in WA accounted for 42.56%. 8.65% of the region was classified as intensified CWT zones, indicating potential hotspots of ecological degradation. Furthermore, interpretable machine learning revealed that the dominant drivers of CWT shifted from water limitation in high trade-off areas to energy limitation in low trade-off areas. These results suggest that current rapid, high-density restoration may constrain the long-term sustainability of vegetation growth, highlighting that adjusting spatial configuration is crucial for optimizing regional carbon-water relationships. Our findings characterize the spatial patterns of CWT and identify targeted mitigation strategies, providing critical insights into reconciling the potential conflicts between carbon sequestration with water consumption, which underpins sustainable vegetation restoration in the LP and other dryland ecosystems.

Broad-scale restoration hotspot identification based on potential natural vegetation modelling

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Landscape-scale ecological restoration is increasingly recognized essential, yet spatial prioritization remains a challenge. We aimed at developing a spatially explicit synthetic solution to identify promising target habitats and locations for complex restoration aims. Our approach is based on an indicator framework that is grounded in the comparison of actual vegetation and model-based potential vegetation estimations. Potential vegetation reflects levels of self-sustainability, in our case in the form of a five-rank ordinal scale allowing capturing of uncertainty. Cross-tabulation of ranks and observations produces indicators quantifying matches and mismatches. Beyond concentrating on individual vegetation types, we derived synthetic representations pointing out locations, where restoration and/or conservation opportunities concentrate. We investigated patterns for Hungary as a case study: 1) the distribution of spatial units with highest number of vegetation types that would be highly sustainable if restored, 2) areas where both the currently present patches are self-sustaining in the long run and interspersed areas showing restoration potential for a wide range of habitats. Restoration hotspots were revealed e.g. in northeastern areas, where high suitability aggregates across vegetation types, offering opportunities for multi-habitat restoration. As candidates for combined conservation and restoration efforts, i.e. regions sharing both high sustainability of existing vegetation and diverse restorable vegetation types, the vicinity of major water bodies and areas potentially covered by lowland forest steppe systems emerged. The spatial identification of such hotspots supports landscape-scale and habitat-complex restoration. Furthermore, the framework enables the detection of areas where conservation and restoration priorities overlap, an approach known to maximize natural capital.

Litter effects of an invasive grass on native species in sandy grasslands

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Open ecosystems such as sandy grasslands are often overlooked in restoration planning, despite their high biodiversity and vulnerability to invasion. Sporobolus cryptandrus, a North American grass, has recently spread in Central Europe, including Hungary, where it may threaten native plant communities. Understanding how this species affects native plants is important for guiding restoration strategies in these ecosystems.

We studied how litter from S. cryptandrus influences seed germination and seedling emergence of nine native grassland species. We compared three treatments: no litter, native grass litter, and Sporobolus litter. We expected that litter would reduce germination by creating physical and chemical barriers, and that Sporobolus litter might have stronger negative effects than native litter.

Our results showed that litter did not have a consistent negative effect across species. In most cases, native and Sporobolus litter had similar effects. Only one species, Bromus tectorum, showed lower germination under Sporobolus litter. This suggests that the effects of litter are species-specific and that Sporobolus litter does not strongly differ from native litter in most cases.

These findings highlight the need to consider species-specific responses when planning restoration of sandy grasslands. They also suggest that not all invasive species have strong negative effects through litter. This type of knowledge can support better decisions on where and how to restore open ecosystems at larger scales.

Targeted rewetting of agricultural peatlands on acid sulfate soils: integrating spatial analysis and cost–benefit assessment

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Cultivated peat soils are a major source of greenhouse gas emissions in Finland, and when located on acid sulfate soils, they also contribute to harmful acid runoff. Identifying cost-effective and spatially targeted mitigation measures is therefore essential, particularly in the context of implementing the EU NRR, which emphasizes multifunctional outcomes such as climate mitigation, water protection, and biodiversity recovery.
This study integrates spatial analysis with a social cost–benefit analysis to evaluate the potential and economic performance of rewetting compared to subsurface drainage. National field parcel data were combined with soil maps, groundwater (DTW) indices, and LiDAR-based detection of drainage systems. The results show that Finland has approximately 38,000 ha of cultivated peat soils on acid sulfate areas, of which about 25,000 ha have rewetting potential. Around 8,000 ha are currently open-ditch drained and represent the key target for restoration-focused interventions.
The economic analysis applies a 30-year CBA framework. Subsurface drainage maintains agricultural production (˜320 €/ha/year), whereas rewetting leads to production loss and requires compensation (˜8000 €/ha), but generates larger environmental benefits. These include higher CO emission reductions (15 vs. 25 tCO/ha/year), alongside improvements in water quality and biodiversity.
The results indicate that subsurface drainage is economically preferable even under low carbon prices, while rewetting becomes socially optimal when broader environmental benefits are fully accounted or CO2 - prices elevate.
Overall, spatial targwting offers potential to support the implementation of restoration policy goals. Its cost-effectiveness, however, depends on adequate valuation of environmental benefits and well-designed compensation schemes for landowners.

Refining European reforestation potential estimates for climate mitigation and biodiversity conservation

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Tree-planting initiatives, as a nature-based solution to mitigate climate change by enhancing carbon sequestration, have become a central focus of many conservation and restoration strategies, including the 2030 Biodiversity Strategy under the European Green Deal. Although the EU Commission provides general guidelines, decisions regarding where and how to plant remain largely open-ended. Misclassification of vegetation types raises concerns regarding inappropriate afforestation of natural and seminatural grasslands, forest-steppes, and woodlands. Here, we address some problems of spatial inadequacy in tree planting by including a refined potential for forest, woodland/forest-steppe cover in Europe. This refined potential accounts for methodological adjustments to the definition of forest cover based on the percent of tree cover and for the inclusion of disturbance by fire and herbivores as drivers of potential tree cover. Our preliminary results show that regions in Europe with the highest uncertainties in tree cover were those covered by forest steppes and woodlands. These vegetation types are the areas most at risk of being classified as forest in previous assessments and targeted for tree planting. Our study suggests that identifying reforestation opportunities depends strongly on methodological choices and value-based criteria. We emphasize the importance of carefully evaluating which areas are both feasible and appropriate for reforestation, considering local ecological and social contexts

SS16 - RESTORATION OF RIVER CONNECTIVITY: FROM THEORY TO PRACTICE

How effective is floodplain restoration in enhancing aquatic biodiversity in running waters?

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Side-arm engineering is a common restoration practice used to rehabilitate degraded floodplains and river lateral connectivity. However, the benefits for aquatic biodiversity in these restored areas remain highly uncertain, primarily due to the lack of suitable monitoring of such measures.
We analysed ten years of monitoring data on fish and macroinvertebrates communities in a restored section of the Upper Rhine River floodplain in France. This included two stations: a 5 km-long newly created side channel as the restored site, and a control site on the by-passed old Rhine.
This case study is particularly interesting in that it reveals the colonisation patterns that have emerged over time as a result of floodplain restoration. We examined these patterns using diversity indices based on both taxonomic and functional attributes of the communities. During the early stages of succession, we found that dispersal capacities played a key role in invertebrate colonisation, in contrast to fish. After ten years, we observed limited gains in richness, with no significant increases in diversity or evenness. Additionally, we observed a significantly different compositional evolution in the communities of fish and invertebrates: invertebrate taxa were characteristic of lateral habitats, whereas no such trend was observed for fish. Surprisingly, changes in all communities were mainly driven by native taxa, despite the Rhine River being a hotspot of xenodiversity.
In conclusion, this case study demonstrates the effectiveness of floodplain reconnection in restoring aquatic biodiversity, as well as the optimal monitoring duration for capturing the colonisation processes.

Reconnection alters hydro-ecological interactions in a backwater-dominated side channel of Po River

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River connectivity, beyond regulating the transport of water, sediments and biota, plays a fundamental role in biogeochemical cycling and nutrient transformation. However, flow regulation and channelization have progressively disconnected large rivers from their perifluvial wetlands.
In line with European river restoration goals, a pilot reconnection project, accompanied by a monitoring campaign supported by FSC 2014-2020 funding, was implemented along the Po River, Italy's largest river. In 2023, a navigation embankment was lowered to increase the frequency of reconnection with a previously isolated side channel.
Field sampling alone may underestimate restoration effects, depending on limited observation periods and sampling frequency. To overcome these limitations, we combined in situ measurements with remote sensing data, enabling reconstruction of system dynamics over an extended period (2018-2025) at higher temporal frequency (˜ 40 observations per year).
The Water Adjusted Vegetation Index was applied to detect water extent and infer river-meander connection as a function of hydrometric level. Suspended Particulate Matter and Chlorophyll-a concentrations were derived from satellite data and used as proxies for hydrodynamic exchange and primary producer response; these products were validated against in situ measurements, showing strong agreement. Finally, the Spectral Angle was used to assess the spectral similarity between the main channel and the meander, providing a quantitative measure of the persistence of river water within the meander.
The intervention shifted the system functioning from a largely disconnected backwater-influenced state to a more dynamic secondary-channel configuration. Restoration altered the hydro-ecological interactions, with stronger river influence and more frequent flood-induced resets.

Restoration of floodplain forest in the Elbe floodplain near Lenzen in Northern Germany

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This presentation focuses on the large-scale restoration of floodplain forest on former floodplain grassland in a floodplain in the North German lowlands along a large river: following the relocation of the dyke near Lenzen, the Elbe has regained 420 hectares of flood retention space here. The connection between the river and the floodplain has been restored since 2010 through the opening of the dyke and the creation of large-scale flood basins. Hardwood and softwood floodplain forests have been developing across more than 300 hectares since 1995. The development of the area is enhanced by the creation of a semi-open grazing landscape, with grazing by hardy horse and cattle breeds, covering an area of around 30 hectares. Numerous variants of floodplain forest restoration have been tested in this pilot project. The main objective was to initiate floodplain forest development by planting groups of trees and shrubs. The tree-shrub groups were established in a variety of configurations. With over 20 species of floodplain woody plants, all natural floodplain forest elements have been incorporated. For comparison, both extensive plantings were established, and large areas were left to spontaneous development. The extensive findings obtained in this process regarding both spontaneous and artificial floodplain forest restoration will be presented. The key factors and challenges involved in floodplain forest restoration will be outlined, considering the highly variable site conditions typical of floodplains, as well as the wide range of outcomes achieved through restoration.

Free Flowing Rivers – Lateral Data Deficiencies - up, over and out

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The Ecostat group has determined that for a river to be free flowing, lateral, longitudinal and vertical connectivity must be considered. Currently in Ireland datasets capturing the 3 orthogonal axes of river connectivity are either in development, data poor and/or unconsolidated. From the longitudinal perspective, a national programme was initiated in 2018 creating an inventory of ˜73,000 instream "potential barriers". As of Spring 2026, 39,953 of these instream structures have been assessed with 7,839 identified as a barrier to fish migration.
Lateral and vertical connectivity datasets are being coalesced and developed, through various governmental datasets. Historic temporal flooding data is being combined with the arterial drainage channels, embankment reaches, flood relief schemes, abstraction locations and urban centres. Lateral, impacts to connectivity are one of the most pervasive pressures in river systems, with widespread river management actions having the specific intention of limiting this interaction. Therefore, the challenge is consolidating the information, quantifying the level of impact to systems and to then assign their free flowing status.
Nationally modelled flood extent projections and historical flood event records will be integrated with site-based data, including primary evidence from on-site surveys and channel measurements (LiDAR), and secondary indicators (trash lines and sediment deposits), to ground-truth modelled flood predictions. The data deficit highlights the need to develop methods for identifying, assessing and prioritising Free Flowing River Mitigation actions to support Irish legislation and EU Directives. This mitigation planning requires a data-driven prioritization strategy.

Restoring the Sélune river continuity: how big dam removal reshapes habitats, biodiversity, and landscape uses

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The Selune river (Normandy, France) went through drastic changes in recent years (2017-2023) after the removal of two dams on its main course. The restoration project of the Sélune river was designed to re-establish ecological continuities to improve the ecological status of the river, and to reconnect the river to the ocean. This project led to the restoration of two neo-valleys, representing a third of the running waters of the main river in the watershed. Such restoration project modifies landscapes as well as long-standing human uses, often generating strong social resistance. This was the case for the Sélune river: some locals initially focused on the loss of familiar landscape features, especially the artificial reservoir-lakes (built in 1920' & 1932'), and the disruption of associated cultural practices, followed by uncertainties about future uses of the new fluvial landscape. Yet, ecological responses were rapid and transformative. The restoration project reestablished the previous riverbanks and supported the recovery of both aquatic and riparian habitats. As habitats improved, biodiversity responded quickly: aquatic invertebrates recolonized restored sections, migratory fish

regained access to upstream areas, and riparian vegetation expanded, supporting associated terrestrial and aquatic invertebrate communities. Despite initial rejection, the ecological shifts observed revealed that the restoration of the Selune river generated new environmental and social opportunities, and fostered previously unforeseen uses. It thus appears essential to look at river continuity restoration projects as a way to redefine the social connection to the river by creating new opportunities through ecological recovery and changing landscape uses.
restoration, Sélune river, dam removal, riparian, aquatic, habitats, social resistance

Lessons learnt on river restoration projects from the demonstration sites network: understanding unfinished projects

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Since 2018, the GEMAPI mandate (Management of Aquatic Environments and Flood Prevention) has strengthened river restoration efforts in France, supported by the European Water Framework Directive (2000/60/EC), which aims to achieve good ecological status for water bodies by 2027, and its transposition into French law through the 2006 Water and Aquatic Environments Act (LEMA). To evaluate the effectiveness of these restoration actions, a network of demonstration sites has been developed since 2010, using a standardized minimal scientific monitoring (SSM) framework focused on hydrobiology, physico-chemical parameters, and hydromorphology. However, the current monitoring approach does not adequately consider the socio-economic, political, and territorial dimensions that strongly influence the implementation and outcomes of river restoration projects. To address this gap, a comparative analysis was developed using a standardized analytical framework based on common and accessible parameters, enabling comparisons between restoration projects through shared methodologies and indicators. The framework combines SSM data with contextual information from national databases (Carhyce, Naïades, Météo-France, Hydroportail) and stakeholder interviews. It includes geographical characteristics (location, river size, hydrology, climate), restoration features (objectives, restoration type, active or passive approaches, technical measures and resources), socio-economic aspects (budget, funding sources, stakeholder involvement), and environmental and legal factors. The methodology was applied to three restoration projects within the network: a completed project on the Aulnes River, a suspended project on the Cher River, and an abandoned project on the Seyes River, illustrating contrasting trajectories and outcomes over time.

Auto-regeneration of spontaneous pioneer plant communities of former gravel pits: restoration on the Dordogne river's floodplain - LIFE Nature Dordogne Project, France

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The physical evolution of the Dordogne riverbed results from several anthropogenic factors: the advent of large dams starting in the 1930s, extractions from the riverbed until 1984 and riverbed modifications between 1970 and 2000. These interventions caused a loss of fluvial dynamics, incision of the riverbed and simplification of fluvial forms, thus reducing the diversity of pioneer habitats. To restore the ecosystem, the LIFE-Nature Dordogne River program (2020-2028) proposes 30 morphological-ecological restoration projects, including 3 gravels pits, over 280 km of river. The action seeks to restore a sustainable ecological balance, considering flood dynamics and the natural regeneration of habitats. For that, the passive ecological restoration is used for regreening the new riparian areas, with bare soils created by the civil engineering works (necessary to reconnect laterally the river) and to test the possibility of low carbon nature-based solutions, without planting or seedling. As the establishment of this spontaneous vegetation varies according to environmental conditions created by the management scheme, floristic surveys were carried out under three variables: excavation/backfill, forest cutting/no cutting, and no plant engineering/plant engineering with RCM/no RCM. The backfills favored the height of herbaceous vegetation and vegetation of closing EU 3270 code. Excavated material promoted EU 3130 and EU 3270 habitats by creating different relative elevations to the watercourse. Vegetation engineering limited the development of these habitats due to its disconnection from the channel, and RCM reduced species richness, probably by limiting germination.

Wetland restoration within the river corridor: the case of the Po Piemontese Natural Park (NW Italy)

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River-shaped wetlands are essential components of floodplains, supporting biodiversity and providing a wide variety of ecosystem services. However, most of these environments worldwide have been altered by anthropogenic interventions affecting rivers and floodplains. As a result, the conservation and renovation of river-adjacent wetlands has become increasingly rare at the global scale, leading to the progressive disappearance of these landforms and their ecological functions. In this context, riverine floodplains and wetlands require preservation and restoration measures. This contribution presents five wetland restoration projects (270 ha) carried out since the 1990s close to the Po River, the main Italian river, within the Po River Natural Park. Their long-term morphological evolution was investigated through multitemporal GIS-based analyses using remote sensing data.
The interventions, promoted and coordinated by the Park Management Authority (PMA), followed a recurring scheme based on the existing regulatory framework for protected areas and on technical criteria defined by the PMA. Cooperation between public and private sectors was established, and the projects were based on sediment quarrying activities. The main phases included: land acquisition by the quarry operator, quarry exploitation under PMA guidance, and transfer of land ownership to the PMA. Consequently, the quarry operator obtained economic benefits, while the PMA acquired restored areas for free.
Initially conceived to restore environmental diversity, wetland restoration later proved to be an effective proxy for reducing exposure to flood hazard and for providing more room for the river, also acting as a catalyst for further floodplain restoration projects.

From invasion to restoration: Case studies on mapping, control and monitoring of invasive alien flora in international basin of tagus river (Spain & Portugal) under the project LIFE Alnus Taejo.

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Invasive alien species (IAS) are na important driver of degradation in Mediterranean riparian ecosystems, threatening biodiversity, ecosystem functioning and the conservation of priority habitats. Within the LIFE ALNUS TAEJO project, ”Conservation and restoration of Mediterranean alder forests priority habitat in the Western International Tagus River Basin”, that aims to restore habitat 91E0* under the EU Habitats Directive along 513 km of rivers in the International Tagus Basin promoting natural regeneration to enhance ecological connectivity.
An ecological characterization was conducted, including assessments of the river habitat index, riparian woodland connectivity, environmental pressures, phytosociological relevés, and the design of conservation measures. Vegetation mapping was carried out, with special attention to distribution áreas of IAS. Fieldwork includes more than 250 relevés and identified IAS as the primary ecological pressure and threat on the surveyed riparian stretches, providing essential knowledge on their distribution and impact along the International Tagus River Basin (Spain and Portugal).

We present the results of the mapping of the IAS, as well the control measures already implemented under the LIFE ALNUS TAEJO project, with a particular focus on the transboundary areas of the Sever and Erges rivers. Results show a high reduction of IAS cover within the first two years monitoring period, accompanied by a progressive increase in native species cover.
Early trajectories indicate partial convergence towards reference communities in locations where native target species were planted.
This study highlights the critical role of monitoring and transboundary cooperation to control biological invasions and enhance the resilience of Mediterranean riparian ecosystems.

Methodological approaches to the successful restoration of urban streams

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Streams in cities are often forced into artificial beds, and both their banks and the surrounding area have been heavily modified. As a result, they can now hardly function as green infrastructure and provide only limited ecosystem services. The restoration of urban streams is therefore necessary to improve connectivity and ecological functionality. This is particularly important for helping cities adapt to climate change, increasing biodiversity and improving the quality of urban life.
However, the planning and implementation of stream restoration measures can face many obstacles and challenges, including lack of space, property rights to adjacent land, conflicting interests among stakeholders, low acceptance among local residents, and very time-consuming planning procedures.
The presentation introduces the methodological approaches of the Interreg Central Europe project ReBioClim, which we have used to overcome obstacles and address challenges at an early stage. This includes the participatory approach, which is essential for raising awareness of the importance of biodiversity and ecosystem services and increasing acceptance of renaturation measures. Furthermore, it provides insight into our multi-perspective approach to develop socio-ecologically integrated solutions for urban stream restoration. It demonstrates how the assessment of ecosystem services – primarily based on mapping stream structure – can be used to determine which measures are required at which locations, and to predict future improvements after the implementation of nature-based solutions.
Selected experiences and results will be illustrated using the example of the four ReBioClim case study cities: Dresden (Germany), Senica (Slovakia), Poznań (Poland) and Jablonec nad Nisou (Czech Republic).

Solutions to flooding of the Estepona River in the urban center of Bakio (BIZKAIA, SPAIN)

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The municipality of Bakio, located on the Atlantic coast, is prone to significant flooding. This phenomenon can be attributed to the interplay of two factors: the impact of the Estepona river floods and the influence of the equinoctial tides. This river has been subject to significant alterations within the urban area, primarily through the process of canalization, a process that has extended to the river's mouth. In addition to the morphological alterations observed, the river has undergone a significant change in the vegetation on its banks, with a notable presence of invasive plant species.
The region's hydrometeorological characteristics, including its precipitation regime, tributary density, tidal influence and constrained river dimensions, collectively cause rapid increases in flow rates, often resulting in overflow. These floods have a substantial impact on a large part of the urban area.In order to mitigate the adverse effects and enhance the area's resilience to the climatic emergency, the project involves the open and dechanneling of a section of the river and the creation of an inland marsh. . This will enable the existing flood plains (4 ha) to laminate the avenues and protect the residences located in proximity
The objectives pursued in this project were as follows:

- The improvement of flooding conditions and the mitigation of risk.
- The improvement of the environmental and ecological conditions of the Estepona river.
- The construction strategy using Nature-Based Solutions such Soil and Water Bioengineering techniques
- The urban integration of the intervention with a floodable park.

The Challenges of Restoring Urban Streams: The Case of Poznań

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The presentation will highlight the results and lessons learned during the implementation of the project titled "Restoring urban streams to promote Biodiversity, Climate adaptation and to improve quality of life in cities (ReBioClim)," carried out under the Interreg Central Europe program.
Based on environmental, spatial, and socioeconomic analyses (including stakeholder interviews and surveys), we were able to identify the most significant issues and challenges facing the restoration of urban streams, particularly small ones.
The results presented here pertain to Poznań, Poland's fifth-largest city by population (with approximately 530,000

residents), which serves as the capital of Wielkopolska, the second-largest region in Poland by area.
Detailed analyses were conducted on the Piasnica. This small stream flows into the Cybina, which is a tributary of the Warta, which in turn flows into the Odra river. Only the upper, 840-meter section of the Piasnica flows through an open channel; the rest (about 5 km) runs through a culvert. It is a sandy lowland stream with a catchment area of approximately 15 ha.
Particular attention was paid to the problem of channelization and concreting of riverbeds, legal and institutional barriers, water quantity and quality, as well as urban development pressure and land ownership structure.
Based on the analyses conducted-including an examination of synergies and conflicts-a set of measures was proposed that are optimal for the Piasnica stream, taking into account the identified problems and residents' opinions.

SS17 - FROM SMALL TO GREAT LAKES RESTORATION: AN OVERVIEW TO PROMOTE LINKS AND COLLABORATIONS

Assessing policy coherence in European lake restoration: Insights from Lake Vesijärvi (Finland) and Lake Karla (Greece)

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We carried out a policy coherence analysis for two case studies of the Horizon project FutureLakes (HORIZON-MISS-2023-OCEAN-01-04), namely Lake Vesijärvi (in Finland) and Lake Karla (in Greece) to assess the extent to which 62 national, European and international policy instruments contribute to addressing key lake restoration challenges. The analysis used a participatory process with key stakeholders from both sites, applying the policy coherence matrix method developed by Mortelmans (2020), coupled with the Likert scoring system, a structured interview method and a desk-based coherence analysis.
Six core lake restoration priorities, defined as "Assessment Areas", were first identified, covering i/ water quality and pollution control; ii/ uptake of innovative solutions (Nature-based Solutions, Circular Blue-Economy Solutions) for restoration; iii/promoting integrated and participative basin management; iv/economic circularity and green financing; v/fostering climate ambitions, vi/promoting biodiversity protection and restoration. To provide a structured representation of the synergies and conflicts among instruments, we calculated the Variability Index and Net Impact Index of the assigned coherence scores.
The results supported interpretations of both vertical coherence (alignment across governance levels) and horizontal coherence (consistency across policy sectors), particularly in relation to lake restoration priorities. In addition, assessing the vertical coherence of the national laws with EU and international policies captures the perceived strength of alignment and levels of uncertainty regarding their implementation. Our results identify also the policy integration limits regarding the Water Resilience Strategy, WFD, the Common Agricultural Policy and the Nature Restoration Regulation.

Improving monitoring: Reaching a compromise to better assess restoration outcomes in small lakes

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Small lakes play a key role in biodiversity conservation and ecosystem functioning at watershed level. Despite their abundance and ecological importance, they remain largely excluded from regulatory monitoring frameworks such as the Water Framework Directive, and are consequently underrepresented in restoration monitoring programs. Therefore, few restoration actions are implemented in these ecosystems and monitoring remains limited.
Since 2023, the LIVE laboratory and the Pole ECLA have been collaborating to assess the relevance of existing monitoring protocols for evaluating restoration effects on macroinvertebrate and macrophyte communities in small lakes. Two methods, used for bioindication or for larger lake restoration projects, were tested on four restored sites across France. The comparison revealed that implementation of the two protocols leads to differences in the characterization of

habitat diversity and community composition that could influence the evaluation of restoration response in small lakes. Findings show that none of the protocols provides an adequate response to the challenges of monitoring restored small lakes, where limited surface area and sometimes high habitat heterogeneity can affect detection of ecological changes. Rather than relying on a single approach, results suggest complementary strengths and limitations and identify trade-offs between ecological representativeness and sampling efforts

Based on these observations, we tested an experimental protocol combining key features of both approaches. This method explores restoration outcomes in small lakes and their associated Habitats of Community Interest and could help support the development of monitoring strategies adapted to these neglected ecosystems and aligned with the objectives of the EU Nature Restoration Law.

Divergent plant recovery along a hydrological gradient in restored Sphagnum-dominated peatland pools

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Peatland pools are important microhabitats that support plant biodiversity. Peat extraction often eliminates these features through vegetation removal and drainage, resulting in habitat loss for peatland species. This study, conducted in eastern Canada, compared vegetation composition around 26 reference pools in undisturbed peatlands and 41 pools in restored *Sphagnum*-dominated peatlands. Vegetation was surveyed along a hydrological gradient at 0, 1, 2, and 10 m from pool edges. Restored peatlands were classified as young (6–13 years) or old (15–26 years) and included both created and spontaneous pools. Compared with reference pools, restored pools exhibited distinct community structures. Species richness and composition varied along the hydrological gradient, shaping plant assemblages and maintaining diversity. In created pools, species richness increased with time and approached values observed in reference pools. However, species composition remained different, particularly at intermediate and distant positions along the gradient, where communities were often dominated by generalist or non-target species such as *Typha latifolia*. In contrast, spontaneous pools supported lower species richness but showed greater similarity to reference pools in species composition, including peatland species such as *Sphagnum fallax*. These findings indicate that increasing species richness alone does not necessarily reflect successful recovery of target peatland communities. Created pools promoted plant establishment, spontaneous pools appeared to better support vegetation resembling natural pools. Restoration efforts should therefore focus on fostering conditions that favor pool species. Adjustments to microtopography, creating gradual hydrological transitions, and improving propagule availability may help guide vegetation assembly toward reference conditions and improve restoration outcomes.

Biomanipulation and restoration : an alpine lake case study

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Mountain lakes, sometimes initially devoid of fish, were widely stocked, first for human subsistence, then for recreation. However, this led to profound changes in ecosystems, and today, fishless lakes are rare in the French mountain ranges. While restoration is often considered from the perspective of passive restoration ("let it happen") or environmental reconstitution, including terracing and revegetation, it could employ other methods to "assist ecosystem recovery" as defined by the SER.

In this context, the Mercantour National Park launched a pilot project in France (the only other case of this kind) and in Europe (few conclusive case studies), aiming to eradicate fish from a small mountain lake. The operation began in 2025 and will continue for several years, until no more fish are caught.

Considering this pilot project as an opportunity to rigorously assess the impact (and effectiveness) of this type of restoration, a team of experts and field operators was assembled around the project, led by Mercantour National Park and French biodiversity agency.

Monitoring protocols, including biological communities (fish, macroinvertebrates, amphibians, vegetation, plankton and their interactions) and abiotic parameters (temperature, oxygen, nutrients) were thus defined. These protocols were implemented before and during the restoration efforts and will continue to be applied after eradication (if successful).

While the project is still in its early stages, 2026 provided an opportunity to conduct an initial assessment of the

ecosystem prior to restoration, using collected data, and a preliminary evaluation of the effectiveness of the techniques employed.

Dealing with invasive species in water bodies restoration projects: manipulation of environmental filters and use of priority effects.

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European alluvial floodplains have undergone severe degradation over the last centuries, leading to major alterations in aquatic biodiversity and hydrosystem functioning. The Woerr site is a protected area surrounding a former gravel pit in northeastern Alsace (France), located at the confluence of the Lauter River and the channelized Rhine River.
Restoration works began in 2012 in this site with the objectives of (1) recreating several ponds to enhance biological connectivity for aquatic species across the site, and (2) reshaping former gravel pit banks, promoting colonization by native macrophytes, and creating sustainable habitats for several protected species. However, over time, these restoration efforts were challenged by multiple biological invasions (*e.g. Elodea nuttallii, Faxonius immunis*).
The control methods implemented to manage these invasive species provided an opportunity to test the manipulation of various environmental filters, including temporary site disconnection, plant transfer, seed bank transfer, coarse sediment transfer, and the control of allelopathic interactions. The colonization patterns and dynamics of both macrophyte and macroinverte-brate communities were monitored over a 15-years period.
Here, we present the results of these long-term surveys, highlighting the successes and failures of the different invasive species control experiments.

SS18 - WETLAND RESTORATION FOR CLIMATE MITIGATION, BIODIVERSITY RECOVERY AND ECOSYSTEM SERVICES

Unlocking Peatland Rewetting in Fragmented Agricultural Landscapes: Governance Barriers and Boundary-Organization Functions in Brandenburg, Germany

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Peatland rewetting can substantially reduce greenhouse-gas emissions from drained organic soils, yet implementation often stalls due to governance constraints. In Brandenburg (Germany), rewetting projects must coordinate many landowners and land users across small parcels and align them with water-management authorities; changes in water levels and infrastructure require broad agreement and procedural clearance.
This contribution analyzes how cooperation is initiated and maintained in four rewetting initiatives in agriculturally used peatlands. We apply Process Net-Map, an interview-based method that reconstructs key process events and maps involved actors, relations, and perceived influence from initial project idea to permitting and construction of hydrological control structures. Using Boundary Organizations Theory, we assess which boundary functions-convening, mediation, translation between knowledge systems, and support for joint problem framing-are currently performed by project actors and which are missing.
Across cases, we find that cooperation is hindered by local reservations toward rewetting, institutional and procedural frictions in water governance, and uncertainty about economically viable land use after rewetting. Effective practices include early co-definition of project areas with land users, sustained trust-building communication, leveraging existing cooperation networks, reframing project goals toward locally salient benefits (e.g., water retention), and actively developing solutions that maintain economic use.
The findings yield governance-oriented recommendations for designing rewetting interventions and clarifying boundary-organization roles to improve collective action in fragmented agricultural landscapes.

Restoring for biodiversity: Connecting hydrology and arthropod communities

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Rewetting the landscape is proposed as an important tools for mitigating biodiversity loss. It is also evident that raising the water table will change ecological communities and species compositions. However, wetland restorations take time and it is unclear what communities that will inhabit the restored wetlands, the same or different from the naturally undrained wetlands. In this talk, I will focus on seasonally flooded wetlands, habitats that often have species rich arthropod communities. To better understand these communities and the environmental factors driving their composition, and restoration, we have combined hydrological modelling and ecological field surveys. To capture wetland heterogeneity at an appropriate spatial scales, we have combined digital elevation models and water table monitoring. The resulting data on inundation frequency at a scale of 2x2 m2 was used to predict arthropod communities, showing predictable community shifts. I will describe our approach and what we can learn about community filtering in wetland communities.

Tracking changes in peatland recovery using remote sensing: lessons from Ireland

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Policy targets for peatland restoration and rehabilitation globally and in the European Union will require focused efforts in terms of identifying areas for restoration, establishing a baseline from which to set targets for outcomes, and scalable, resource efficient methods to track change over time. In this paper, we focus on a large-scale industrial peat extraction site in Ireland (ca. 5,000 hectares) where rehabilitation activities began in the late 1990s. Rehabilitation involved rewetting and surface manipulations to promote natural regeneration of typical peatland plants. Monitoring of the site since 2001 has combined site level vegetation surveys with mapping the recovery of peat-forming species, requiring expert ecological input. In order to reduce the need for site level surveys we tested the use of remote sensing techniques to track recovery of peatland plants, in particular changes in cover of *Sphagnum* (bog moss) species. Using freely available satellite imagery we assessed the presence or absence of *Sphagnum*, followed by an ecological ground truth survey to check the accuracy of our methods. Remote sensing data proved useful to track high level changes (resolution 10m); but targeted ecological validation remains essential. Field visits help to identify local issues that cannot be interpreted using remote sensing, however the level and intensity of field survey required is reduced. These methods can be transferred to other sites and given the scale of peatland restoration and rehabilitation required globally, can support monitoring ecological recovery at scale along with effective use of resources.

Peatland CO2 and CH4 under climate change and alternative restoration options: process-based simulations

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Both anthropogenic land-use and climate change affect the greenhouse gas dynamics of peatlands. The climate impact of pristine peatlands is expected to shift towards more climate warming under strong climate change especially due to increased methane emissions. However, little is known how drained and rewetted peatlands respond to future climate. Here we use process-based JSBACH-HIMMELI model to study both past weather and climate change scenarios in European peatland sites with different land-cover and land-management. We simulate different alternative land use options the site being either pristine, or drained for forestry, agriculture or peat extraction. We consider rewetting and afforestation as restoration measures.
The model includes peat-YASSO soil carbon model and HIMMELI methane production and transport components. The peatlands drained for forestry are simulated with a separate forestry-growth model (JSBACH-FOM) considering the harvests. We use climate scenario data from two climate models from CMIP 6 including SSP1-2.6 and SSP5-8.5 pathways. We use the simulation output to study the temporal dynamics of soil carbon, water table level, carbon dioxide and methane fluxes due to changes in management and climate change also studying the effect of increasing drought events.

Seasonal variability in CO and CH fluxes for a restored saltmarsh chronosequence

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Saltmarshes store and sequester significant amounts of 'blue carbon', making them potential climate mitigators, and their restoration is a potential nature-based solution (NbS). However, any greenhouse gas (GHG) fluxes from restored or natural salt marshes can diminish this potential, but the extent of GHG emissions are largely unknown. This limits our ability to accurately determine on what timeline carbon benefits from salt marsh restoration are achieved. To address this, GHG (CO and CH) fluxes were measured for two seasons (winter and summer) using *in-situ* closed-chambers on a chronosequence of restored (from 2-80 years since restoration) and natural 'reference' saltmarshes in the Colne and Blackwater estuaries, Essex, UK. The flux of CH was highest in newly restored marshes and declined with marsh age since restoration. There were no clear trends in CO exchange with marsh age, but respiration exceeded photosynthetic activity for both seasons and marsh age or state. This study underscores the importance of accounting for seasonal variation in methane emissions and ecosystem respiration to avoid overestimating the climate mitigation potential of restored saltmarshes. Understanding seasonal GHG fluxes, as well establishing carbon stocks, is essential to inform accurate carbon accounting and guide effective coastal restoration from a carbon perspective.

45 years of monitoring of fen meadow restoration in the Valley of the Zuidleie (Belgium): lessons learnt.

Kris Decleer, Research Institute for Nature and Forest – Belgium

Traditional mowing management was reinstalled in 1982 after 30 years of abandonment, while drainage ditches were no longer maintained. In 1992 and 2002, 5 hectares of fen meadow that were raised with more than one meter of sludge in the 1960s were successfully restored after the removal of the sludge up to the peat soil. Many key plant species recolonised the site, while the ecosystem engineer Pedicularis palustris was reintroduced. Gradually the site became wetter during the winter period, but during summer, climate change resulted in a higher frequency of extremely low groundwater levels up to one meter below the soil surface. The impact of all these events on the vegetation and peat soil development and the biomass production of the site is discussed.

What are the hot topics in peatland restoration research in the light of the EU Nature Restoration Law?

Anne Tolvanen, Natural Resources Institute Finland – Finland

The EU Nature Restoration Law (NRL) aims to enhance biodiversity, improve ecosystem services, increase climate resilience, and support climate mitigation and adaptation. In Europe, wetlands and peatlands have been more intensively drained for agriculture, forestry and peat production than elsewhere in the world. While drainage has generated substantial economic benefit, it has also led to biodiversity loss, greenhouse gas (CO2 and N2O) emissions from peat soils, and increased nutrient and organic matter export, resulting in water darkening and eutrophication. Although peatland restoration has been active since the 2000's, the NRL requires a substantial expansion of restored area. The ambitious target offers remarkable opportunities to improve peatland ecosystem status, but it also creates new research needs and challenges in reconciling restoration with economic activities. Which practical measures could simultaneously improve ecosystem condition and maintain economic benefits, thereby improving the acceptance of restoration? What are the impacts of land-based restoration on aquatic ecosystems? What are the impacts of peatland restoration on climate under different habitat types, restoration measures, and time scales? Does peatland restoration increase resilience to extreme hydrological events such as droughts and floods, and will there even be enough water for restoration in future? What role can restoration play in supporting threatened species under future climate, as suitable habitats shift northward? What are the economic benefits and costs, and how can private funding be mobilized for restoration? What kind of monitoring is needed? I will present recent results and ongoing research related to these questions.

From degradation to recovery: peatland restoration recorded in a Holocene sequence from Central Romania

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Peatlands are highly sensitive ecosystems whose ecological functioning strongly depends on hydrological stability. In recent decades, many Romanian peatlands have undergone degradation due to drainage, grazing, and increasing climatic stress, leading to lowered water tables and enhanced peat decomposition. In this study, we present a multi-proxy reconstruction of Holocene hydrological variability from the Mlaca Tătarilor peat bog (Central Romania).
Depth-to-water-table (DWT) changes were quantitatively reconstructed using testate amoebae assemblages and

integrated with peat physical properties, including organic matter content, moisture, bulk density, and magnetic susceptibility. The sequence spans the last ˜11,700 years and reveals major hydroclimatic oscillations throughout the Holocene. The most pronounced drying trend occurred during the last millennium and culminated during the 20th century, when reconstructed DWT values reached their maximum (˜30 cm), indicating severe drying of the peat surface. This interval is also characterized by decreased peat moisture, declining organic matter content, and increased magnetic susceptibility, reflecting peatland degradation and enhanced mineral input associated with anthropogenic disturbance. Unlike several other Romanian peatlands that continue to show recent drying trends, the upper-most part of the Mlaca Tătarilor sequence records a clear shift toward wetter conditions after 2016. Reconstructed DWT values decrease substantially, coinciding with restoration measures implemented at the site, including hydrological rehabilitation works aimed at reducing drainage effects.
Our results demonstrate that restoration measures can rapidly improve peatland hydrological conditions and highlight the value of palaeoecological records for assessing ecosystem degradation and restoration success.

Citizen and Landowner Perceptions of Wetland Restoration Across Europe: Insights from Large-Scale Surveys

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Wetland restoration is increasingly recognized as a key nature-based solution for climate mitigation, biodiversity recovery and ecosystem service provision. Yet successful implementation depends not only on ecological effectiveness but also on societal acceptance and stakeholder engagement. This study examines citizens' and landowners' perceptions of wetland restoration across six European countries using large-scale survey data.
Results from nearly 5,000 citizen respondents reveal strong overall public support. Wetlands are widely valued for biodiversity conservation, habitat diversity, species richness, and inter-generational worth. Most respondents consider restoration acceptable, necessary and beneficial. However, knowledge of wetlands and restoration processes remains low, indicating a gap between positive attitudes and informed engagement.
Preference heterogeneity is substantial. While a majority supports restoration on environmental grounds, distinct groups show cost sensitivity, status quo preference, or less structured opinions. Cross-country variation emerges as the primary driver of these differences, with socio-economic factors playing a more limited role.
Among over 2,000 landowner respondents, acceptance levels are similarly high, yet important constraints emerge. Most landowners consider restoration acceptable and beneficial, but emphasize that it must not compromise forestry or agricultural production. Respondents favour shared funding models and hold mixed views on whether restoration should target public or private land. A forthcoming analysis examines how landowners' knowledge of wetland restoration shapes their willingness to implement it.
These findings underscore the importance of integrating social dimensions into restoration strategies. Effective policy must balance environmental and economic objectives, account for diverse stakeholder preferences, and strengthen public awareness to support large-scale peatland and wetland restoration.

Mitigation potential of greenhouse gas emissions from boreal peatlands under different management and restoration regimes

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Sustainable management and restoration of carbon (C) rich peatlands may efficiently contribute to both EU's climate targets and biodiversity by providing cost-efficient climate change mitigation, maintaining biodiversity, and providing income for landowners. Boreal peatlands in Finland, Sweden, Estonia, Latvia and Lithuania account for more than half of the peatland area in the EU, with the proportions of drained peatlands in these countries ranging from 18% to 75%. In ALFAwetlands project (www.alfawetlands.eu), boreal peatland management and restoration options studied included both rewetting and options potentially enhancing C input to the soil without rewetting, such as continuous cover forestry and ash fertilization. We reviewed evidence from climate change mitigation potential of common land-use options for these peatlands. Our data synthesis of annual greenhouse gas fluxes indicates that boreal paludiculture shows a net C loss based on the net ecosystem C balance at least in the short term after rewetting cultivated peat soil.

Drained peatland forests are commonly net C sinks due to their tree growth whereas their soils can be a C source or a sink. All forest harvest methods raise soil water table level but do not necessarily reduce annual CO2 emissions. In peat extraction sites, options without rewetting such as afforestation combined with fertilization may stop net annual C losses just in one year. Land use decisions may optimize many targets: climate, biodiversity, water quality, and economy simultaneously. Confounding factors, e.g. time perspective, may affect landowner's preferences. Long-term changes in peat carbon stock under land use options require further study.

CO2 balances of rewetted and natural peatlands in the Soomaa mire complex, Estonia

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Natural peatlands are major carbon (C) reservoirs and sinks. Drainage accelerates peat decomposition, threatening these ecosystems and increasing soil CO2 emissions. Rewetting drained peatlands aims to preserve these C reservoirs and restore peat-accumulating conditions. Quantifying post-rewetting C balances is necessary for assessing peatland restoration as a climate change mitigation strategy but requires extensive greenhouse gas flux monitoring. Thus, peatlands remain underrepresented in greenhouse gas balance studies.

We determined annual CO2 balances of two Estonian ombotrophic bogs in Soomaa over the two-year period November 2023-2025, comparing forestry-drained sites rewetted five years earlier with their natural reference sites. Ecosystem CO2 exchange was measured monthly using manual sampling with laboratory GC analysis during the non-growing season and dynamic chambers with an EGM-5 during the growing season under opaque, transparent, and partially shaded conditions. Soil water table level, soil and air temperature, and photosynthetically active radiation were measured continuously. Annual NEE, GPP and Reco balances were then compiled from modelled hourly fluxes based on relationships between the measured instantaneous fluxes and environmental parameters.

All sites were net CO2 sources in both years but notably less in the second year. The difference likely reflected the contrasting hydrological conditions between the growing seasons. Furthermore, the rewetted sites were mostly substantially smaller CO2 sources than their natural references. These results suggest that rewetting can reduce net CO2 losses from drained bogs within a few years, although annual balances remain strongly influenced by hydrological variability.

Seed-enriched sand nourishments on muddy substrate, to restore seagrass meadows in Loch Craignish, Scotland

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Through collaboration among industry, researchers and restoration practitioners, a novel seagrass restoration technique was tested in Scotland in March 2025. The approach used a mixture of eelgrass seeds (*Zostera marina*), sediment and seawater applied via industrial sand nourishment methods. In this pilot project, 750 m2 muddy, low-oxygen seabed was covered with 10 cm sand enriched with 100 000 seeds (˜140 seeds/m2). Besides providing substrate for seagrass establishment, sand nourishment aimed to improve benthic light conditions and restore biogeochemical processes. Seawater was pumped into a mixing tank, wherein ˜sand from a land-based geological source (d50 = 0.25 mm, d60/d10 = 3.65) was added with constant rate. The mixture was then pumped via floating pipelines to a spreader installed on a working vessel to distribute the mixture on the seabed. Tested variables were: 1. adding seeds in the mixing tank versus on the spreader, and 2. low (5%) and high (10%) sediment mixture concentration. On a nearby sand-nourished layer, 60 bundled eelgrass transplants were planted. Two months after seeding, 3% of the seeds germinated, with 0.3% surviving after 4 months. Highest seedlings numbers were found in the mixing tank ($p = 0.0059$) and 5% sediment concentration ($p = 0.0015$) treatments. Unfortunately, 7 months after planting, seedlings had died and < 5% of transplants remained. At SERE 2026, we will further elaborate on the lessons learned from integrating seagrass seeds into sand-nourishments. This project demonstrates how multidisciplinary collaboration can unlock new opportunities for restoring blue carbon coastal wetlands through large-scale restoration approaches.

SS19 - ASSISTED RESTORATION OF EXTRACTIVE SITES ACROSS EUROPE: WHAT WORKS WHERE?

Spreading harvester ant refuse piles enhances restoration success of dry Mediterranean grasslands after soil rehabilitation in former quarries and intensive cultivated sites

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Global biodiversity decline highlights the urgent need for effective and sustainable restoration strategies, especially in grasslands that provide critical biodiversity and ecosystem services but are increasingly degraded by land-use changes. In the Crau Plain (southeastern Mediterranean France), we tested whether ant refuse piles created by the native harvester ant *Messor bar-barus* L. could serve as a natural seed source for restoration, comparing their effectiveness with usual hay transfer and local commercial seed mixture applications in degraded sites (quarry ex-ploitation or intensive cultivation). Over three years, we monitored species richness, community composition, and similarity to a non-degraded neighboring reference grassland under contrasting soil rehabilitation treatments and unsown controls. Our results showed that both hay transfer and ant refuse piles significantly increased species richness and compositional similarity to refer-ence grasslands compared with the commercial seed mixture and unsown controls. Refuse piles also consistently supported small-stature species typical of biological crusts, a microhabitat of dry Mediterranean grasslands, while hay transfer promoted taller grass species. The quarry site restored with grassland topsoil achieved always the best overall outcomes. The commercial seed mixture performed poorly, resulting in lower species diversity and the introduction of unin-tended non-local taxa. To conclude, our findings demonstrate that ecosystem engineering by the use of invertebrates productions can provide a novel, low-impact, and sustainable nature-based solution for grassland restoration.

Tailoring quarry rehabilitation across Imerys sites in Europe: Site-specific successes and barriers

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As a specialist in industrial minerals, Imerys is deeply committed to restoring nature by proactively rehabilitating its quarry sites. However, successful restoration requires tailored methods adapted to unique local contexts. This raises the central question of this session: 'What works where?'
In this joint talk, Imerys and its scientific partner Patrinat will address this question by draw-ing on examples from some key sites across Europe with different ecological backgrounds and rehabilitation objectives. We will navigate through the implemented actions, the results of their rehabilitation processes and the difficulties encountered.
In Austria, we will compare the differences in decades of effort using passive 'renaturation' (natural regeneration) and active 'recultivation' (seeding and planting).
In France, habitat-specific interventions such as creating functional wetlands coupled with mon-itoring, have already yielded the return of biodiversity.
In Greece, where conditions are arid and challenging, the approach centres on leveraging spon-taneous natural processes, mimicking native soil symbiosis and collaborating closely with uni-versities to establish phrygana and maquis ecosystems.
Drawing on these examples, we will conclude by outlining the lessons learnt to improve the success of quarry rehabilitation and the persistent universal barriers to success. Finally, we will outline our perspective on the necessity of long-term follow-up to assess and centralise effective restoration techniques.

Twenty-Five Years of Grassland Restoration in Mined-Land: Lessons from a Spontaneous and Assisted Site Recovery Experiment

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Surface-mined land represent major challenges for successful ecological restoration Especially on erosion-prone slopes, effective restoration methods are required that ensure rapid vegetation establishment while accounting for the site's inherent ecological potential. In the former mined area Rossbach (Saxony-Anhalt, Germany), we studied the vegetation development over 25 years on a slope with loess substrate and an inclination of approximately 8◦. The following three treatments were implemented in September 2000: spontaneous succession, green hay transfer (71 target species), and the sowing of a regional seed mixture (20 target species) covered with mulch. We analysed whether community assembly differed among treatments and whether species composition converged over time due to species exchange.
Both green hay transfer and sowing of a regional seed mixture accelerated vegetation devel-opment towards species-rich grasslands. Even after 25 years, differences among introduction methods persisted in species composition. Spontaneous succession showed the greatest increase in target species richness over time, likely reflecting the proximity of the species introduction treatments, although a higher proportion of ruderal species compared to the assisted treatments retained.
The results emphasize the significance of first-comer effects for the long-term community assem-bly. Assisted recovery methods, namely hay transfer and sowing of regional seed mixtures, are effective restoration tools when rapid vegetation establishment is required or when no target species seed sources are present or nearby. Moreover, successfully introduced species gradu-ally colonized adjacent spontaneously developing sites. Combining spontaneous and assisted recovery in various places on one site can foster the development of species-rich grasslands in post-mining landscapes.

Assisted Restoration of Metal-Affected Post-Extractive Sites: Opportunities, Limits and Transferability

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Post-extractive sites are frequently affected by substrate degradation, elevated metal concentrations and limited natural recovery potential. In such contexts, assisted restoration is often needed to overcome barriers to spontaneous succession and to support the re-establishment of ecological processes.
This study examines an assisted restoration approach for metal-affected degraded substrates, with a focus on improving site conditions during the early stages of recovery. Using treatment-based enhancement of metal uptake and stabilization processes, the study evaluates the potential to reduce contamination constraints and facilitate subsequent vegetation development. Restoration performance was assessed through a Total Uptake Index (TUI), used as an indicator of metal accumulation relative to substrate concentrations .

Results show that assisted treatment can substantially improve metal uptake compared to un-treated conditions, although responses are non-linear and depend on treatment intensity. The findings highlight both the potential and the limits of intervention: while assisted restoration can reduce bioavailable metal fractions and improve the prospects for site recovery, effectiveness remains strongly dependent on local substrate chemistry and contamination profiles.
From a restoration perspective, the approach is particularly relevant for post-extractive sites where spontaneous succession is constrained and where initial intervention is required to create conditions for longer-term ecological development. The results suggest good transferability to similar metal-affected sites across Europe, while also underlining the need for context-specific design. Highlights what works in restoring degraded extractive sites and provides a basis for more targeted and context-specific restoration approaches across Europe

Turning sandpits into opportunities: Designing post-mining habitats for orchid conservation

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Climate change-driven aridification is accelerating wetland loss and degradation across Europe. In many regions, natural processes that could counteract these trends and improve the ecological condition of water-dependent habitats are no longer present. At the same time, sand extraction creates anthropogenic habitats that may develop into moist sites with high conservation value. Therefore, abandoned sandpits should be incorporated into conservation planning. To ensure that sandpits develop into suitable habitats after abandonment, conservation aspects must be considered during the design phase (e.g. location, depth, and size). In this study, we investigate how anticipatory ecological design can facilitate the development of abandoned sand-pits that provide suitable habitats for orchids. We surveyed 42 abandoned sandpits in the Great Hungarian Plain, assessing orchid populations and other rare plant species, site characteristics and potential colonisation distances of orchids. We recorded 15 orchid species, representing 48% of the regional species pool. Sandpit size had a positive effect, while groundwater depth had a negative effect on both species richness and population size. Site age positively influenced population size. Dispersal analyses indicated that one-third of populations originated within 1 km, although long-distance dispersals (up to nearly 100 km) was also detected. Orchid richness correlated positively with other rare species, highlighting their value as indicators of conservation importance. Properly designed sandpits can function as effective safe havens for orchids when excavated close to the groundwater level and constructed at sufficiently large sizes, and may further contribute to the development of refugia networks at broader spatial and temporal scales.

Applying non-expert Biodiversity Net Impact Assessment tools to an actively restored quarry: Are we getting the right answers or asking the wrong questions?

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There is increasing pressure on extractive industries to quantify biodiversity impacts and demonstrate measurable net gains from restoration. In response, standardized tools for non-experts have been developed, including the Net Impact Assessment (NIA) by WBCSD and the Biodiversity Indicator and Reporting System (BIRS) by IUCN. While these tools aim to support operational decision-making and reporting, their outputs lack validation against empirical ecological data.
This study assesses the applicability and reliability of non-expert biodiversity net impact tools in the context of an actively restored quarry.Specifically, it asks: (i) Do these tools provide ecologically meaningful assessments of restoration outcomes? and (ii) To what extent are the underlying questions and scoring criteria consistent and reproducible across different users?
We applied NIA and BIRS assessment protocols to both non-experts and experienced ecologists within an actively restored quarry at Secil-Outão, targeting revegetation and recolonization of faunal communities. Tool outputs were compared with ecological field data (species composition). Discrepancies were analyzed to identify methodological limitations, ambiguity in assessment criteria, and sensitivity to observer variability.
Preliminary results indicate an overall negative impact reported by NIA and BIRS (–27.47% and –28.02%), closely aligning with ecological estimates (–25.78%). Although response patterns were consistent, substantial scoring variability suggests sensitivity to individual interpretation, raising concerns about comparability across observers. No significant differences were found between non-experts and experienced ecologists.
These results suggest that such tools can support reporting and benchmarking but may not fully capture ecological dynamics in restoration contexts. We recommend combining them with targeted expert input and context-specific indicators.

Landscape regeneration in natural spaces: Protected Landscape of the Mining Basins (Asturias, Spain)

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Law 42/2007 on Natural Heritage and Biodiversity defines a Protected Landscape as a portion of territory that, due to its natural, aesthetic, and cultural values, is considered to merit special protection. The Protected Landscape of the Mining Basins encompasses surface areas within different Asturian municipalities.

The objectives are: (i) the conservation of the exceptional values that characterize it; (ii) the preservation of the harmonious interaction between natural and cultural heritage. The environmental effects derived from industrial activity, together with the area's aesthetic and landscape worth, have shaped a singular landscape in which biotic and abiotic components are equally relevant. The designation as a Protected Landscape aims to conserve the ecological importance associated with the network of mining infrastructures that still remain today.
The origin lies in the demand for conservation for the upper sector of the Turón river valley (Mieres, Asturias). The surrounding urban areas have been heavily affected by industrialization, which has left numerous impacts; therefore, it is reasonable that those areas which have preserved high environmental value to today should be subject to protection. The population is concentrated in the valleys, distributed among small villages and scattered homesteads. The climate is temperate oceanic, with mild temperatures and high humidity. European beech and chestnut dominate the vegetation landscape. Regarding fauna, notable species include the Cantabrian capercaillie, Egyptian vulture, black woodpecker, Iberian desman, and broom hare. Among the anthropogenic elements, mining infrastructure predominates. In recent years, efforts have been made to recover and preserve the archaeological and industrial heritage.

Assisted establishment of pioneers after metal mining: does silicification matter?

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Silicon (Si) is currently considered a beneficial element for higher plants exposed to both abiotic and biotic stresses. The experimental evidence is largely based on crop species, yet its broader ecological relevance in natural systems remains poorly understood.
We investigated whether adaptations to multiple abiotic stresses on post metal-mining land co-occur with increased silicification in spontaneous herbaceous vegetation. We analysed soils and pioneer vegetation on two model post-metal mining sites in Serbia, with distinctive severe soil constraints and fair availability of soil Si (30-60 mg kg^{1}) at both sites. Leaf Si was measured in 46 species. Overall, the keystone pioneers were only a few widespread pseuometallophytes of broad ecological valence. Under extreme Pb availability (up to 1000 mg DTPA-extractable Pb kg^{1}), silicification remained moderate; forbs (leaf Si 4–8 g kg^{1}) were the major constituents of the depauperate flora. Next, along the nutrient-deficiency gradient, species richness and variability of Si accumulation peaked at intermediate stress. However, community-weighted mean Si concentration in the most severely stressed young communities on acidic low-P soils (pH < 4; Olsen P < 5 mg kg^{1};) was approximately 30% higher than in adjacent mesic grassland on unpolluted soils. The increased silicification co-occurred with complete species turnover, and was primarily associated with grasses, while not detectable in lower-Si legumes.
This preliminary work suggests that understanding how silicification relates to spontaneous pioneer establishment may be a necessary first step toward evaluating the practical relevance of Si biology for assisted restoration of post-mining ecosystems.

How do plant and animal communities recover after sand extraction in Lanzarote?

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Sand extraction represents a severe disturbance in arid ecosystems but also provides opportunities to evaluate passive restoration processes and to design tailored restoration strategies for mining contexts. The El Jable system (Lanzarote, Canary Islands), part of the Natura 2000 network and a UNESCO Biosphere Reserve, encompasses critical habitats for endangered steppe birds and numerous endemic plant and invertebrate species. However, this region has experienced decades of sand extraction associated with urban and tourism development, with no restoration strategies implemented. This study examines the spatial and temporal evolution of sand pits (1951–2024) and evaluates their ecological recovery potential using a chronosequence approach that integrates vegetation surveys and fauna monitoring. Abandoned extraction sites were classified by age and compared with reference systems, including natural vegetation and long-abandoned farmland. Plant cover, diversity, and community composition were analyzed, with

particular attention to differences among subunits. Results indicate that passive restoration leads to slow and incomplete recovery, with pronounced internal heterogeneity. Large pit bases show negligible vegetation development and conditions that remain largely inhospitable to colonization. In contrast, runoff areas concentrate resources and support higher plant diversity. Widlife monitoring reveals regular use of the pits by multiple animal groups. Species recorded within extraction sites are primarily widespread generalist species, while steppe birds of conservation concern are rarely observed inside pits. These patterns document persistent ecological alteration following sand extraction and highlight taxon-specific use of post-mining habitats. These findings raise important questions regarding the most appropriate restoration approaches for these disturbed areas.

Reference vs. target vegetation for post-mining sites across Europe

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A map of potential natural vegetation exists for the whole of Europe at a scale of 1: 2500000. Despite its coarse resolution, it can be tentatively used to inform restoration practitioners about the reference vegetation and, in some cases, even the target vegetation that may be expected at a given disturbed site, whether reached through spontaneous or assisted succession. Similar maps are available for some European countries at more detailed scales. However, in restoration projects it is often neither feasible nor reasonable to achieve the respective reference vegetation. Instead, restoration targets may correspond to less advanced successional stages than the late ”climax” stage represented by the potential natural vegetation. Nevertheless, the probability of reaching natural vegetation through spontaneous succession increases with latitude and decreases with climatic seasonality, especially in terms of precipitation. Consequently, particularly in southern Europe, we often cannot expect the respective reference stage can be solely reached by spontaneous succession, and an adoption of active restoration measures is needed. Examples from post-mining sites across Europe will be presented comparing the respective reference and reasonable target vegetation.

Natural recovery of vegetation and soil fungi in Mediterranean abandoned cobblestone quarries (Spain)

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Quarry mining is among the most severe anthropogenic disturbances affecting terrestrial ecosystems by completely removing aboveground vegetation and topsoil, causing a profound and long-lasting land degradation. Although restoration techniques have been shown to improve vegetation recovery, it remains unclear to what extent plant and microbial communities can naturally regenerate in abandoned quarries and how strongly this recovery is driven by the local environmental conditions. We selected an abandoned quarry mine in Tarragona (Catalunã). Four adjacent areas were selected (front, cut, forest, and rear), where 12 plots (5x5m) were established. Plant biomass was collected, and each plot was divided into five subplots (1x1m), where total vegetation height, species presence, and cover were recorded by the same observer. In each plot soil samples were collected to analyse soil properties and soil fungal community composition. Preliminary results highlighted higher bulk density and plant diversity, but lower pH, organic matter content, and ectomycorrhizal fungi richness in the mined areas compared to the adjacent forest. Interestingly, in mind areas a positive correlation was observed between soil organic matter content and plant height. The natural recovery of soil fungal communities was strongly affected by local soil conditions and vegetations species composition, with plant height emerging as a reliable indicator of soil recovery in degraded ecosystems. Moreover, even after 50 years, the quarry supported vegetation and soil fungal communities that remained markedly different from those found in the adjacent forest, suggesting a slow recovery trajectory.

Support for restoration in mineral extraction sites: Expanding efforts beyond existing protected habitats

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Quarries and mines (extractive sites) are largely overlooked in current National Restoration Plans, despite their potential to support biodiversity by restoring valuable habitats. Open sandy grasslands, continental dunes, and steppe-like vegetation, now widely reduced due to long-term land-use change, can be found in post-mining sites. However, the lack of nearby source populations and the increasing pressure of invasive and expansive species often constrain natural revegetation, highlighting the need for assisted restoration approaches.
This study evaluates the outcomes of assisted restoration in selected extractive sites in the Czech Republic. We focused

on vegetation development, species composition and the management across sites subjected to different restoration strategies, with particular attention to disturbance regimes. The effectiveness of interventions was assessed in relation to the persistence and restoration of target species.
The results show that limited establishment of target species and subsequent declines in target species were strongly associated with the lack of assisted restoration. In unmanaged sites, competitive grasses expanded, followed by woody encroachment, leading to progressive habitat degradation. In contrast, sites actively restored supported higher persistence of open-habitat species. Additionally, even semi-open, non-target vegetation still provided considerable conservation value.
The timely implementation of active measures, particularly in modified landscapes where high-quality habitats are lacking, may combine natural processes and long-term disturbance-based management to preserve a diverse mosaic of habitats. Properly restored habitats in extractive sites can significantly improve habitat connectivity, thereby creating a network that complements existing protected areas and strengthens nature conservation on a landscape scale.

Post-quarrying restoration as an opportunity for protected plant species: the Secil-Outão case study

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Global biodiversity has declined dramatically in recent decades, with plant species facing particularly high extinction risks. The ecological restoration of degraded areas is an excellent opportunity to contribute to the regeneration and conservation of endangered species.Yet, the success of these efforts depends on the understanding of the environmental requirements and ecology of the target species to ensure tailored restoration actions. In the Secil-Outão quarry, located in the Arrábida Natural Park, several RELAPE plant species (rare, endemic, localized, threatened or endangered) have been recorded over the last years. The objective of this work was to identify and map the populations of RELAPE plant species in restoration areas, characterize their ecological niches and identify factors limiting their dispersal and establishment. We found > 15 RELAPE species, showing that restored limestone quarries may offer suitable conditions for endangered plant species. Highest abundances were recorded in older restoration areas and closer to natural vegetation, suggesting a good species colonization capacity through natural vegetation propagules. The work allowed to characterize species ecological niches, providing an important basis to promote passive or assisted regeneration of the target species in areas undergoing ecological restoration at the Secil-Outão quarries and similar post-quarrying areas. The results inform restoration practices, contributing to the integration of threatened plant conservation into post-quarry ecological restoration.

Recovery of specialised flora in extractive sites: Restoration approaches and outcomes

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Restoration measures at sites degraded by mining and quarrying typically focus on improving site conditions and re-establishing vegetation cover, often overlooking the specific ecological requirements of specialised flora. Common interventions (e.g. topsoil transfer, substrate amendment, and commercial seeding) can accelerate revegetation but may also promote plant communities of low conservation value. Low-intervention approaches based on spontaneous succession can retain conditions supporting specialist species, although outcomes remain highly dependent on propagule availability and landscape context, and assisted restoration measures may be required.
We synthesised published studies and restoration observations on specialised flora recovery across multiple extractive contexts and substrate types worldwide. The review covered measures including spontaneous succession, assisted propagule introduction, and site management. Interventions were evaluated against two ecological constraints: habitat filtering and dispersal limitation. We found that no single measure was universally effective; outcomes depended on whether interventions maintained the conditions defining specialist niches - both substrate suitability and biotic interactions - and addressed local propagule limitation.
Restoration success requires identifying locally limiting constraints and selecting measures accordingly. These findings support the development of habitat- and species-specific strategies that explicitly target the ecological conditions necessary for rare and specialised plant communities to establish and persist in post-mining landscapes.

Why do we undertake assisted restoration?

Andy Duncan *, Alexandra Hemming *, Georgina Watkins
Heidelberg Materials UK – United Kingdom

Local communities including regulators can often have a negative perception of operational quarries particularly if they are in prominent locations. Not waiting for only future generations to benefit, National and Local Planning Policy can require some operations to undertake progressive reclamation with rapid results.
Within the extraction sites assisted restoration is not always limited to the planting phase. Manipulated succession and species balance form part of subsequent management**.** Expectations for Long Term Management Plans and extended aftercare form part of modern Mining Licence. Reflecting on cases studies from within the UK, we will explore the expectations, what can be achieved, the planning and budget requirements as well as the ability to provide quarry restoration evidence early on . We will also explore challenges like the availability of materials, review trialling, and demonstrate how assisted restoration within quarries can be a complement to nature colonisation and support priority habitats and species conservation.

SS20 - EXTRACTION SITES AS BIODIVERSITY HOTSPOTS FOR RESEARCH AND TRAINING

Using extractive sites to stimulate research on biodiversity restoration and management best practice

Shane Sparg *, Heidelberg Materials Group – Germany

Extracting natural resources comes with a responsibility to mitigate potential impacts on biodiversity and restore nature once completed. As biodiversity is a local topic, understanding what and how to restore can come with its challenges.
To stimulate innovative research at a local level, Heidelberg Materials has been running a national and global biodiversity project competition, The Quarry Life Award, since 2012. Over the run of the last 6 editions, over 1400 project ideas were gathered, of which 600 have been trialled in the field. 30 projects have received a first-place award in the global competition for their respective project category, in recognition for their concept, methodology and successful delivery. Competition projects have resulted in best practice guidelines for restoration and management of habitats and species associated with extractive sites.
Reflecting on case study examples, we demonstrate how a simple idea can sometimes have a significant impact for conservation and the way extractive companies can integrate nature into their site management.

Extractive sites restoration; the role of research in driving ecological restoration at scale and focused on biodiversity recovery

Nigel Symes, BirdLife International - Europe and Central Asia – Belgium

Quarrying and mining activities could leave sterile, biodiversity poor landscapes behind. However, with evidence-led careful planning and reference to published research, high value ecological outcomes are most often achieved. Key decisions taken about what to restore worked out quarry lands to, and how to do so are best based on scientific evidence. This is a critical step that is at times missing in practice. This presentation will demonstrate the value of evidence-based restoration and provide examples of how this has delivered successful outcomes for extractive sites. The evidence gathered from trials and from monitoring the effectiveness of practice informs how we adapt and improve planning and techniques to ensure favourable outcomes for biodiversity, more coherent restoration of ecosystems, as well as more cost-effective restoration and reduced aftercare interventions. Furthermore, it will make the case for effective dissemination of research to support those responsible for practical implementation of restoration.

Strengthening community engagement and biodiversity through the Quarry Life Award

Jops Hill, Heidelberg Materials UK – United Kingdom

Community engagement is playing an increasingly important role in strengthening the relationship between industry, biodiversity, and local communities. UK extraction sites, participating in the Quarry Life Award (QLA) worked closely with both research and community stream projects to explore how meaningful engagement can enhance ecological outcomes while making biodiversity work more accessible.

The 2025 programme demonstrated the value of connecting local communities directly with active sites, enabling participants to contribute to real-world conservation and restoration initiatives. It was observed that engagement is most effective when it is inclusive, locally relevant, and clearly linked to tangible environmental outcomes. By facilitating collaboration between site teams, researchers, schools, and community groups, the QLA created opportunities to deepen understanding of habitat restoration and promote stewardship at a local level.
Building on these experiences, there is significant opportunity to further strengthen community engagement in future editions of the programme. Importantly, these initiatives demonstrate how operational sites can act as hubs for biodiversity learning and community connection. By embedding engagement activities into site activity, we can support conservation and restoration goals while also building lasting relationships with surrounding communities.

Pollinators attracting researchers to quarries

Ludovic Pero * , Laurent Nachbaur *, Matthias Rohaut *
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Recognition of the importance of pollinators, and the pressure placed on them due to habitat loss and landuse practices. Through an initiative like the Quarry Life Award (QLA), scientific research demonstrates the important role quarries can play in providing habitat for and supporting a wide variety of pollinators. The QLA 6th edition attracted a lot of interest in pollination ecology with a project in France being awarded the National Prize and the scientific category winner in the International competition. In showcasing the project, we also reflect on its significance not only for improving quarry biodiversity management and restoration planning but its contribution into a larger regional and national pollinator strategy.

SS21 - USING NATURE-BASED SOLUTIONS FOR RESTORING SOILS OF URBAN, INDUSTRIAL, TRAFFIC, MINING AND MILITARY AREAS: SWEET DREAMS OR PROMISING TOOLS?

Riparian Zone Ecological Restoration in the Kerr Brook Watershed, New Brunswick testing novel techniques

John Major, Natural Resources Canada – Canada

Kerr Brook Watershed (KBW) is a 2000 ha watershed located within the heart of the General Maneuver Area (GMA), indicating that it is among the most heavily impacted by training activities located in a Military training area, NB, Canada. The area was initially cleared for training activities in the mid-1990s to maintain line of sight, however the riparian trees and vegetation were also removed. Since then, intense grass competition is among the greatest obstacle to ecological restoration. One experiment is a three x three factorial of treatments include mechanical site preparation treatments: 1) Inverted mounding involves an excavator with bucket that flips the grass upside down, 2) Disc trenching creates wide enough opening to reduce competition, and 3) control, no treatment. Cover material treatments include 1) Straw, keeps moisture in soil, prevents erosion, reduces frost heave and keeps competition down, 2) Coconut matts, keeps moisture in soil, prevents erosion and keeps competition down, and 3) control, no treatment. Growing stock experimenting with a variety of native early-successional deciduous species which provide cover, shade, fruit and stock for wildlife and reduce the risk of wildfire: They coppice readily once established if damaged by wildlife or military equipment activity. Species include experimenting with choke and pin cherry (*Prunus virginiana, P. pensylvanica*), speckled and green alder (*Alnus incana*, *A. viridis*), gray and white birch (*Betula populifolia*, *B. papyrifera*), red and silver maple (*Acer rubrum, A. saccharinum*), and red oak (*Quercus rubra*). Early results will be presented.

Combined effects of metal contamination and drought on vegetation recovery in a Mediterranean brownfield: insights from a long-term phytostabilisation trial

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In Mediterranean ecosystems, soil contamination by metals and metalloids (MM) and drought represent major abiotic stressors hindering ecological restoration. A pilot operation was implemented at the Escalette brownfield site (Calanques National Park (PNCal), Marseille, South-East France), which hosts a former lead smelter that generated widespread soil contamination, particularly by lead, arsenic, zinc and copper. In 2015, 20 restoration plots were implemented through earthworks and planted with 8 MM-tolerant native species, with no soil amendments or irrigation after plantation in accordance with PNCal regulations. Results obtained after 3 years show a significant gain in biodiversity, with the establishment of a permanent partial vegetation cover, although no significant improvement in soil quality (organic matter, nutrients, microbial biomass) was observed. The 4-year monitoring confirmed that the combined effects of MM contamination and drought strongly reduced taxonomic and phylogenetic diversity through environmental filtering. However, Coronilla juncea, one of the 8 MM tolerant species, emerged as a key species, demonstrating high tolerance and phytostabilisation potential, notably through its root symbioses. This work underscores the importance of ecological engineering interventions on contaminated Mediterranean soils and of long-term monitoring to acquire the knowledge needed for sustainable rehabilitation face to climate change.

Can sealed soils recover? Decompaction effects on soil biodiversity after 50 years of soil sealing and prospects for nature-based restoration

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Soil sealing is considered as the most severe form of soil degradation, causing significant deterioration of both biotic and abiotic soil functions beyond the natural thresholds of reversibility. In december 2023, the removal of a concrete slab from a former industrial 1970 building within the sub-steppic ecosystem of La Crau plain (Bouches-du-Rhône, Southeastern Mediterranean France) provided a rare opportunity to monitor soil desealing and restoration techniques effects on soil physical, chemical and biological properties. While civil engineering case studies emphasize soil decompaction as a necessary post-desealing treatment for specific soil properties, we assessed its actual effects over three years across seven indicators: soil physico-chemistry, hydrophysical properties, microbial communities, meso and macrofauna, organic matters quality, the viable soil seed bank and the soil surface vegetation, in comparison with the unsealing treatment alone and the nearby sub-steppic ecosystem reference.
Post-removal decompaction yielded contrasting results across indicators. While it significantly improved water retention capacity and helped mitigate physico-chemical changes caused by anthropogenic inputs (calcium carbonates), it also reduced particulate organic matter, a fraction readily available to soil biota. Neither decompaction nor desealing alone permitted the full recovery of microbial activity, soil seed bank, vegetation, or soil fauna within three years.
Consequently, nature-based solutions are currently being investigated, such as organic matter inputs from nearby sheepfolds and the introduction of local earthworms to complement the benefits of decompaction. This hybrid approach reflects the need to embed soil restoration within an ecologically coherent framework, moving beyond exclusive reliance on civil engineering interventions.

Soil rehabilitation and establishment methods drive greater reintroduction success of two dominant plants in highly degraded dry grasslands than their provenance

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Dominant perennial species reintroduction into highly degraded Mediterranean dry grasslands has shown limited success. Indeed, grassland restoration often involves both soil improvement and seed addition. Nevertheless, methods used for soil rehabilitation and plant establishment may influence the success of dominant species reintroduction, as well as the effectiveness of seed provenance. The aim of this study was to test effects of soil rehabilitation, plant establishment methods and seed provenance on the reintroduction success of Brachypodium retusum
P. Beauv. and Thymus vulgaris L., two dominant species of Mediterranean dry grasslands in southern France. Our study

was conducted in The Crau plain, an area which is characterized by low post human disturbances regeneration due to the poor dispersal capacities of these two dominant species. A two years trait-based experiment was conducted on a set of different sites representative of ecosystem degradations and restoration operations in this area: a rehabilitated quarry with either original grassland soil or former orchard soil and a former orchard with deep or conventional plowing. Regional commercial and micro-local provenances of the two species were established by sowing and transplantation. Results showed that plants survived significantly better and had more favorable trait values with original grassland soil transfer and that transplantation helped overcome early establishment limiting factors. Moreover, seed provenance may improve re-establishment success but does not always, emphasizing the importance of including origin testing to enhance species establishment.

From soil transfer to vegetation trajectories: 15 years of experimental restoration in a Mediterranean sub-steppic ecosystem

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In 2009, a pipeline leak severely impacted a sub-steppic dry grassland, in Mediterranean Southern France leading in 2010 to the excavation and removal of more than 5 hectares of contaminated soil and vegetation. To explore ecological engineering approaches for ecosystem recovery, a large-scale soil transfer was implemented in 2011 using 72,000 tons of soil from a nearby undisturbed site before its use for quarry exploitation. This operation was coupled with experimental reconstructions of soil profiles designed to test the importance of vertical main soil organization: inclusion or exclusion of the organic layer (0-20 cm), the mineral layer (20-40 cm), and the gravel-rich substrate (> 40 cm), under both compacted and non-compacted conditions. We assessed soil physicochemical and hydrological properties, vegetation composition and diversity over fifteen years (2011–2026) alongside the reference steppe. Results show that surface soil properties and vegetation establishment can recover relatively rapidly, whereas vertical soil functioning and hydrological properties remain strongly impaired. Treatments involving the transfer of the organic layer produced plant communities more close to the reference steppe in terms of species composition, richness, and diversity. In contrast, gravel-dominated substrates supported poor, pioneer-dominated communities. However, none of the tested approaches achieved full ecological restoration. Notably, vegetation trajectories increasingly diverged toward communities associated with biological soil crust systems, rather than the targeted typical steppe. Overall, our findings highlight the critical role of the upper soil layer as a reservoir of propagules and emphasize that soil compaction and disrupted vertical structure can constrain long-term restoration success in semi-arid ecosystems.

Unpredictable beginnings: contingency and environmental filtering shape early plant communities in urban brownfields

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Understanding how stochastic processes and environmental constraints shape early community assembly remains a key challenge in ecology, particularly in disturbed, human-modified ecosystems. Urban industrial brownfield sites offer an opportunity to explore these processes due to their high environmental heterogeneity and disturbance legacies. We examined herbaceous plant communities in 300 quadrats across 30 brownfields in southern Belgium to assess the influence of heavy metal soil contamination and the landscape context on their taxonomic and functional composition. Our results revealed consistently high variability between sites, with a marked site effect and a small proportion of variance explained by environmental variables, suggesting that contingent processes may outweigh environmental control at early stages of community assembly. Community composition appears to be largely determined by stochastic colonization dynamics and priority effects. Functional analysis, based on CSR strategies, showed the dominance of competitive and ruderal species, with a low abundance of stress-tolerant strategies. This pattern suggests that dispersal limitation may take precedence over abiotic filtering in structuring functional composition. Nevertheless, heavy metal gradients acted as significant local filters, structuring plant composition. These findings highlight the complexity and limited predictability of ecological trajectories in contaminated urban soils and point to potential limits of relying solely on spontaneous vegetation dynamics for ecosystem recovery. In general, the early formation of communities in brownfield sites results from the interaction between stochastic colonization and context-dependent environmental filtering, highlighting the importance of maintaining a mosaic of brownfield sites within urban landscapes to preserve plant community diversity and the ecological function they support.

Spontaneous succession under soil and landscape constraints: dispersal filtering and urban species pools shape brownfield true bugs communities

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Whether spontaneous ecological processes can meaningfully contribute to biodiversity restoration in post-industrial landscapes remains a key question in the development of nature-based solutions. Industrial brownfields present particularly challenging soil conditions (e.g. contamination, compaction, low fertility) and substrate heterogeneity, which may limit vegetation development and faunal recolonisation.
We investigated the spontaneous recolonisation of Heteroptera communities across 32 brown-fields in Wallonia (Belgium) through a participatory monitoring scheme involving trained citizen scientists. A total of 145 standardized surveys were conducted between 2023 and 2025, generating a robust presence/absence and community composition dataset. Heteroptera were selected as functional indicators given their sensitivity to vegetation structure and trophic resources.
We recorded 65 species, representing nearly half of the regional pool, demonstrating substantial biodiversity recovery potential despite strong abiotic constraints. However, community assembly was strongly shaped by ecological filters. Brownfields were dominated by highly mobile, generalist, and widespread species, indicating a strong dispersal filter and a major influence of the surrounding urban species pool.
At the site level, species richness was primarily driven by vegetation structural diversity, high-lighting the importance of habitat heterogeneity, even under constrained conditions. Notably, brownfields also supported rare and specialist species, reflecting the diversity of ecological niches generated by spontaneous dynamics.
Our results suggest that spontaneous succession can operate under strongly constrained conditions but does not fully overcome them. Rather than a substitute for intervention, it represents a complementary process combinable with targeted actions. Participatory monitoring also pro-vides a scalable framework for documenting and guiding such hybrid restoration strategies.

Forgotten heroes in restoration: Bryophytes in post coal mining sites and their potential to facilitate succession on phytotoxic spoil heaps

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Effective restoration and management of post-coal mining landscapes are essential for supporting biodiversity, soil formation, and carbon sequestration. However, many older spoil heaps are characterized by phytotoxic substrates with low pH and elevated heavy metals concentrations, which severely impede vascular plant colonization and delay primary succession. While these extreme conditions represent a major challenge for traditional restoration, bryophytes often thrive, potentially acting as key functional components of the developing ecosystem.
We investigated bryophyte community composition across a gradient of phytotoxicity in brown coal post-mining sites and experimentally tested their interactions with vascular plants in a pot experiment. Our results demonstrate that the type of restoration measure and substrate chemical characteristics shaped the bryophyte community. Specifically, the main toxicity gradient was defined by lead, arsenic concentrations and substrate pH. Furthermore, traditional reforestation methods significantly increased the bryophyte cover, though simultaneously reforestation suppressed bryophyte species diversity. Contrarywise, phytotoxic areas could provide an opportunity for bryophyte colonisation. Under phytotoxic conditions, mosses significantly enhanced vascular plant germination and facilitated root biomass. We suggest that soil bryophytes provide facilitation for ecosystem recovery, particularly on phytotoxic substrates where vascular plants otherwise only slowly establish. By mitigating the impact of heavy metals and improving micro-environmental conditions, bryophytes accelerate primary successional processes and promote the redevelopment of functional native ecosystems.
Systematic integration of bryophytes into restoration ecology planning may offer a promising strategy for overcoming substrate toxicity and enhancing the long-term success of post-mining landscape recovery.

Soil Contamination and Biodiversity Impacts After Ammunition Destruction: A Phytostabilization Perspective

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Soil contamination by pollutants derived from military munitions represents a major environmental issue in conflict, training, and destruction areas. Accurate characterization of this contamination, along with analysis of the relationships between contaminant concentrations and their effects on biodiversity, are essential for fully understanding ecological impacts and effectively guiding remediation strategies. In the Crau plain (southeastern France), five sites used for ammunition destruction after the Second World War still exhibit marked ecological alterations 78 years later. These disturbances, particularly pronounced at the center of former burning areas, indicate very low ecosystem resilience. Contamination present is likely to negatively affect biodiversity, with varying sensitivities among the different biological compartments studied. Spatially, contaminant dispersion follows a decreasing gradient from the core of the patches, mainly oriented along the strong, dominant "Mistral" wind (northwest to southeast). This gradient is thought to structure biological responses in a discontinuous manner, with a gradual recovery of communities below a certain critical threshold. Furthermore, vegetation degradation (reduction in species richness, diversity, and cover) generates significant indirect effects on soil fauna and microorganisms through trophic changes and alterations of microhabitats. In this context, experimental transplants of *Brachypodium retusum*, a dominant native perennial pseudo-metallophyte grass, were carried out. The restoration of a functional plant cover could significantly limit contaminant transfer, particularly by reducing wind erosion of bare soils and enhancing their retention This approach aligns within an assisted phytostabilization strategy aimed at immobilizing trace metals while promoting the long-term establishment of vegetation adapted to constraining edaphic conditions.

From abandoned mines to resilient ecosystems: ecological restoration and phytostabilization in Eastern Morocco (Upper Moulouya mining districts)

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Abandoned mining areas in Eastern Morocco represent highly degraded landscapes marked by soil contamination, biodiversity loss, erosion, and ecological instability. Decades of extractive activities have left extensive mining wastelands that pose major challenges for restoring arid and semi-arid Mediterranean ecosystems. This study focuses on the former mining sites of Midelt (Zaida, Ahouli, and Mibladen) and the Touissit and Sidi Boubker mines in the Oujda region, among the most important abandoned mining districts in Eastern Morocco.

Ecological restoration is considered a key approach for rehabilitating soil functions and improving ecosystem resilience. This work presents the main restoration strategies applied to these sites, with particular emphasis on phytoremediation and revegetation techniques adapted to local environmental conditions. Special attention is given to heavy metal-tolerant plant species capable of stabilizing contaminated soils, limiting pollutant dispersion, and progressively enhancing the physicochemical and biological properties of mining substrates.

Preliminary results show that several native plant species have strong potential for phytostabilization and habitat restoration, while also supporting the gradual recovery of plant and microbial biodiversity. The integration of nature-based solutions with ecological management practices adapted to the climatic conditions of Eastern Morocco offers promising opportunities for the sustainable restoration of post-mining landscapes.

This study highlights the importance of a **multidisciplinary approach** combining ecology, soil science, and environmental management to transform former mining areas into resilient and functional ecosystems that can provide long-term ecosystem services to local communities.

Potential of Cuban native Morella as actinorhizal nurse plants for restoring nickel mine soils

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Open-pit nickel mining in Cuba leaves extensive post-extraction landscapes on ultramafic substrates. These soils are naturally poor in nutrients and rich in metals. The mining disturbance further limits their natural recovery. We evaluated whether native *Morella* species possess characteristics that would justify their potential as nurse and metal-accumulating plants to restore post-mining sites. Combining herbarium X-ray fluorescence screening, field and micro-scopic observations of roots, stable nitrogen isotopes, and molecular barcoding of root nodules, we assessed metal accumulation and beneficial root symbioses in three species of Cuban *Morella: M. shaferi, M. punctata,* and *M. cerifera*. Root nodules were recorded in all three species across ultramafic localities, and isotopic estimates indicated substantial biological nitrogen fixation, with mean %Ndfa values ranging from 43 ± 10% to 88 ± 13% among species, individuals, and sites. Molecular analyses linked the root nodules to N-fixing actinobacteria *Frankia*, and micro-scopic observations suggested possible endomycorrhizal associations that still require molecular confirmation. *Morella shaferi* showed the strongest manganese accumulation, with leaf tissue concentrations above 10,000 μg. g–1 hyperaccumulation threshold. Together, these results suggest that the Cuban *Morella* species combine tolerance to metalliferous substrates with symbiotic traits that enhance nutrient uptake and facilitate plant establishment. Native *Morella* species, therefore, emerge as a promising nature-based tool to accelerate the functional restoration of nickel mining soils in Cuba.

Soil and Water Bioengineering applied to Linear infrastructures

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Soil and Water Bioengineering is a specific discipline that combines technology and biology in which native plants and plant communities are used as living building material to solve erosion and conservation problems, contributing to the regeneration of degraded ecosystems due to natural or anthropic causes, regenerating dynamics of ecological and geomorphological processes and to the recovery of Biodiversity It is a hybrid discipline, in which the engineering aspect tackles specific construction problems, whilst the biological aspect-the plants-is responsible for stabilizing and regenerating the and the ecosystem

This nature-based solution can be used to restore natural areas such as rivers, forests, and wetlands, as well as heavily impacted areas such as urban areas, sites of extractive activities, and linear infrastructure. The ultimate objective of these techniques is to promote ecological connectivity and biodiversity by activating ecological processes, protecting the soil, and providing wildlife habitats.

We are aware of the significant transformation to the ecosystem entailed by the construction of our infrastructure. To promote awareness of these techniques among civil engineers, the Provincial Council of Bizkaia asked us to write a manual on bioengineering specifically for linear infrastructure. The manual includes representative examples of the application of these techniques in this field, as well as the main techniques and all the necessary calculations that every designer needs to justify their decisions In the oral presentation, we will present the content of the manual with specific examples

SS22 - COMBINING ENERGY TRANSITION WITH THE RESTORATION OF BIODIVERSITY, ECOSYSTEM SERVICES AND ECOLOGICAL FUNCTIONS

Solar panel, vegetation management and legacy effects on vegetation in European solar parks

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Increased land use, land abandonment and construction activities have led to a loss of European semi-natural grasslands. The rapid development of renewable energy sources to meet growing energy needs, such as solar parks, may further increase pressure on these grasslands. The construction of solar parks involves earthworks to install panel supports, bury connection cables, resulting in total or partial destruction of above-ground vegetation.
We analysed the effect of solar panels, vegetation management and previous land use on vegetation (cover, species richness and light-indicator value) and species composition of plant communities in solar parks. Solar panel effects were analysed under, between panel arrays, and outside panel shadow. Vegetation managemend included grazing, mowing and a combintation of both. Existing datasets from three European countries (France, Germany, UK) were used for this analysis, comprising 161 solar parks surveyed between 2016 and 2025.
Solar panels significantly reduced vegetation cover and species richness. We also found significantly lower light indicator values under panels resulting from light interception. The effects of management were not significant, but showed a significant interaction with panel effects. Pre-construction land use affected species richness being lowest on former woodland sites. In conclusion, the impact of solar park construction is greater in woodlands, advocating for active restoration measures. Woodland species are less well adapted to grazing or mowing, and grassland species are often not available in the soil seed bank of former woodlands.

Finding where seabirds and turbines won't clash: an ecological perspective on management and development opportunities in the UK's marine environment

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Many anthropogenic, geological and ecological factors compete for space in the UK's already crowded EEZ, making finding low potential conflict areas for management and development difficult. Legislation and designation lag behind scientific evidence and only avoiding areas with administrative protection leaves critical habitat open for development. We are developing a spatially explicit tool to test UK government net zero scenarios (ranging from low to high ambition) and to assess whether we can achieve our targets while prioritising ecological constraints. By gathering data on four key factors (wind farm development constraints, blue carbon and habitat restoration areas, fisheries activity and seabird habitat use), this tool will identify areas of high conflict and offer alternatives for development where possible.
The species-specific effects of offshore wind (OW) on the movement and breeding success of seabirds interact with threats of climate change, invasive species and avian flu, increasing susceptibility to detrimental effects from OW in inappropriate locations. We performed Getis-Ord hotspot analyses on decades' worth of tagging and visual survey datasets for twelve seabird species and overlayed the resulting hotspots to triage the UK EEZ for seabird habitat use. Similar analyses identified crucial areas for blue carbon, habitat restoration and fisheries as well. These form the basis for a weighted sum of competing interests to achieve an ecologically fair measure of potential conflict.
We aim to assess if the UK's clean energy targets can still be reached while actively avoiding ecologically important areas.

Nature-Inclusive Design in marine infrastructure: harnessing the energy transition to restore ecosystem services and ecological function

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The rapid expansion of marine energy infrastructure, from offshore wind foundations to coastal protection structures, presents one of the most underutilised opportunities in ecological restoration. Globally, hard artificial substrates now cover vast areas of the seafloor. Yet, conventional concrete is a biologically poor medium, typically supporting low-diversity assemblages dominated by opportunistic species at the expense of ecological function. Nature-inclusive design (NID) offers a framework for rethinking this relationship. By modifying concrete at the level of chemical composition, surface texture, and macro-structural form, it is possible to engineer bio-enhancing substrates that actively promote the recruitment and retention of diverse marine communities, without compromising structural integrity or project economics. This presentation will showcase projects and ecological monitoring data from nature-inclusive solution deployments across coastal and offshore contexts.
Large-scale deployments of ECOncrete NID solutions, validated across multiple ecological contexts, demonstrate consistently higher species richness, greater abundance, and more functionally complex assemblages on modified structures compared to conventional structures. These biological assemblages, in turn, deliver measurable ecosystem services, including biogenic reef formation, filter feeding, and nursery habitat provision.
This presentation examines the evidence base for NID in the context of offshore energy infrastructure and asks how the current wave of marine construction, driven by decarbonisation targets, can be redirected toward net-positive ecological outcomes. With deliberate design choices, the same infrastructure built to deliver clean energy can actively support the recovery of marine ecosystems. We discuss policy implications and monitoring frameworks needed to evaluate and standardise ecological performance at scale.

Combining renewable energy and biodiversity conservation: preliminary evidence from Mediterranean photovoltaic parks.

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The rapid expansion of renewable energy is essential to achieving climate neutrality targets, yet its consequences for ecosystems are still not fully understood. In this context, we present the results of a research line started in 2022 through a collaboration with the energy company GALP, which enabled ecological studies to be carried out in its photovoltaic parks, and which is now being further consolidated within the European BRET project (*Evidence-Based Strategies for a Biodiversity-positive Renewable Energy Transition*), funded by Biodiversa+.
Over the past years, we assessed the ecological effects of photovoltaic parks in Mediterranean ecosystems in the northeastern Iberian Peninsula. Specifically, we evaluated changes in soil properties and the responses of vegetation, arthropod, bird and bat communities.
In this presentation we are showing our results on soil arthropods and flora. Surveys were conducted across several photovoltaic parks, comparing microhabitats located beneath solar panels with adjacent open areas, both inside and outside the park perimeter fencing. We analyzed biodiversity patterns using indicators such as vegetation cover, species richness, and beta diversity, with the latter being partitioned into turnover and nestedness. This approach allows us to assess not only changes in biodiversity, but also shifts in community composition.
Our results suggest heterogeneous responses among microhabitats and across sites, with changes in community structure. This work provides initial evidence to support the design of management strategies aimed at minimizing impacts and promoting photovoltaic infrastructures compatible with biodiversity conservation.

Pollinators in three German solar parks under different regional seed mixtures

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The rapid expansion of solar parks has created a land-use conflict between renewable energy production and biodiversity conservation. While solar parks have the potential to contribute to habitat restoration, their ecological value strongly depends on established vegetation. Transforming solar parks into species-rich semi-natural grasslands often

involves sowing seed mixtures, yet evidence of their impact on pollinator communities remains limited.
This study assessed the effect of different regional seed mixtures vs. spontaneous colonization between and outside module rows on pollinator communities within three German solar parks. Vegetation characteristics, including total plant species richness and cover, as well as the number of flowering species and overall flower cover, were recorded, and the seed mixture establishment success was evaluated. Pollinators, focusing on butterflies and wild bees, were surveyed using sweep netting and transect walks.
Two years after sowing, seed mixture establishment varied significantly among mixtures and solar parks, with all mixtures supporting a higher plant species richness than spontaneously colonized areas. Nevertheless, the pollinator communities were primarily shaped by site-level factors rather than seed mixtures. Butterfly diversity and abundance were higher in outside-row areas, with distinct community composition, while wild bees showed weaker responses to transect location.
Our results indicate that solar park design currently outweighs differences between seed mixtures in shaping pollinator communities. However, since seed mixtures supported higher plant species richness than spontaneously colonized areas, longer-term monitoring is needed to determine whether functional differences among seed mixtures and their effects on pollinators will emerge over time.

Using plant pollinator networks to evaluate regional seed-mixtures used in different photovoltaic systems

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Sowing regional wildflower mixtures is an effective measure that is already widely used in grassland restoration. It can generate synergistic effects like the provision of ecosystem services such as pollination and pest control. However, in solar parks - and especially in agrivoltaics - this method is still a relatively new approach. To evaluate the success of such interventions plant pollinator networks are a promising tool taking into account ecological functioning and resilience.
We investigated plant pollinator networks in three south-facing ground mounted solar parks in 2024 and in one agrivoltaic facility with vertical solar modules across three growing seasons (2024-2026). At each photovoltaic site seed mixtures different in species number or forb proportion were sown between or next to module rows.
Plant pollinator networks of sown areas tended to be more complex and diverse than of spontaneously colonized control areas, indicating enhanced resource use, in particular when high-diversity seed mixtures containing many wildflower species were used. In the agrivoltaic facility, sown strips additionally suppressed weeds, reducing the risk of their spread into adjacent cropped areas.
These findings demonstrate that habitats of high ecological value can successfully be established within multifunctional land-use systems combining solar energy, agriculture and nature conservation, offering a promising path forward. By sowing diverse seed mixtures with a high proportion of wildflowers floral resources across the growing season are provided for pollinators, likely enhancing ecosystem functioning and resilience.

Solar farm impact on soil carbon and plant biomass: A modelling approach

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What is the impact of ground-mounted solar farms (SFs) on soil organic carbon (SOC) and plant aboveground biomass (AGB)? SFs may present risks and opportunities for the delivery of ecosystem services (e.g., SOC storage and sequestration) due to their high land take but low infrastructure footprint. We assessed spatial and temporal changes in AGB production and SOC accrual to answer this question and provide some of the first scientific evidence. We used seasonal weather data (e.g., temperature, rainfall) from two SFs and field data (AGB and SOC) from 18 SFs in England and Wales to parameterise the MISCANFOR biomass growth model and a multipool-multicohort soil carbon model. We modelled changes in SOC across Great Britain over a 30-year SF lifespan under different design (solar panel coverage) and land management (from intensive vegetation management to unmanaged) options. Areas underneath solar panels produce significantly lower plant AGB than areas between solar arrays (gaps) and margins. Soils in gaps and margins can accrue SOC over time depending on management, but soils under solar panels loose SOC over the SF's lifetime due to impacts on plant productivity and growth. Land management exerts stronger effects on SOC than SF design under intensive mowing regimes (i.e., biomass removal), but SF design becomes more important in driving SOC change over time and space as levels of vegetation management decrease. These results will help optimise SF design and land management to ensure the long-term delivery of ecosystem services.

Legacy effects of pre-construction habitats on solar park plant communities and interactions with solar panels

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The area of European solar parks is constantly increasing. Solar parks can be considered as novel ecosystems including open grassland-type habitats and areas shaded by solar panels both managed by grazing or cutting. Previous studies have shown that solar panels strongly affect plant communities by light and rainfall interception. However, the influence of previous land use or habitat type and their interaction with panel effects are largely unknown. Such potential legacy effects need to be taken into account in decisions on management and restoration actions. In our study, we analysed legacy and solar panel effects on plant communities in 16 French solar parks. We were particularly interested in interactions between legacy effects and microhabitat conditions mediated by solar panels. We selected solar parks constructed in four habitat types: forests, grasslands, industrial sites, and crop fields. In each park, the vegetation was surveyed in ten plots of 1 m^2 under panels (always shaded) and ten plots outside panels (never shaded), resulting in a total of 320 plots. We found that preconstruction habitat type affected plant species composition and – to a lesser degree - plant functional composition. Solar parks sharing the same preconstruction land use showed more similar communities than those on different habitats, particularly in former woodlands. The observed legacy effects depended on microhabitats. Under panels, communities strongly reflected previous habitats, in particular for woody and ruderal species. Understanding these dynamics inform management and restoration strategies to re-establish both ecological and functional diversity.

SS23 – DIGITAL EDUCATIONAL TOOLS FOR SKILLS DEVELOPMENT IN ECOLOGICAL RESTORATION

Trigger Change! Open source materials - a new model for educating our future land restorers

Karen Sudmeier, United Nations Convention to Combat Desertification – Germany

The restoration economy is poised for significant expansion, creating jobs and fostering innovation. However, there is a significant lack of skilled professionals to meet this demand worldwide. This presentation introduces a new model for educating future land restorers. Spearheaded by the G20 Global Land Initiative, UNCCD, in partnership with leading university partners researchers and practitioners in the field, we first introduce two new open source Master's/ Bachelor's level courses on land restoration. Entitled: Trigger Change! Innovative Sustainable Agriculture Solutions to Land Restoration and Trigger Change! Sustainable Urban Land Restoration, the university course kits include PPTs, case studies and a course manual, equivalent to 48 teaching hours or a 3 credit (ECTS) course each.
We developed these courses for three main reasons: offer a new model of education, which provides open source high quality educational materials to level the gap in quality educational materials between the Global South and North on restoration; address the need for new emerging skillsets required for the restoration economy; and finally, create new spaces for innovation and forward thinking in tackling the emerging challenges posed by our planetary crises.
However not all learners have access to tertiary education. The presentation will conclude with information on a forthcoming Massive Open Online Course: "Opportunities in Land Restoration" with a wide appeal to youth and practitioners worldwide, keen to learn more about careers, innovation and entrepreneurship opportunities in this field. All three courses are good examples of the potential for digital education for ecological restoration and beyond.

Foundations of Restoration Ecology: A Global, Flexible Course for Building Scientific Capacity in Restoration Practice

Elise Mackie, Society for Ecological Restoration – United States

Scaling up ecological restoration to meet global biodiversity and climate goals requires accessible, high-quality training grounded in ecological science. The Society for Ecological Restoration's (SER) Foundations of Restoration Ecology course responds to this need through a flexible, fully online learning experience designed for a global audience of practitioners, students, and professionals at all career stages.
This presentation introduces the course structure, content, and learning pathways, offered through Open Access, Verified Certificate, and University Credit options in partnership with the University of Montana. Learners engage with core ecological principles across levels of biological organization, including population genetics, ecosystem dynamics,

biodiversity–ecosystem function relationships, and approaches to monitoring and assessment. The course emphasizes strengthening scientific literacy, critical thinking, and the application of evidence-based practices in restoration.As part of a growing ecosystem of digital learning tools, this course expands access to foundational training, particularly for those in regions with limited access to formal education in restoration ecology. It also supports professional development, including progress toward SER's Certified Ecological Restoration Practitioner (CERP) credential.
By combining scientific rigor with flexible delivery, this course contributes to building a skilled, inclusive, and globally connected restoration workforce.

The Professional Platform for Education and Learning (PROPEL)

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To enhance the effectiveness and dissemination of educational and capacity-development initiatives, the UN Decade Task Force on Best Practices is designing a centralized platform for ecosystem restoration education and learning. The platform will build on existing initiatives, hubs, and educational partnerships and will promote the creation of new initiatives and capacity development partnerships. The Professional Platform for Education and Learning (PROPEL) will be hosted by the Framework for Ecosystem Restoration Monitoring (FERM), which facilitates knowledge dissemination in addition to its core mandate of tracking global restoration progress during the UN Decade. Among its key functionalities, PROPEL will link existing knowledge hubs through a common search engine and will include a registration form to allow the inclusion of educational programmes and capacity development initiatives that are not yet hosted on existing knowledge platforms.
The platform will serve as a unified entry point for access to a wide range of educational and capacity development programmes, including online certificate programmes for practitioners, accredited academic programs, massive open online courses, field-based courses for practitioners and decision makers, online and in-person short courses and educational workshops, and training programmes for practitioners and extension professionals.
We envision that PROPEL will be used by three main groups: i) students, restoration practitioners, government agencies and NGOs; ii) ecosystem restoration educators; and iii) organizations who seek to develop partnerships to deliver capacity-development programmes for their staff or to other groups (universities, government agencies, NGOs and the private sector).

From screen to stream – transforming knowledge into action for freshwater restoration through the MERLIN Academy

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Achieving the targets of the European Nature Restoration Regulation and related biodiversity and climate policies requires increased restoration knowledge and skills across sectors. To address this challenge, the MERLIN project developed the MERLIN Academy, a freely accessible online learning platform supporting capacity building for freshwater restoration and Nature-based Solutions.
The Academy provides structured, self-paced learning opportunities through a series of digital learning modules that translate scientific knowledge, practical experience and project outcomes into accessible training resources. The modules cover key aspects of restoration implementation, including restoration planning and evidence generation, stakeholder engagement and governance, financing and economics of restoration, and the upscaling of restoration actions through evidence-informed decision-making workflows. The learning modules integrate videos, texts, infographics, podcasts, webinars and self-assessment quizzes into a flexible learning environment that supports learners from diverse professional backgrounds in developing restoration knowledge and skills.
The Academy was developed to serve practitioners, river basin managers, public authorities, consultants, NGOs, researchers and students, thereby supporting both continuing professional development and academic education. By providing open-access, multilingual training materials, it helps bridge the gap between research and implementation while promoting knowledge exchange across Europe.
Building on the success of the MERLIN Academy, the Biodiversa+ funded FLOODTRAIN project will further expand its training portfolio and strengthen its role as a platform for restoration capacity building. Together, these initiatives demonstrate how digital learning can support the growing need for restoration expertise, helping to translate knowledge into action and enabling the large-scale implementation of freshwater restoration across Europe.

Scaling ecological restoration skills in Europe: Introducing the Digital Ecological Restoration Toolbox (DERTO)

D. Gigante Fátima *, Society for Ecological Restoration - Europe (SER-Europe) – Belgium

The growing ambition to achieve global biodiversity and climate targets, alongside the implementation of the European Nature Restoration Regulation, highlights an urgent need to scale up ecological restoration across Europe. Meeting this challenge requires a well-trained, cross-sectoral workforce spanning agriculture, forestry, landscaping, and related industries. In response to this emerging need, the TEAM#UP consortium, comprising 15 partner institutions across five European countries, has developed the Digital Ecological Restoration Toolbox (DERTO) as an open educational resource to enable this transition.

DERTO provides free and accessible learning materials designed for Vocational Education and Training (VET) schools, higher education institutions, and lifelong learners. It aims to upskill and reskill practitioners by offering structured training content, including teaching materials in ecological restoration, an extensive resource library, access to virtual restoration demonstration sites for learning from real-world restoration projects, and Massive Open Online Courses (MOOCs) aligned with international principles, standards, and best practices in ecological restoration, and hosted by the Society for Ecological Restoration (SER). These resources are designed to bridge knowledge gaps, strengthen competency development, and support career pathways in ecological restoration across sectors.

This presentation will introduce the DERTO platform, highlight its role within the broader TEAM#UP project, and demonstrate how these tools can support the upskilling of the next generation of ecological restoration professionals across Europe and beyond.

Building global capacity for ecosystem restoration: FAO's e-learning portfolio in support of the UN Decade on Ecosystem Restoration

Andrea Romero * , Christophe Besacier
FAO Forestry – Italy

The United Nations Decade on Ecosystem Restoration (UN Decade) has underscored the urgent need to strengthen technical capacities to restore degraded ecosystems at scale. As co-leader of the UN Decade, FAO, in collaboration with other global leading organizations, has developed a comprehensive portfolio of self-paced e-learning courses through the FAO e-learning Academy to support practitioners, policymakers, researchers, and other restoration stakeholders worldwide. This presentation will provide an overview of these courses, which offer practical guidance on restoration principles and standards of practice, key ecological and social concepts, stakeholder engagement, monitoring frameworks, financing mechanisms, the development of bankable business plans, restoration approaches such as agroforestry, and the use of high-quality reproductive material for restoration interventions. The courses are freely accessible, peer-reviewed, and offer a certificate of completion. They demonstrate how digital learning can accelerate knowledge dissemination, enhance professional competencies, and contribute to scaling up effective restoration action globally. By combining knowledge, practical tools, and interactive learning methodologies, they help bridge capacity gaps across regions and sectors, supporting countries and organizations in achieving restoration commitments and advancing the mission of the UN Decade.

SS24 - MINI-FORESTS IN EUROPE: THE MIYAWAKI METHOD FROM SCIENCE TO SOCIETY

Miyawaki method forest makers as a business endeavor. Can mini forests contribute to the restoration economy?

Nicolas De Brabandere * [1], Elise Van Middelem *
Urban Forest Europe – Belgium

The extractive economy is a model based on removing natural resources to extract economic value. This approach frequently leads to environmental degradation, social inequity, and wealth extraction. The model is increasingly questioned for its inability to provide long-term sustainability or equitable benefits.

In contrast, the restoration economy is a restorative, market-based economic sector focused on repairing degraded ecosystems. It aims to create jobs, stimulate local businesses, and generate ecological benefits.

Urban Forests is a Belgian company specializing in creating mini-forests using the Miyawaki method. Its clients range

from individuals, companies, and industries to public services, schools, and citizen groups. The objective is to meet client demand for improving the environment, social well-being, and biodiversity. To date, Urban Forests has created 170 Miyawaki forests, engaging over 17,000 participants across four countries-primarily in Belgium and France. The company employs four staff members and operates without subsidies. Its economic model is both profitable and integrated, serving as an inspiration for other companies contributing to a restorative economy.
By presenting Urban Forests and other partners, such as SUGi and Alvéoles en ville, the talk provides strong evidence that a regenerative economy can be both profitable and credible. It demonstrates the potential to create jobs and engage a wide range of stakeholders, delivering extensive environmental benefits.

The Miyawaki method as a scientific approach: early evidence, measurable impacts, and methodological challenges across region

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The Miyawaki method is increasingly used in urban and peri-urban restoration, yet its scien-tific basis and the robustness of claimed benefits remain under active debate. This presentation examines the method as a testable ecological approach, grounded in potential natural vegeta-tion, dense multi-species planting, and the assumption that early interspecific interactions can accelerate the assembly of site-adapted forest communities.
We present early evidence from contrasting implementation contexts. In Italy, a standardised experimental network of 16 Tiny Forests has been established to assess plant survival, growth, vitality, and the field response of woody assemblages under Mediterranean conditions, including the role of community self-selection through interspecific interactions. In the UK, Earthwatch's Tiny Forest programme has generated a larger monitoring base through citizen science, re-porting measurable signals for biodiversity, thermal comfort, infiltration, and social outcomes across more than 100 sites. In south-west Australia, Murdoch University is testing Miyawaki forests in a Mediterranean-climate setting, comparing survivorship, growth, and biodiversity against nearby conventional plantings and nearby remnant natural systems. In continental Eu-rope, Urban Forests has helped adapt and scale the method in Belgium since 2016, contributing practical evidence on site design, species selection, and early-stage development across multiple urban contexts.
By bringing these experiences together, the talk aims to stimulate a transparent discussion on what is currently supported by evidence, what remains uncertain, and how future monitor-ing can make Miyawaki-based restoration more rigorous, comparable, and credible.

Potential of European Natural Vegetation for Creation of Stable Amenity Mini-Forests

Elgene Box, University of Georgia – United States

Stable amenity mini-forests can be retrofitted into urban and other built-up areas by the "Miyawaki Method," which attempts to create potentially stable forest environments quickly. Such forests improve local environments but also protect many plant desirable species. The method involves six basic steps:

1. Understanding the local potential natural forest vegetation and its long-term canopy dominant species
2. Preparing and planting pot-grown saplings of these species, with root systems already well developed
3. Planting on a prepared, usually slightly raised site, with imported better soil if necessary
4. Planting mixtures of perhaps 6-15 local canopy tree species, plus a few understorey species
5. Planting at a high density, which promotes rapid, light-seeking upward growth

Mulching immediately after planting, to hold water and prevent weeds.
The strategy is to go directly to the potential terminal-stage ("climax") tree species, without going through all the usual successional stages (which may need 50 years). "Miyawaki forests" have now become quite popular worldwide, and many attempts have not understood the first step: understanding the local potential long-term dominant tree species. And *this* is the scientific basis for the Miyawaki method: long-living "climax" tree species that cannot be displaced by other species because they are the most shade-tolerant. Some challenges do remain for adaptation to other climates. Does Europe have enough long-living, canopy-dominant deciduous tree species to support stable mini-forests? Mixes of slower-growing climax and more available, faster-growing successional tree species create unstable stands and will not produce forest stability over many years.

The Miyawaki method as landscaping.

Adrian Wong, SUGi – United Kingdom

Cities are running out of room for nature. SUGi treats the Miyawaki method not only as a planting technique but also as a landscaping practice: a way to weave dense, native, multi-layered forests into the everyday fabric of the city. London is one of our most active living laboratories.
The Southbank Forest, planted on a slim strip beside the Thames, is now one of the most studied SUGi sites in the world. Within months, it brought back birds, pollinators, and fungal networks once considered absent from this stretch of central London. A summer surface-temperature reading recorded a 28.6◦C cooling effect inside the forest. Independent ecoacoustic research has tracked soundscape complexity over time, building evidence that wild forest elements can re-establish ecological function on plots once thought too small or too urban to matter.
A pilot study with the University of Oxford is examining the effect of these pocket forests on the well-being of nearby residents and visitors, adding to the growing science that links daily proximity to biodiversity with measurable mental and physical health outcomes. The site has also become a magnet for human connections.
The implication for urban landscape practice is direct: the wild belongs in cities, and the Miyawaki method offers a credible, replicable way to bring it back, with measurable benefits for biodiversity, public health, and the social fabric of place.

The Miyawaki method for NGOs: constraints, purpose, and opportunities - How can NGOs engage diverse communities through a comprehensive and distinctive approach? How can it be made sustainable in terms of funding and community engagement ?

Damien Saraceni * , Guillaume Dozier *, Stéphanie Saliou *, Claire Narraway [1], Axel Heineck *
[1] Earthwatch Europe – United Kingdom

The Miyawaki method of afforestation is founded on principles of both ecological restoration and community engagement. Over the last 10 years, it has gained recognition as a powerful tool to engage communities in restoring and protecting nature and
address societal challenges. Active citizen participation in Miyawaki planting can help alleviate eco-anxiety by delivering concrete actions at the local level, foster connection to nature, and encourage long-term pro-environmental behaviors. To maximise social benefits, long-term community engagement is preferred; however, achieving this comes with financial, design, and organisational challenges. Drawing on the experiences of 4 NGOs, this presentation explores how organisational models, grounded in citizen participation, can address challenges such as maintaining volunteer engagement and pragmatically adapting existing protocols.
Boomforest is a NGO founded in 2016 in Paris. It leads community-based Miyawaki forest planting in France and empower citizens to start their own local projects.
Earthwatch Europe is an NGO and research organization that connects people with nature and champions science-led action. Earthwatch leads the Tiny Forest programme and coordinates the Miyawaki Research Network.
MiniBigForest is an NGO founded in France in 2018 that has carried out more than 80 community-led tree-planting projects using the Miyawaki method.
Citizens Forests is a NGO founded in Bönningstedt in 2019. It enables the public to plant Tiny Forests according to the Miyawaki method in Germany and Austria.
Together, these examples demonstrate that sustainable community engagement relies on the interplay between accessibility, methodological rigor, citizen empowerment, and innovative funding strategies, and suggest practical pathways for implementation

The Miyawaki method for outdoor education

Daan Bleichrodt, Institute for Environmental Education (IVN) – Netherlands

The Miyawaki method is increasingly recognised not only as an approach for rapid native forest establishment in urban landscapes, but also as a valuable platform for environmental education and community participation. Within the context of ecological restoration, schools provide a distinct setting where forest creation can be integrated with learning, and long-term engagement with nature and environmental stewardship.
This presentation brings together experiences from IVN Environmental Education in the Netherlands, Societree in the United Kingdom, Miyawaki Forest Program at Murdoch University in Western Australia. Across these initiatives, small dense native forests established on school grounds are being used as living laboratories where students participate in

site preparation, planting, maintenance, ecological observation and where teachers use the forest as an outdoor classroom. In the Netherlands teachers are trained to also teach math, language and other subject in the forest. We estimate that 209.100 (Societree 4000, 5100 Australia – how many at IVN 200.000+) students have been engaged in forest making the past ten years and monitoring activities across these three initiatives.
Experiences from participating schools indicate that Miyawaki forests can generate multiple educational and health benefits. They provide opportunities for hands-on STEM learning, strengthen ecological literacy, and help children understand local species, habitats, and ecological relationships through direct hands-on experience. Schools also report benefits for student wellbeing, including curiosity, enjoyment, a sense of agency, and stronger connection with place and nature. Importantly, regular engagement with these small forests can foster long-term environmental stewardship and boot immune systems.

SS25 - NATIVE SEED QUALITY FOR ECOLOGICAL RESTORATION

Building a native seed quality framework in Australia: from X-ray detection software to batch traceability systems

Simone Pedrini, School of Molecular and Life Science, Curtin University, Bentley, WA – Australia

Reliable, transparent and replicable seed quality testing is crucial to the agricultural and horticultural seed supply chain. Traditional seed testing approaches, such as cut test, germination, and tetrazolium tests, have been used on native species. While effective for conservation and research purposes, there's been limited uptake from native seed suppliers. Native seeds present numerous complexities compared to the selected agricultural varieties, such as high interspecific variability, challenging and at times not yet fully understood dormancy mechanisms, complex morphological features, and many species that have not been tested before. Moreover, native seed suppliers often deal with a large number of relatively small batches across numerous species and provenances. Such issues have so far made seed testing non-cost-effective and limited its implementation in the native seeds and restoration industry.
Rapid, automatic seed quality assessment using X-ray imaging could represent a cost-effective approach to the broad adoption of seed quality testing across the native seed industry.
Here, we present a novel X-ray image (DICOM files) analysis software (XanthorRAY) that identifies, counts, and estimates seed quality on relatively large sampling batches (up to 500 seeds). Customisable, species-specific parameters allow for automatic image manipulation and analysis. At the same time, a feature for manual correction by a seed specialist can provide more accurate results and build a training dataset to improve the accuracy of the viability detection algorithms. Such software could drastically reduce the time (and cost) required to complete each test and enable broader implementation of quality testing for seed-based ecological restoration.

Towards effective ecosystem restoration in Kenya: Addressing gaps in quality native seed systems

Victor Otieno * [1,2], Lucy Adhiambo [1], Denzel Indasi [1]
[1] Centre for Ecosystem Restoration Kenya – Kenya
[2] Jomo Kenyatta University of Agriculture Technology – Kenya

The UN Decade on Ecosystem Restoration has intensified global efforts to restore degraded ecosystems, increasing demand for high-quality native seeds adapted to local environmental conditions. Kenya's restoration initiative is underpinned by 15 billion tree-growing, targeting degraded forests, rangelands, wetlands, and agricultural landscapes. However, the effectiveness of these efforts is constrained by weak native seed systems characterized by inadequate seed supply, limited availability of genetically diverse planting materials, insufficient technical capacity, poor storage infrastructure, and weak policy and regulatory frameworks. Many indigenous species also exhibit complex seed dormancy and storage behaviors, limiting their large-scale propagation and use in restoration programs.
Despite these constraints, Kenya presents significant opportunities for strengthening native seed systems to support large-scale ecosystem restoration. Growing national and international investments in restoration, advances in seed science and conservation technologies, the establishment of community-based seed enterprises, and increasing awareness of biodiversity conservation provide a strong foundation for developing resilient seed supply systems. Integrating scientific research with indigenous ecological knowledge can improve seed sourcing, collection, storage, and propagation of native species adapted to diverse ecological zones. In addition, collaborative partnerships among government institutions, research organisations, local communities, non-governmental organisations, and the private sector can enhance seed quality assurance, capacity building, and restoration outcomes.
We present the major challenges and emerging opportunities in developing quality native seed systems in Kenya within the context of the UN Decade on Ecosystem Restoration. Strengthening native seed systems will be critical for enhancing biodiversity conservation, ecosystem resilience, climate change adaptation, and sustainable livelihoods.

Seed quality of native seed produced through direct multi-species harvest

Slodowicz Daniel * [1], Anita Kirmer [2], Sabine Tischew [2], Simone Schneider [3], Simone Pedrini [4], Andreas Bosshard [1], Kevin Liautaud [5], Aure Durbecq [6]
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Direct multi-species harvest of native seed (commonly known as "direct harvest") is increasingly recognized as a fundamental technique for ecological restoration. This technique involves harvesting native seeds as a multi-species mixture directly from natural or semi-natural habitats, while preserving local plant population genetic diversity, and thus contributing to restoration success.
Traditional seed quality tests, such as those outlined by the International Seed Testing Association (ISTA), are primarily designed for homogeneous, single species seed lots and are not directly applicable to heterogeneous seed mixes. Seed quality tests for viability, germinability, and dormancy, which are routinely performed on single-species seed lots, become problematic when applied to multi-species mixes with varying physical and physiological characteristics. The complexity of these mixes makes it challenging to establish uniform testing protocols that accurately reflect the quality of all constituent species and therefore makes comparison difficult.
When considering quality tests for heterogeneous seed mixes, it is essential to determine the specific information required and its practical relevance. There is a significant trade-off between the depth of quality testing and the cost-effectiveness of native seed mix production. Extensive testing protocols would inevitably increase production costs, potentially limiting the availability and use of these mixes in restoration projects. This economic consideration must be balanced against the need for quality assurance.
Here, we propose a practice-oriented, evidence-based approach to quality assurance for native seeds produced through direct multi-species harvesting. This presentation is part of the "Direct multi-species harvest of native seeds for ecological restoration - International principles and standards".

High-quality seeds for a Europe ready for ecological restoration

Sandra Malaval *, Fédération des conservatoires botaniques nationaux – Végétal local certification – France, European native seed producers association – ENSPA – France

With the need for ecological restoration set to be immense in the coming years, the sector responsible for producing and supplying suitable seeds is becoming more organized and professional. Without this sector, there can be no concrete progress toward large-scale restoration that is accessible to all stakeholders. This is a key factor in the success of Europe's ambitions in this area. At the European level, the European Association of Native Seed Producers is a leading authority in this field and represents the most dedicated and experienced producers of herbaceous seeds. In France, Vegetal local certification supports the development of a supply chain for high-quality seeds for ecological restoration. This quality depends not only on the intrinsic quality of the seed lots-which is rooted in both academic and practical expertise-but also on the traceability and genetic diversity of these seeds. Through concrete examples of tests, procedures, and commitments, we will explore the work of seed producers in Europe to illustrate how they are innovating in the realm of quality-with minimum standardization-to create the seeds that will shape the ecosystems of tomorrow, prioritizing living organisms and ecosystems above all else.

Nationwide assessment of genetic variation of grassland plants as basis for the development of generalized seed transfer zones - The German RegioDiv project

Walter Durka * [1], Stefan Michalski , Johannes Höfner
[1] Helmholtz Centre for Environmental Research GmbH - UFZ – Germany

Germany has seed transfer zone system established for grassland restoration seed mixtures. Zones are based on ecoregions. We investigated 30 plant species frequently used in restoration across all seed zones in Germany and established genetic diversity data based on ˜14000 samples from 2500 sampling sites. We identify intraspecific genetic clusters and spatially extrapolate their distribution, analyse population structure and assess isolation-by-distance and isolation-by-environment. Species showed between 2 and 8 genetic clusters with spatially coherent distribution. Nearly all species showed patterns of isolation-by-distance.

Heterploid species, displaying two cytotypes are problematic as mixing of cytoypes is potentially detrimental in restored populations and in seed production fields. We analysed teh spatial distribution of cytotypes in six species finding both parapatric and sympatric distributrion patterns. Based on frequency of cytotypes we propose a decistion scheme for each seed zone, which cytotype(s) should be used.
In an attempt to synthesise the distribution patterns of intraspecific groups in order to construct new improved seed zones, we clustered 72 subregions based on genetic identity (PCR scores). We found that (1) the new clusters do not match the existing seed zones, (2) the existing 22 seed zones encompass 70% of total spatial genetic variation, (3) already 16 optimized seed zones could encompass the same proportion of spatial genetic variation. As a consequence of the high genetic representativenes of the current zones, we do not propose a change to their outline, since any change would fundamentally challenge the seed producers.

SS26 RESTORING NIGHT CONDITION FOR BIODIVERSITY (DARKER SKY)

Coordinator Gallet Sébastien, Université de Brest

ALAN (artificial Light at Nigth) is a major disturbance for urban and rural ecosystems, little taken into account in restoration ecology. The darker Darker sky project is an example of how transdisciplinary and transnational cooperation can be mobilized to answer both scientific and practical issues. The session which is part of the final event of the Interreg program will present main approach and income from the program.

Introduction: Restoring night: the Darker sky project

Reynier Peletier, University of Groningen

DARKER SKY is an INTERREG North Sea project (ERDF funding), which aims at reducing light pollution and ecological connectivity in the North Sea Regions (France, the Netherlands, Germany, Denmark) by providing municipalities and ports with innovative measuring, monitoring and co-design methods for the implementation of environmentally sound and energy-efficient light reduction, benefiting biodiversity and communities. The project has 8 demonstrator sites, in which different technical and/or systemic light installations are implemented, and evaluated through monitoring. The demonstrator sites – co-developed with regional stakeholders and citizens – act as examples showing neighbouring municipalities how successful light reduction projects can be performed. In this talk I give an introduction to the project.

Learning from co-construction process

Nynke Visser, University of Groningen

This presentation explores the co-design approaches used in the Interreg North Sea project *DARKER SKY*. Five pilot sites applied different strategies, ranging from top-down governance to strongly community-driven participation, reflecting their local context. The comparison shows how governments, researchers, stakeholders, and citizens collaborated to develop sustainable lighting solutions that balance ecological protection, safety, and functionality. It also highlights the importance of scientific monitoring, public engagement, and transnational knowledge exchange. The findings demonstrate that successful lighting transitions require context-specific co-design approaches supported by long-term

collaboration and adaptive governance.

Monitoring light pollution and pressure on ecosystems

Andreas Haenel, Working Group Dark Sky Germany

we will present and compare different methods, how to measure light at night in order to quantify the reduction of light pollution. We used mainly the following methods:

- measure the luminance of the sky (sky brightness)
- measure illuminance on the ground from the surroundings (natural but also artificially illuminated)

We also discuss the different measurement and reduction methods which are challenging due to the very low light levels and propose some simple techniques.

Monitoring effect of light modification on wildlife (Yoann/ Arjen)

Yoann Roulet,University of Brest ; Arjen Strijkstra University of Applied Sciences, Leeuwarden

Within the Interreg North Sea project DARKER SKY, a standardized monitoring framework was developed to evaluate the ecological effects of lighting modifications across the North Sea region.
We present the results for bats, birds, insects and benthic fauna regarding lighting installation and modification. Bat activity was monitored using automated ultrasonic acoustic recorders during spring, a migration period for bats using coastal area as corridors and stopovers, or summer, as breeding period. Bird responses were also assessed through automated acoustic recordings in spring and summer to identify changes in nocturnal and crepuscular activity. Insects were monitored using sticky traps in spring and summer, to indicate changes of lighting on sensitive insect groups. Intertidal benthic communities were surveyed using quadrat sampling to evaluate effects of light on organism density and community composition. Several effects of lighting management will be discussed, as well as the relevance and feasibility of using those indicators to monitor night restoration.

Evaluate implementation of night restoration process: The Global night restoration wheel

Sébastien Gallet, University of Brest ;

According to The SER's principles and to the results and discussion of the Darker Sky Project a global recovery wheel is proposed in order to synthesize the different components of the evaluation of a "night restoration" project. For the Global Night restoration Wheel (GNRW) six attributes are proposed: Biodiversity / Light Environment / Social integration / Technology design / Sustainability/ economy and resources. Each of the are declined in three indicators noted from 0 to 5 star. The "5 five star" level corresponds to the optimum level of the indicator according to local context, i.e. without light pollution. It can be considered that a 0/1 star reveals a degraded situation or even a negative effect of the light modification. A "3 stars" level corresponds to a minimum acceptable or expected level.
Implementation of the Gobal Night recovery wheel will be illustrated from pilots site of the Darker Sky Project.

Discussion/Conclusion

The Darker Sky Team

SS27 – ADVANCING KNOWLEDGE AND COOPERATION IN THE MEDITERRANEAN REGION THROUGHOUT THE UN DECADE ON ECOSYSTEM

From plant conservation to restoration delivery: GENMEDA as a Mediterranean hub for ecological restoration

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GENMEDA (Network of Mediterranean Plant Conservation Centres) was created to strengthen collaboration among Mediterranean seed banks and plant conservation centres, promote ex-situ and in-situ methodologies, exchange knowledge and germplasm, and develop joint initiatives for biodiversity conservation. Building on this foundation, the network is now evolving toward
a broader restoration role. With 36 members from 14 countries, GENMEDA offers a unique trans-Mediterranean platform linking EU and non-EU institutions, combining expertise in seed biology, ex situ conservation, propagation, translocation, habitat management and restoration practice. In this contribution, we present how GENMEDA can function as a Mediterranean restoration hub by: (i) mobilising plant conservation infrastructure and data for restoration planning and implementation; (ii) aggregating protocols, standards and case studies from initiatives such as ECOPLANTMED, CARE-MEDIFLORA, and LIFE SEEDFORCE, inter alia; (iii) fostering cross-border cooperation among researchers, practitioners and public bodies; and (iv) supporting the implementation of the EU Nature Restoration Regulation and the development of National Restoration Plans. We also reflect on current challenges, including uneven geographical representation, the need to move from a species-centred to a habitat- and ecosystem-based restoration culture, and the opportunity to better integrate soils, water, pollinators and nature-based solutions. GENMEDA's experience shows how long-standing plant conservation networks can facilitate restoration on a Mediterranean scale.

Building capacities for standards-based ecosystem restoration throughout the UN Decade and beyond

Andrea Romero * [1], Christophe Besacier [1], Cara Nelson [2], Cristiane Sater Melnik [1], Robin Chazdon [3], James Hallett

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[3] University of the Sunshine Coast – Australia

The United Nations General Assembly declared 2021–2030 as the United Nations Decade on Ecosystem Restoration (UN Decade). To improve net gain from restoration for biodiversity, ecosystem integrity and human wellbeing, UN Decade partners publish Standards of Practice to Guide Ecosystem Restoration with engagement by hundreds of people from over 57 countries. The Standards of Practice include more than 300 recommendations for all phases of restoration projects and are applicable to the broad array of restorative activities included as ecosystem restoration under the UN Decade. Following publication, there is a corresponding need to promote their use and adoption to advance restoration practice and policy. To that end, FAO, IUCN-CEM and SER are developing a multi-tool platform to guide, support and train users on the concepts and use of the standards of practice. The platform includes a navigation tool, an e-learning course series and a decision support and project appraisal tool. The objective of the presentation will be to provide an overview of a beta-version of the multi-tool platform and invite participants to engage in the pilot test phase. In addition, the presentation will shed light on progress of other key UN Decade products created to facilitate capacity development for effective restoration including the UN Decade Capacity, Knowledge and Learning Action Plan and the UN Decade framework for dissemination of good practices.

Upscaling restoration of Mediterranean forests through regional cooperation and good practices sharing

Christophe Besacier, Food and Agriculture Organization of the United Nations – Italy

At the midpoint of the UN Decade on Ecosystem Restoration (2021–2030), this intervention will highlight how regional cooperation and good practices sharing can be translated into coordinated, large-scale restoration action, with a specific focus on the Mediterranean region. Particular attention will be given to the World Restoration Flagship "Restoring

Mediterranean Forests", advancing under the framework of the Committee on Mediterranean Forestry Questions - *Silva Mediterranea.* This flagship represents a major regional effort to address forest degradation through proactive management and restoration, contributing to a growing momentum for collaboration across Mediterranean countries. The initiative has compiled and systematized existing good practices across the region, effectively capitalizing on ongoing efforts in post-fire restoration. It focuses on approaches that have already demonstrated their effectiveness, with the aim of strengthening a common approach to restoration and enabling their scaling-up and replication in other countries and regions facing similar challenges. The presentation will also introduce the emerging Mediterranean Forest Initiative (MFI), jointly implemented by FAO, UNEP, and UNDRR, as a key mechanism to scale up this regional momentum. The MFI aims to move from fragmented efforts to a more structured and enlarged collaboration among partners and stakeholders, by harmonizing monitoring, strengthening capacities, mobilizing finance, and fostering cross-border cooperation. In doing so, it seeks to bridge the gap between global commitments and on-the-ground implementation.
By bringing together global tools and regional experiences, the contribution will explore priorities and pathways to upscale restoration efforts in Mediterranean region over the remaining years of the UN Decade and beyond.

SS28 WET HORIZONS: POLICY-READY EVIDENCE AND TOOLS FOR EUROPE'S WETLAND RESTORATION

Coordinator(s): Shubiao Wu, Lorenzo Pugliese

WET HORIZONS

This session presents the key findings and final outputs of the EU Horizon-funded project WET HORIZONS, which brings together leading European researchers, biogeochemical modellers, and policy analysts to advance knowledge, tools and governance for wetland restoration. The session highlights how the project's results support climate-smart, cost-effective and policy-relevant decision-making at regional, national and EU levels.

Emission Factors for Restored Peatlands

Aram Kalhori, GFZ Helmholtz Centre for Geosciences, Potsdam

New, detailed emission factors (EFs) that improve IPCC Tier approaches by capturing complex carbon fluxes at site and national scales, supporting more accurate GHG mitigation accounting.

ServiPeat

Mateusz Grygoruk, Centre for Climate Research, Warsaw University of Life Sciences-SGGW

An online tool assessing peatland ecosystem services, multifunctionality, and potential trade-offs to guide rewetting and restoration strategies.

Socio-economic context and cost-effectiveness

Daniel Urban, Scotland's Rural College Klaus Glenk, Scotland's Rural College

Assessment of cost-effectiveness of peatland rewetting. We focus on bottom-up marginal abatement cost curves, reporting on variation across regional case studies.

"Serious Play" in Peatland and Wetland Decisions

Alessandro Gimona, The James Hutton Institute

We present an open-access multi-criteria decision tool integrating spatial data, indicators, and future projection model outputs, enabling users to interactively explore the potential benefits and trade-offs of different management possibilities on greenhouse gas mitigation potential and biodiversity, given economic considerations and climatic projections

Policy Messages & Recommendations

Rosie Everett, Scotland's Rural College

Synthesis of project insights with implications for the Nature Restoration Law, climate commitments, and land-use planning. The presentation of a White Paper on rewetting policy recommendations, that is going to be written jointly by all four sister projects (ALFAweltands, REWET and RESTORE4Cs), is planned for this presentation as well.

W2 - IMPLEMENTING THE NATURE RESTORATION LAW IN MARINE ENVIRONMENTS

Equity and inclusion as key to succesful marine restoration

Annet Pauwelusse, Wageningen University and Research – Netherlands

In this pitch I address the social and political dimension of nature restoration in the EU. While the need for community and stakeholder inclusion is widely acknowledged, there are various ways and degrees in which such inclusion is done in the implementation or marine restoration. Though my research project 'The Future of Past Reefs' I explore the conditions for inclusion and participation in marine restoration programs that is not just effective, but also just and socially sustainable. Such inclusion goes beyond mere consultation to also make room for plural knowledge and values throughout the development of restoration plans.

LIFE DREAM project: Deep REef restoration And litter removal in the Mediterranean sea

Federica Foglini * [1], Giorgio Castellan [1], Valentina Grande [1], Mariacristina Prampolini [1], Maria Letizia Vitelletti [1], Simonetta Fraschetti [2], Emanuela Fanelli [3], Gianfranco D'onghia [4], Frine Cardone [5], Claudio Lo Iacono , Katerina Anastasopoulou [6]
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LIFE DREAM is a transnational project designed to protect, restore, and preserve deep reef (DR) ecosystems across the Mediterranean Sea, in line with the EU Biodiversity Strategy for 2030. Deep reefs are ecologically critical benthic habitats functioning as carbon sinks and hosting highly diverse associated fauna. Yet they are increasingly threatened by multiple anthropogenic pressures, including climate change, unsustainable fishing, and marine litter (ML) accumulation, making urgent action for their conservation essential.
The project addresses these challenges through an integrated strategy combining scientific research, active and passive restoration, stakeholder engagement, and circular economy principles. LIFE DREAM will expand the knowledge base on deep reef distribution, health status, and ecosystem services, while mapping conflict areas between human activities and conservation needs. This will support proposals to extend the Italian Natura 2000 network to deep-sea environments, focusing on the Southern Adriatic Sea (Bari Canyon) and the Gulf of Naples (Dohrn Canyon).
Restoration activities include passive restoration through targeted marine litter removal, carried out with the active involvement of local fishing communities, and active restoration through deployment of ecofriendly 3D-printed modular artificial reef structures serving as substrates for reef-forming species. Recovered plastic waste will be processed through a low-temperature pyrolysis prototype to produce second-generation fuel, embedding circular economy principles into core operations.
LIFE DREAM also prioritises stakeholder engagement and public awareness, promoting behavioral change among fishers and sea users. Its outcomes will deliver best-practice guidelines for deep reef restoration and a replicable model for extending marine protected areas into the deep Mediterranean Sea.

A long-term collaborative approach to sustainable deep-sea trawling: the Aristeus antennatus fishery in Palamós, Spain

Juliana Quevedo * [1], Pablo Couve [1], Nixon Bahamon [1], Jacopo Aguzzi [1], Joan B. Company [1]
[1] Instituto de Ciencias del Mar – Spain

The red shrimp (*Aristeus antennatus*) fishery in Palamós is one of the most emblematic deep-sea trawl fisheries in the western Mediterranean. Over several years, we have built a bilateral collaboration with local fishers, WWF, and government and fisheries agencies, through which fishers have voluntarily adopted management measures aimed at more sustainable extraction of *A. antennatus* and accompanying megafauna. We will present this ongoing collaborative process and its outcomes so far. We have recently recovered historical monitoring data from the area that were previously unavailable ("sleeping data"), which will form the basis for future analyses and, ultimately, a socio-ecological model to evaluate the effectiveness of these measures and support marine restoration planning.

Implementing the Nature Restoration Law: insights for deep sea habitats from REDRESS

Nadia Papadopoulou * [1], Johanna Buerkert *, Redress Consortium *
[1] Hellenic Centre for Marine Research – Greece

The Horizon Europe REDRESS project works across 2 European seas on 13 cases supporting the restoration of deep habitats, such as cold-water coral reefs, sponge fields, sea pens, bamboo corals, and soft habitats, degraded by various activities and pressures. The project provides mapping, modelling and restotation prioritization frameworks, innovative monitoring methodologies, while also assessing success and cost-effectiveness of interventions. The project supports Member States implement the Nature Restoration Regulation (NRR), by focusing on the institutional, political, and societal conditions needed to enable active and passive restoration in the deep sea. A unique challenge here is the invisibility of the deep sea habitats, followed by the very few restoration interventions implemented so far, all of which are still considered, by many actors, a scientific exploration and a new frontier and not a necessity or a priority. A common challenge is the lack of a clear governance and finance framework (questions around participation, legitimacy, support, sustainability). But there is opportunity here in the framing of the message and the discourses used by the actors involved that could support the success of the EU NRR.

Implementing the Nature Restoration Law for Marine Environments

Clara Rodrigues * , Paula Bastos , Inês Machado
WavEC Offshore Renewables – Portugal

The EU Nature Restoration Regulation (NRR) provides a legal basis for scaling up marine restoration, but implementation depends on governance systems able to translate binding targets into workable pathways across diverse marine contexts. Within CLIMAREST WP5, WavEC assessed conditions required to support long-term uptake and replication of coastal and marine restoration, including economic viability, financing opportunities and institutional barriers. The main outcomes show that restoration at scale depends not only on ecological or technical aspects, but also on regulatory, governance, political and financial conditions. Across CLIMAREST demonstration sites, despite differences in habitats and approaches, recurring challenges included dependence on external funding, low political priority, limited access to finance, high costs, insufficient baseline data and difficulty measuring success. Fragmented responsibilities, complex permitting procedures and limited coordination across governance levels were also identified as critical obstacles to implementing restoration at the pace and scale required by the NRR. A key lesson from CLIMAREST is that marine implementation of the NRR requires clearer allocation of responsibilities, fit-for-purpose permitting pathways, coordination with policy frameworks such as the Marine Strategy Framework Directive, Water Framework Directive and Maritime Spatial Planning, and governance arrangements that support legitimacy, public support and long-term stewardship. The lessons emerging from CLIMAREST identify transferable actions and enabling conditions that can be adapted to regions with similar ecological, socio-economic or governance contexts. Overall, achieving NRR objectives at scale will require legally robust, coordinated and participatory governance systems, supported by credible evidence, efficient permitting, long-term monitoring and financing approaches adapted to diverse restoration contexts.

Implementation of marine restoration projects - insights from CLIMAREST

Ida Beathe Øverjordet, SINTEF Ocean AS – Norway

The Mission Ocean project CLIMAREST implemented restoration solutions across five marine ecosystems including seagrass meadows, oyster reefs, rocky bottom algae forests and soft bottom ecosystems influenced by aquaculture and sewage. Replication of the solutions were initiated in six sites across Europe. Across demos the success of the

implementation, observed and projected ecological and socio-economic benefits, as well as barriers and enablers for scaling were analyzed. The aim of the speed talk is to inspire the workshop attendants in the discussion about how to successfully implement the Nature Restoration Regulation in the marine environment.

Empowering local communities to implement restoration actions in support of the Nature Restoration Regulation.

Ida Beathe Øverjordet, SINTEF Ocean AS – Norway

The Mission Ocean project BlueActionAA is engaging local communities in the restoration and protection of marine and freshwater ecosystems. The project is offering local stakeholders financial support through cascading grants, capacity-building resources and technical assistance to ensure effective implementation of ecosystem restoration. By promoting community-led initiatives, it seeks to advance the goals of the EU Mission Restore Our Ocean and Waters by 2030. It will assist EU Member States in implementing relevant legislation and enhance community readiness to adopt innovative restoration solutions, contributing to the European Green Deal's targets. In this session we will highlight the empowering mechanisms and upcoming cascade grant opportunities.

Baltic Restoration Action Plan and Toolbox

Kurvinen Lasse, Metsähallitus Parks Wildlife Finland – Finland

The Protect Baltic project supports Baltic Sea marine restoration through a Regional Restoration Action Plan and adaptive Restoration Toolbox mandated by the 2021 Baltic Sea Action Plan (B27). Developed in consultation with HELCOM WG BioDiv while gathering input from stakeholders, as well as EU, and ICES events, they guide restoration of benthic species, biotopes, and habitats through harmonised measures, practical methods, and agreed targets, while addressing alignment with the EU Nature Restoration Regulation, data gaps, and usability ahead of implementation from late 2026.

A national framework for Posidonia oceanica meadow restoration in Greece: Scientific guidance and implementation tools under the EU Nature Restoration Regulation

Vasilis Gerakaris * [1], Eugenia T. Apostolaki [2], Maria Salomidi [1]
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The EU Nature Restoration Regulation (NRR) sets legally binding targets for degraded ecosystems, including Posidonia oceanica meadows, yet translating these obligations into effective restoration action remains a major challenge across the Mediterranean. In Greece, this presents a substantial challenge: seagrass restoration is ecologically demanding, the species recovers slowly and is highly sensitive to disturbance, and evidence for successful large-scale active restoration in the Mediterranean remains limited.
To support national implementation of the NRR, the Hellenic Centre for Marine Research (HCMR) developed a national guidance framework, providing scientific guidance and practical implementation tools for P. oceanica restoration across Greek coastal waters. The framework offers a transparent decision-support pathway linking ecological status assessment, pressure analysis, restoration prioritization and intervention planning, bringing consistency to a field where approaches have often varied among institutions and stakeholders.
Rather than treating active restoration as a default solution, the framework prioritizes prevention, pressure mitigation and passive recovery, reserving active measures for situations where pressures have been effectively addressed and natural recovery is unlikely to achieve restoration objectives within realistic management timescales. Adaptive management principles are embedded throughout the framework, including predefined performance thresholds, monitoring requirements and decision pathways for modifying or terminating interventions when necessary. Key implementation barriers remain, including the absence of dedicated licensing procedures, fragmented governance responsibilities and limited long-term financing mechanisms. Addressing these challenges is essential for achieving durable restoration outcomes. By bridging restoration science, policy and practice, the framework provides a structured basis for planning, prioritizing and implementing P. oceanica meadow restoration in Greece.

Life MAPPER: Guidelines for MAPping, ProtEcting, and Restoring Marine Ecosystems

Federica Foglini, Cnr-Istituto di Scienze Marine del Consiglio Nazionale delle Ricerche = Marine Science Institute – Italy

Marine habitats are fundamental to ocean biodiversity and provide critical ecosystem services, yet decades of overexploitation have severely degraded large portions of European marine environments. The EU Nature Restoration Regulation represents a landmark response to this crisis, but its effective implementation is hampered by a critical knowledge gap: vast areas of EU marine habitats remain unmapped, and existing maps frequently lack the biological resolution required for regulatory purposes.

LIFE-MAPPER directly addresses this challenge by consolidating scientific knowledge and best practices in marine habitat mapping and ecological restoration across four objectives: developing harmonised mapping guidelines and cost-benefit analyses; establishing standardised methodologies to assess habitat quality, quantity and connectivity; producing operational guidance for restoration technique selection and cost estimation; and designing a prioritisation framework to maximise ecological benefits and optimise resource allocation.

Results will be delivered through the **LIFE-MAPPER Manual** and an open-access **Knowledge Platform**, supporting EU Member States and the European Commission in the coherent implementation of the Marine Strategy Framework Directive, the Habitats Directive, and the EU Biodiversity Strategy 2030.

THEMATIC SESSIONS

(Within session abstract order may differ from programmation)

Agricultural landscape restoration

Animal species & restoration

Coastal restoration

Ecosystem functioning

Education and training

Enabling restoration: Socioeconomic perspectives

Forest restoration

Grassland, prairie, steppe and other open ecosystem restoration

Invasive species & restoration

Landscape scale and corridor restoration

Marine Restoration

Nature Restoration Regulation, from planning to implementation

New tools and technologies

Peatland restoration

Policy frameworks for restoration, NRR and beyond

Sociological Perspectives and Stakeholder Involvement

Standards and indicators

Urban environment restoration

Wetlands and Rive

AGRICULTURAL LANDSCAPE RESTORATION

Governance challenges in riparian restoration on agricultural land: How conceptions and valuations shape the potential for riparian zone restoration on agricultural land in Norway

Erica Colman-Denstad, University of Oslo – Norway

Riparian zones on agricultural land represent narrow but important corridors for biodiversity and connectivity and contribute to a range of ecosystem services. They are also multifunctional socio-ecological spaces that are interpreted and valued differently across stakeholders.
Drawing on workshop dialogues and documents from a collaborative research project in Norway, this paper examines how the potential for restoration of watercourses and riparian zones on agricultural land becomes entangled with, and weighted against, broader debates about the responsibility of farmers, food security, climate resilience and biodiversity loss. Because legal frameworks provide flexible yet ambiguous definitions of these areas, actors draw on different assumptions about what defines a riparian zone, what consitutes ecological function, what outcomes are non-negotiable, and which roles and functions should guide restoration decisions. As a result, participants operate with divergent value hierarchies that are left implicit and concealed by flexible concepts, balancing considerations such as food security and agricultural considerations, runoff and erosion, flood protection, water quality and biodiversity in fundamentally different ways. These competing interpretations shape governance processes and influence which restoration pathways are considered legitimate or feasible.
Taking an interdisciplinary approach informed primarily by cultural history and philosophy, this paper explores these social and cultural barriers for meaningful and feasible riparian zone restoration, by unpacking how ecosystem services interact with stakeholder value hierarchies.

Life After Corn!

Gilles Lecuir, Regional Agency for Biodiversity in Paris Region – Institut Paris Region – France

In 2010, the village of Muttersholtz (Bas-Rhin, France, population 2,300) produced a municipal biodiversity atlas that identified ecological corridors in need of restoration, particularly in areas of intensive agriculture where irrigated corn is the primary crop.
In this session we invite you to explore through images how, 15 years later, all of these ecological corridors have been restored by mobilizing every possible tool and resource: protection under the local urban plan, land monitoring, creation of a network of ponds, restoration of grass strips and hedge plantings, as well as rural leases with environmental clauses, real environmental obligations, local consultation, and payments for environmental services.
A final 2-hectare municipal plot of cornfields was restored between 2022 and 2023, following the retirement of its farmer, with the creation of a large linear wetland spanning over 1,000 square meters in the center, a late-mowing zone to the north, and an area left to evolve naturally to the south. After the project was approved by the LPO, the work was carried out by Nature et Techniques, a local company specializing in ecological engineering. No helophytic plants were planted along the pond's banks to allow the seed bank to establish itself naturally based on the substrate and exposure; the meadow was seeded with a mix of local seeds, yielding positive results as early as the following spring
A documentary film was made about this restoration of ecological corridors: https://www.youtube.com/watch? Muttersholtz was awarded French Capital of Biodiversity in 2017 and 2025.

Simulation-Informed Landscape Design for Restoring Ecological Functions in Tropical Agricultural Landscapes

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Land-use change has transformed many tropical landscapes from forests into agriculturally dominated systems, often resulting in simplified monocultures and degraded ecological functioning. Agricultural land uses such as rubber and oil palm plantations provide socio-economic benefits but frequently reduce ecological functions, creating trade-offs that challenge long-term multifunctionality. Ecological functions also respond differently to landscape configuration. Consequently, key questions arise about how landscapes can be designed to restore multiple ecological functions while

maintaining viable livelihoods under fluctuating commodity prices.
To address this challenge, we developed the ecological-economic land-use change model EFForTS-ABM, based on data from Indonesia. The model simulates spatially explicit land-use decisions by smallholder farmers and their consequences for economic outcomes from crop production, as well as ecological functions such as carbon pools, biological pest control, and biodiversity. Using EFForTS-ABM, we simulated alternative landscape designs with varying degrees of ecological connectivity under different price scenarios for rubber and palm oil. We then assessed landscape-level ecological and socio-economic functions and the trade-offs among them over time.
Our results show that individual ecological functions respond differently to changes in landscape designs, resulting in differences in the magnitude of trade-offs with socio-economic functions. In addition, temporal land use changes, driven by crop price fluctuations, alter restoration outcomes and trade-offs over time. These findings provide a basis for identifying landscape designs that support the restoration of multiple ecological functions while sustaining long-term economic benefits and demonstrate the usefulness of ecological-economic land-use change models such as EFForTS-ABM for evaluating restoration-oriented landscape designs under changing socio-economic conditions.

Can the EU Nature Restoration Law deliver for agricultural ecosystems?

Karl Delauw, University of Ghent – Belgium

Agricultural ecosystems are at the centre of the climate and biodiversity crises. Intensive agricultural practices have contributed significantly to biodiversity loss, soil degradation, water pollution, and greenhouse gas emissions, while agriculture itself is increasingly vulnerable to ecological decline and climate impacts. In response to these interconnected crises, the EU Nature Restoration Law (NRL) introduces legally binding restoration targets.
This presentation forms part of a doctoral research project examining whether the NRL provides a sufficiently coherent and effective legal framework for the ecological restoration of agricultural ecosystems, or whether important gaps remain. While the NRL represents a significant step forward compared to the existing EU legal framework, important questions persist regarding its ability to deliver meaningful restoration outcomes in agricultural ecosystems.
Several potential shortcomings of the NRL for agricultural ecosystems will be critically assessed. Particular attention is paid to the relationship between the NRL and existing EU policies such as the Common Agricultural Policy (CAP), as well as to broader issues of coherence with climate, water, soil, pesticide legislation and even EU-animal law. In addition, the presentation explores challenges related to implementation, enforcement, and governance.
The presentation argues that the effectiveness of ecological restoration law depends not only on ambitious restoration targets, but also on the degree to which restoration obligations are coherent, enforceable, and integrated within existing frameworks. By identifying key legal and governance challenges, this presentation contributes to ongoing debates on how restoration frameworks can better support effective, legitimate, and long-term restoration of agricultural ecosystems in Europe.

Successful green hay restoration of former arable land in Ireland – farmer-led, ignoring the guidelines, and still flower-rich!

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The use of ‘green hay’ – the same-day transfer of hay from a species-rich donor site to a species-poor recipient site – as a restoration technique is still quite new in Ireland. This presentation will tell the story of an unlikely success. A progressive-minded farmer wanted to do better for nature on a farm she inherited, and in spite of its past use for intensive arable production, and her not having experience with the use of green hay nor any advisors on board at first, she nonetheless embarked on an ambitious experiment. She may not have followed the guidelines, but the results have been striking. It is now flower-rich, buzzing with life, and remarkably, supports a thriving orchid population. We have tracked the site over time using detailed botanical quadrats, and the results thus far will be presented. The learnings from this site and the possibilities for more widespread use of the technique across Ireland will be discussed.

Do restored agroforestry buffers still function after two decades? Preliminary evidence from the Guvrin intermittent stream, Israel

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Intermittent streams in dry agricultural landscapes require restoration approaches that function under long dry periods, episodic floods and chronic agricultural pressure. Along the Guvrin Stream, northern Negev, Israel, KKL-JNF established broad-leaved riparian buffer strips in 2006 by distancing crops from the stream corridor and planting trees along restored margins. Nearly two decades later, their ecological functioning has not been systematically quantified. We present preliminary baseline evidence from an ongoing integrated assessment of these restored agroforestry buffers.
Soils were sampled on the field-facing and stream-facing sides of the tree strip across paired plots adjacent to two land-use contexts: rainfed winter cropping with low inputs, and summer-irrigated, high-input vegetable/grassland systems. Tree vitality was assessed using repeated leaf SPAD measurements on *Ceratonia siliqua*, *Pistacia atlantica* and *Ziziphus spina-christi*.
Preliminary paired analyses indicated clear attenuation of salinity-related soil indicators only under the summer-irrigated/high-input context. Electrical conductivity declined from 587.3 *± 17.1* to 455.9 ± 26.2 μS cm^{1}, –22.1%, q = 0.037; total dissolved solids from 278.2 ± 7.4 to 194.5 ± 8.7 ppm, –30.2%, q = 0.00027; and salinity from 0.283 ± 0.011 to 0.204 ± 0.008 ppt, –27.7%, q = 0.0042. Comparable attenuation was not detected under rainfed winter cropping. SPAD values were higher under the irrigated/high-input context in *C. siliqua* and *P. atlantica*, but not in *Z. spina-christi*.
These preliminary results suggest that restored riparian agroforestry buffers may provide measurable restoration functions where agricultural pressure is highest, while highlighting the need for continued monitoring of buffer design, species suitability and soil–water–vegetation responses.

ANIMAL SPECIES & RESTORATION

Ant and carabid beetle responses to restoration of species-rich temperate grasslands

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Temperate grasslands are one of the unique but endangered ecosystems of the world. In the past a large area of them have been ploughed and their recovery is rather slow. Majority of restoration projects target plant diversity despite the fact that many organisms directly interact with plants or fulfil ecological functions. We studied the recovery of ant and carabid beetle communities in the White Carpathians by comparing ancient well-preserved grasslands with grasslands re-established on former arable fields by sowing regional seed mixture (˜20 years ago). A more detailed assessment was made along transects from ancient to restored grassland through a hedgerow. Composition of both communities was less species-rich and complex in the restored grasslands. Ant species found in restored grasslands represented a subset of the ancient grassland species pool with lower variability between localities. In restored grassland, compared to ancient ones, generalists, more aggressive species, and those which establish colonies independently and rely on stored resources (claustral) were more frequent. In case of carabid beetles, the composition of their community was different between the restored and ancient grasslands with little overlap. Eurytopic and macropterous species were frequent in restored grasslands while adaptable, brachypterous and carnivorous species were typical for ancient grasslands. The hedgerow had a positive effect on number of species and Shannon-Wiener index by allowing coexistence of ants requiring woody plants as well as relic and forest carabid beetles with species of open landscape. Our study demonstrates the history of grassland to affect the composition of insect communities.

Reduced management intensity promotes biodiversity in mountain grasslands

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Semi-natural mountain grasslands are increasingly threatened by management intensification, highlighting the need for biodiversity-friendly management practices. Although agri-environment schemes promote extensive management to enhance biodiversity, robust evidence is till lacking on whether degraded intensively managed mountain meadows can be restored to more biodiverse states by reducing management intensity.
We experimentally tested the effects of reduced management intensity on biodiversity and agronomic performance in

formerly intensively managed hay meadows across 12 sites in the Swiss Alps. Since 2019, two of three meadows per site were restored by adopting either extensive management (no fertiliser) or low-intensity management (one-third of the former fertiliser dose), while the third meadow remained intensively managed (control).
After six years, plant species richness was 18% higher in extensively managed meadows than in controls. Fertiliser cessation shifted plant community composition toward a higher proportion of legumes and reduced vegetation density, resulting in lower hay yields (- 15–32%), while forage quality remained largely unchanged.
Extensive management also benefited arthropod communities. Already four to five years after the cessation of fertilisation, abundances (+ 38–112%) and species richness (+ 27–81%) of spiders, true bugs, leafhoppers, and butterflies increased compared to controls. These responses were associated with increased vegetation structural complexity and higher number of potential host-plants. Wild bees and hoverflies did not respond to reduced management intensity.
Overall, reducing management intensity can rapidly enhance biodiversity while maintaining forage quality, though long-term sustainability will require landscape-scale management strategies to balance biodiversity conservation and agricultural production.

How do Field Size and Crop Type moderate the Effects of Flower Strips and Hedgerows on Pollinators – A global Meta-Analysis

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The enhancement of field margins by temporary wildflower strips and permanent hedgerows to support pollinators in agricultural landscapes is a widely applied restoration practice. While individual studies report positive effects of these interventions, a comprehensive assessment comparing the temporary and permanent measures and simultaneously considering factors such as field size and crop type is still lacking. Therefore, we conducted a literature-based hierarchical meta-analysis including data from 40 research articles on the main pollinator groups Hymenoptera, Lepidoptera, and Diptera. The abundance and species richness were analysed. Our results showed significant positive effects of both restoration measures on pollinator abundance. Effects were stronger for wildflower strips than for hedgerows. A similar pattern was observed for species richness, with comparable effects. Our findings revealed strong positive effects across all organism groups with no significant differences in abundance. For species richness, a significantly stronger effect for Hymenoptera compared to Lepidoptera and Diptera was found. Crop type showed no significant effects on overall pollinator abundance or species richness, with only minor differences in effect magnitudes. Similarly, field size was not a significant moderator of restoration effects for pollinator abundance or species richness. Overall, our results show that the restoration of agricultural landscapes is an important tool for promoting the persistence of pollinators. While crop types and field sizes appeared to be of relatively minor importance, both restoration measures, permanent hedgerow structures and temporal wildflower strips, clearly improve the stability and diversity of agricultural pollinator populations.

Risks and management implications of reintroduction scenarios for European and Atlantic sturgeons in Western European rivers

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Sturgeons are an ancient clade that persisted through major climatic fluctuations but now face severe decline in the Anthropocene. This study focuses on the European sturgeon (Acipenser sturio) and the Atlantic sturgeon (A. oxyrinchus), two long lived diadromous species formerly widespread in European rivers, now critically endangered or regionally extinct and targeted by reintroduction programs. We assess habitat suitability, population establishment, and potential interspecific competition under current and future climate scenarios. We develop a hybrid species distribution model combining environmentally driven habitat suitability with simplified population dynamics parameterized from key life history traits, providing a mechanistic framework to quantify niche breadth, overlap, and environmental constraints across European catchments over time.
A central objective is comparing ecological niches at population and species levels. Reintroduction programs typically rely on a single source population, so realized niches used in calibration represent only a subset of the historical species niche. We therefore compare population level niches (Garonne Dordogne for A. sturio; Saint John River for A. oxyrinchus) with species level niches reconstructed from palaeo ecological data over the last 12000 years and historical records from 1850 to 1950. This comparison clarifies how differences in temperature and precipitation tolerances and

life history traits may shape interactions and coexistence under environmental change.
By linking habitat suitability, life history traits, niche overlap, and population dynamics, this study supports conservation planning by identifying basins where conditions limit establishment or where competition may hinder reintroduction success, thereby informing decisions on basin and species selection, and management strategies in Europe.

Keystones and flagships: white-tailed eagle reintroductions in wetland, freshwater and coastal restoration

Duncan Halley, Norwegian Institute for Nature Research – Norway

Single species reintroduction is one of the oldest forms of ecological restoration. While the shift in emphasis to large scale, ecosystem-based restoration is a wholly welcome development, species reintroduction remains an important tool in wider ecological restoration - both for restoring ecological functionality to degraded systems (keystone species) and for fostering public interest in nature restoration, leading to greater support for and understanding of restoration in general (flagship species). Reintroductions of white-tailed eagles to Scotland, Ireland, England, Spain, and inland France provide an illuminating example of the continuing role of species reintroduction in restoration generally. In this talk reintroductions from 1975 to the present are examined - in their functions of the restoration of a keystone large avian scavenger (the 'vulture' of freshwater and coastal ecosystems), a predator, and as a flagship species whose reintroduction has directly affected the development of more ecosystem-based approaches to ecological restoration in the same areas. The challenges and opportunities encountered in the 50 years of reintroductions into varied social and economic, as well as natural, environments are described. The insights for more effective use of this and other species for wider ecosystem restoration in future - and some pitfalls to avoid - are detailed.

Knowledge of the many: Using Citizen Science data to reveal plant-pollinator interactions and pollination hotspots for butterflies (order: Lepidoptera)

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Europe's pollinators are facing strong population declines and although they are providing ecosystem services estimated at over EUR 5 billion per year, knowledge of their plant associations is incomplete. Citizen Science platforms are used to record single-species interactions, yet comprehensive assessments of plant-pollinator interactions are limited. Here, we investigate these interactions for the well-known taxa of butterflies and burnet moths (order: Lepidoptera) in Germany, a central European country, using over 300,000 images from iNaturalist. We trained a neural network to detect Lepidoptera and flowers on Citizen Science images, recognise their interactions and identify them to species-level. Based on these interactions and available data on the distribution of butterflies in Germany we identified hotspot areas of ecosystem services and compared interactions networks between regions. We argue that citizen science data, combined with automated image analysis, can greatly expand our understanding of pollination ecology. Our approach is scalable to other taxa and regions and can provide important insights to inform current policies, such as the EU Pollinators Initiative 2023 and Article 10 of the Nature Restoration Regulation (EU 2024/1991). We discuss our findings in light of the development of criteria to identify and map Key Pollinator Areas (KPAs) and Buzz Lines (action 2.3/ 4.4) under the EU Pollinators Initiative, conservation tools which shall help to put Europe's pollinators back on track.

From roots to shoots: How the introduction of meadow ants affects grassland restoration from the soil to the pollinators

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Ecosystem engineers are crucially important assets in the efforts to restore degraded land-scapes worldwide. They recreate habitats, restore missing niches, increase heterogeneity and can provide resilience and stability to fragile ecosystems. Ant mounds have historically been translocated to fulfil economic functions such as "pest control" in commercial forestry and to rescue mounds from potential destruction, but very rarely has their translocation for restoration purposes been examined - despite their strong ecological influence and the benefits they provide the wider ecosystem through engineering. Among grassland ant species, the yellow meadow ant (*Lasius flavus*), is a keystone species and ecosystem engineer known for increasing soil, structural and vegetative heterogeneity within grassland habitats. The impact of yellow meadow ant translocation not been investigated. This study performed translocations of yellow meadow ant mounds at two different sites in the UK, examining the effects of their introduction to two different

grassland habitats after 15 months. We investigated whether yellow meadow ants change soil properties (pH and carbon-nitrogen ratio), increase the diversity of soil microbiota functional groups, or affect plant species composition, and whether the presence of the ants affects the wider grassland or is restricted to the mounds. We also examined the role of mounds in providing resources for pollinating insects seeking warm patches, bare ground or flowers. Our results reveal the potential benefits of yellow meadow ants as a tool for the restoration of grasslands, for the benefit of soil and pollinators.

PIGARGO's project: the return of europe's largest eagle to the iberian peninsula

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The GREFA Pigargo's Project was initiated with the primary objective of reestablishing the White-tailed Eagle (*Haliaeetus albicilla*) within the northern Iberian Peninsula. To evaluate the project's potential, an experimental reintroduction phase was conducted between 2021 and 2022 in the Asturian village of Pimiango, Spain. During this period, 25 individuals of Norwegian origin were translocated and released.
The release technique employed was developed by GREFA over the course of it's 45-year history-a hybrid of hacking and acclimatization. This project marked the inaugural application of this technique to the White-Tailed Eagle, with empirical data indicating a highly favorable response from the species.
To facilitate rigorous scientific monitoring, all specimens were fitted with GPS/GSM tracking devices. This technology allowed to analyze: habitat selection and adaptation patterns, interspecific interactions with local endangered fauna and potential conflicts with local socio-economic activities.
The concluding feasibility study confirms the successful integration of the species into the northern Iberian ecosystem, confirming a null impact on endangered species and local socioeconomic interests. Trophic monitoring indicates that the common carp (*Cyprinus carpio*) constitutes the main prey for the released individuals, an invasive alien species that occurs in high densities throughout their frequented habitats. While electrocution remains the primary mortality cause, the current survival rate is established at 68%. Pair formation reveals five pairs, two of them trios. In 2025 the project achieved a significant rewilding milestone: the first successful wild-reproduction of the species since its regional extinction in the late 19th century.

Building a pollinator landscape network through participatory territorial planning : early feedback from the "Trame Pollinisateurs" (Pollinator Network) program in France

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As pollinators decline accelerates across Europe, restoring their populations is a major priority under the EU Nature Restoration Regulation (NRR). In response, the French NGO Noé developed the "Trame Pollinisateurs" (Pollinator Network), an innovative framework designed to restore ecological corridors for wild pollinators across open ecosystems. This tool leverages connectivity as a catalyst for multi-stakeholder engagement, demonstrating how adjacent local initiatives scale up into cohesive regional networks.
The methodology bridges GIS-based spatial modelling with collaborative planning to integrate local socio-economic dynamics into the ecological design. First, regional mapping of pollinator-friendly habitats is generated using diverse datasets (land cover, agricultural registries, artificial barriers, pesticide pressure etc). This baseline is then used during workshops uniting local stake-holders to co-design ecological continuities.A first pilot conducted in the Nièvre department in 2025 mobilized 25 diverse stakeholders including public authorities, farmers, beekeepers, conservationists, and land managers, covering 30% of the municipalities. Through participatory mapping, participants contributed 115 field observations and delineated over 320 km of potential corridors, where semi-natural grasslands, watercourses, and local dynamics emerged as key structuring elements for future restoration.
Beyond mapping, the program establishes long-term local governance to deploy targeted restoration projects and pollinator monitoring across agricultural, urban, and natural matrices. This presentation will share the co-design methodology, initial spatial results from the pilot, and strategic perspectives on how participatory corridor restoration can successfully fulfill NRR Article 10 targets by reconnecting fragmented landscape ecosystems.

Impact investing: lessons learned from human-wildlife coexistence in HiP, KZN South Africa

Sandra Hoomans, Wildlife Act – South Africa ; Saxion UAS – Netherlands

Biodiversity monitoring delivers data for strategic decision-making concerning sustainable socio-ecological systems. In the case of the Hluhluwe-Imfolozi (abbrv. HiP) region, KZN South Africa, governmental policies interfere with conservation by allowing mining industry to put physical pressure on the area. Another pressure stems from growing numbers of communities living close to HiP-borders, and from poaching activities. Disruptive events endanger conservation of endangered species. Covid impacted on local economies and negatively influenced monitoring. Power shifts especially in the USA meant less funding for local NGO Wildlife Act, that provides monitors to HiP. The consequence being, discontinuation of educating monitors, thereby endangering conservation work. Climate change destabilizes water flows, HiP went from severe drought to flooding. Hostility among communities puts pressure on conservation work and the deliberate cutting down of fences meant absorption of already low budgets for conservation. Based on interviews in 2023 a strategy map was made, enabling making strategic decisions, prioritizing and measuring impact and serving as an overall method to focusing HiP management on activities that result in sustainable social-ecological systems. The question however remains how to structurally educate local youth and design a strategy to set up and connect business to biodiversity conservation. Gaining insights into drivers of the quality of local SES, research into sustainable values-based strategic decision-making and interactive design of integrated strategies, applying practical business tools such as BSC, can well support ecological restoration provided that governments are able to effectively provide an institutional framework aligned with e.g. the Global Biodiversity Framework.

Friends, not foes: Why invertebrate recovery starts with predators

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Global restoration efforts are expanding rapidly, yet our understanding of how invertebrate communities assemble in newly created habitats remains limited. We investigated whether top-down or bottom-up processes drive community assembly across 53 restored calcareous grasslands and 59 broadleaved woodlands in Britain, spanning 1-67 years post-restoration. We sampled predatory and herbivorous invertebrates and used Structural Equation Modelling to assess how local factors (site age, size, habitat structure) and landscape context influence trophic guild interactions. Top-down processes dominated community assembly in terms of the diversity of both habitats. Large predators drove community structure, increasing both small predator and herbivore diversity. All trophic relationships were positive, suggesting facilitation prevails over competition during restoration. Vegetation structure played a key role in structuring invertebrate communities, but landscape effects were minimal. These findings highlight the crucial role of top-down predation in diversifying invertebrate communities during restoration, emphasising the need for minimum habitat requirements for these taxa.

Restoration of plant-flower visitor networks with pollinator conservation measures

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Ecological restoration is a key strategy for mitigating ongoing pollinator declines. While the addition of floral resources is acknowledged to benefit pollinators and enhance network complexity and functional redundancy, the contribution

of non-floral resources, such as nesting sites, remains understudied despite their essential role in the establishment and persistence of wild bee populations. We hypothesize that the addition of nesting sites, without any changes in floral composition, may enhance bee diversity and thus affect interaction network properties.
As part of the European research project RestPoll ("Restoring pollinator habitats across European agricultural landscapes"), we evaluated the overall effects of ecological restoration on plant-flower visitor interaction networks by comparing restored and unrestored sites, while also assessing the influence of the different restoration measures implemented within the project, through floral resources addition, nesting sites addition, and/or through bee-friendly practices implementation.
A total of 159 sites (76 restored, 82 unrestored) across 7 countries (Germany, Spain, Hungary, France, United Kingdom, Sweden and Switzerland) was considered in 2024. For each site, we constructed bipartite flower-bee interaction networks by pooling data collected within the year. Network metrics, such as network size, nestedness and specialization, were computed and used as response variables in models to assess both the global effect of restoration and the effect of different restoration measure categories. Preliminary results suggest that restored sites support larger networks regardless the restoration measure. Furthermore, the combination of bee-friendly practices and resource addition appear to produce more specialized networks than the other implementation categories investigated.

COASTAL RESTORATION

In the marshes of the Atlantic coast, what operational levers can be used to restore riparian habitats?: example of a project carried out on a research farm

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The Nature Restoration Regulation (CE 2024/91) was adopted by the European Union in 2024 and requires that 90% of degraded ecosystems be restored by 2050. In France, the implementation of this regulation in a national action plan must set specific objectives and outline measures to achieve them. In this context, the INRAE Saint-Laurent-de-la-Prée research farm, located in the marshes of the Atlantic coast, has been testing an innovative approach to biodiversity conservation and restoration since 2019, i.e. a results-based approach. Quantitative targets for the desired level of biodiversity are set and agricultural practices and field adaptations that promote this biodiversity are implemented, while taking into account the farm's productive goals and even seeking synergies between "agriculture and biodiversity conservation" wherever possible. This can lead to efforts to restore certain habitats, such as ditch banks which provide breeding, feeding, and refuge sites for many animal and plant species-both terrestrial and aquatic, e.g. dragonflies, amphibians, fish. However, these riparian habitats are subject to pressures (trampling by cattle, impacts of invasive species - in particular the Louisiana crayfish and the coypu), which tends to cause them to disappear. We therefore sought to identify the operational levers needed to restore them. On the research farm, a project to reshape the banks of a ditch was combined with an experiment involving the reseeding and protection of vegetation. We show that this reshaping reduces the formation of new coypu burrows, but that plant recolonization is largely limited by the combined action of coypus and crayfish.

Scaling Up Estuarine Recovery: Lessons from the Wilder Humber Seascape Restoration Programme

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The Wilder Humber programme is a pioneering, five-year, data-led initiative restoring marine habitats and species across the Humber Estuary. Led by Yorkshire Wildlife Trust and Lincolnshire Wildlife Trust, and supported by Ørsted alongside the Environment Agency and the Marine Management Organisation, the programme represents a collaborative approach to large-scale marine recovery.
Operating at a seascape scale, Wilder Humber focuses on restoring ecosystem function and connectivity rather than isolated habitats. Key interventions include seagrass restoration, the reintroduction of 500,000 native oysters, saltmarsh

creation, and reconnecting sand dune systems. Together, these actions aim to enhance biodiversity, improve water quality, increase blue carbon storage, and strengthen ecological linkages across the estuary.
This abstract highlights seagrass and native oyster restoration as flagship case studies of innovation. Seagrass restoration in the Humber is particularly ambitious given the estuary's high turbidity and dynamic conditions. An intertidal planting trial tested multiple methods, including seed-based approaches and seagrass sod transplantation, demonstrating significant differences in performance. These insights are now guiding a hybrid, patch-based approach to improve establishment, encourage natural expansion, and strengthen habitat connectivity.
The programme is also delivering the UK's first intertidal native oyster restoration, actively shifting ecological baselines. By trialling different life stages, including spat-on-shell and adult oysters, this work explores scalable, climate-resilient pathways for reef recovery, enabling oysters to establish under local environmental conditions and better withstand future stressors in a highly modified estuarine system.
By integrating science-led approaches with cross-sector partnerships, Wilder Humber demonstrates how complex estuarine systems can be restored at scale.

Shore Up: Integrating root tensile strength research into nature-based coastal erosion strategies

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Helping Nature Heal Inc. – Canada

Coastal communities across Atlantic Canada are increasingly affected by shoreline erosion driven by storm intensity, changing precipitation patterns, and upland runoff concentration. Conventional hard armouring approaches often fail to provide long-term resilience while negatively impacting ecological function. This presentation introduces Shore Up, Helping Nature Heal's nature-based, educational shoreline stabilization approach that integrates applied field practice with plant biomechanics research to develop adaptive, living coastal protection systems.
A key foundation of this work is research on root tensile strength, including findings from Lambton College, which demonstrate that plant roots function as a structural reinforcement network within soil matrices. Variations in root architecture, density, and tensile capacity significantly influence slope stability and resistance to erosive forces such as runoff, wind, and wave energy.
Shore Up translates this research into practical design by selecting plant species based on their biomechanical properties and roles within layered stabilization systems. Deep-rooted anchoring species, fibrous mat-forming plants, and surface stabilizers enhance soil cohesion, slow hydrological flow, and increase infiltration. Community-based implementation enables landowners to participate in ecological restoration processes.
Case studies from Nova Scotia, New Brunswick, and Prince Edward Island demonstrate reduced erosion and improved ecological function. These results highlight the importance of bridging research and practice, positioning root biomechanics as an underused parameter in coastal design. Shore Up is transferable across regions due to application in diverse soils and reliance on varied coastal plant species, enabling adaptable, nature-based strategies for scalable shoreline resilience.

Evaluating estuarine fish assemblage trajectories under ongoing restoration efforts

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Estuarine intertidal zones have historically been embanked and drained for agriculture, urbanisation, and industrial development, disrupting tidal exchange and severing hydrological connectivity between wetlands and estuarine channels. Reinstating these connections through depolderisation is critical for fish assemblages that depend on intertidal habitats as nurseries and feeding grounds. Here, we investigate long-term successional trajectories of fish assemblages in the Gironde estuary (France) following passive restoration via natural storm breaches at two former polders (Marais de Mortagne, 1999; Île Nouvelle, 2010). By combining historical post-breach monitoring data with new surveys conducted in 2026, we quantify assemblage responses along a restoration gradient spanning diked, semi-restored, and control sites. We apply a hierarchical joint species distribution modelling framework to capture species-specific responses to environmental and management gradients, while accounting for residual co-occurrence patterns, ecological traits, and spatio-temporal structure. Our results provide strong statistical evidence for a restoration effect on species occurrence probabilities over time. Approximately half of the species exhibited positive trajectories along the restoration gradient, including estuarine-dependent taxa such as *Chelon ramada*, *Dicentrarchus labrax*, and *Platichthys flesus*. In contrast, restoration had a marked negative effect on opportunistic invasive freshwater species, including *Ameiurus melas*, *Cyprinus carpio*, *Gambusia holbrooki*, and *Pseudorasbora parva*. Seasonality explained the largest proportion of variance in species occurrences, while salinity emerged as the most influential physicochemical

driver. By quantifying occurrence probabilities in relation to restoration dynamics, this study provides robust indicators of community recovery and offers actionable insights for adaptive management of estuarine ecosystems.

CO-WATERS - Restoring our ocean and waters together with regional and local communities.

Lise Guennal, NTNU (CO-WATERS project leader) – Norway

The Coalition of cities, regions, islands and ports for the Mission Ocean and Waters is developped by the project CO-WATERS, an Horizon Europe project running from 2025-2029. It aims to empower waterfront communities to restore marine and freshwater systems through collaboration, tailored services, and on-the-ground action as part of the EU "Restore our Ocean and Waters" mission which mobilise actors across Europe to protect and restore our water systems. CO-WATERS offers tailored services, such as networking, peer learning, trainings, citizen and stakeholder engagement, and funding advice, to help them take effective action. Backed by 17 partners, including six pilot areas, CO-WATERS will also develop the MOW Label to be acquired by waterfront cities, regions and islands, recognising their efforts to contribute to the Mission objectives.

ECOSYSTEM FUNCTIONING

Functional trait based selection of Mediterranean riparian vegetation for wastewater influenced stream restoration

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Wastewater discharges in Mediterranean streams stress riparian vegetation and worsen regional water quality. Within a One Health framework, this study aims to contribute to restoration projects that simultaneously enhance water quality and vegetation water availability. We tested the effects of treated urban wastewater on the growth and condition of several Mediterranean riparian plant species with different life forms.
An eight-month mesocosm experiment was conducted at the Urbar River Lab outdoor facility located at the Montornès del Vallès Wastewater Treatment Plant (WWTP), near Barcelona, Spain. Monospecific plantations of *Alnus glutinosa*, *Cornus sanguinea*, and *Iris pseudacorus* were established in 12-m-long flumes irrigated with WWTP effluent. Growth indicators and functional responses, including stem diameter, biomass production and composition, and leaf chlorophyll content, were monitored throughout the experiment.
Considering the chemical composition of WWTP effluents, we hypothesized that plant species capable of withstanding root anoxic conditions would perform better under the experimental conditions. Our results reveal contrasting species-specific responses. *C. sanguinea* exhibited high mortality and poor growth, likely due to excessive root flooding. In contrast, *I. pseudacorus* and *A. glutinosa* successfully tolerated the experimental conditions despite differing growth strategies, attaining higher final biomasses. Metal (Cu, Ni, Cd, and Fe) accumulation was detected in all species, primarily in roots, suggesting limited mobilisation to aboveground tissues.
Overall, our results suggest that treated urban WWTP effluents can support sustained plant development under appropriate conditions. However, the selection of species with suitable functional traits is necessary for ensuring the long-term success of wastewater-irrigated plantations and riparian restoration efforts.

Functional strategies for native graminoid establishment: insights from a BEF experiment in the Cerrado

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Grasslands and grassy biomes are among the most threatened ecosystems worldwide. Yet, their restoration remains limited by competition from invasive grasses and poor knowledge on native graminoid establishment, challenges shared across tropical savannas, Mediterranean grasslands, and temperate steppes. In the Cerrado (Brazilian savanna), one of the world's most biodiverse grassy biomes, restoration is particularly constrained by African pasture grasses, such as *Urochloa* spp., which suppress native ground-layer recovery. We established a biodiversity-ecosystem functioning (BEF) field experiment in a site degraded by decades of pasture use and heavily invaded by exotic grasses, manipulating species richness and functional diversity to test their effects on restoration outcomes. More than 14,000 individuals from 17 native graminoid species were propagated and transplanted during the 2025 rainy season. We quantified 13 above-and belowground functional traits associated with resource acquisition, drought tolerance, fire response, and competitive ability, a trait space that mirrors key axes of variation documented in grassland communities across biomes. These traits are linked to restoration performance indicators, including survival, growth, and vegetation cover during the first year. We test whether acquisitive strategies enhance early establishment under favorable conditions, while conservative strategies confer persistence through seasonal stress. By linking functional strategies to restoration performance, this study contributes to trait-based guidelines for species selection applicable beyond the tropics, toward a more general theory of graminoid community restoration.

Functional traits reorganization of urban springtail communities at night according to public lighting practices and context

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Artificial light at night (ALAN) is a rapidly expanding form of anthropogenic disturbance. Mitigation measures are therefore necessary to restore natural lighting conditions however, the effects are still understudied. In addition, soil fauna responses to ALAN are still poorly studied although it plays a keystone role.

In this study we investigated the impact of switching-off lighting at 23:00 at the latest compared to a full-night lighting on Collembola in 12 urban parks at Brest and Caen (France). Soil cores were sampled before and after 23:00 on all parks and Collembola were extracted using modified Berlese-Tullgren funnels. We measured the abundance and proportion of overall Collembola and orders independently, but also body length, presence of furca, ocelli and pigmentation. Finally, we assessed the abundance and proportion of life-forms (epedaphic, hemiedaphic and euedaphic).

To account for the nested structure of the data, a model averaging procedure was applied including landscape, climatic, soil physical and chemical characteristics and park management variables.

We observed that Poduromorpha abundance decreased under part-night lighting regardless of sampling time, whereas Symphypleona abundance increased, but only at the beginning of the night. Furca presence rate increased under part-night lighting, likely in interaction with sampling time, independently of taxonomic order. Life-form distribution was not influenced by lighting regime.

Therefore, these findings suggest that lighting regimes have consequences on functional traits of the soil communities and associated role in urban ecosystems and should be accounted in restoration processes and assessment.

Diversity and functional composition of plant communities: A comparative study of wildflower strips and field margins in agricultural landscapes

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Since the mid-20th century, agricultural intensification has led to simplified landscapes and reduced biodiversity. We evaluated how typical agri-environmental measures, such as perennial wildflower strips (WFS) and permanent field margins (margins), contribute to restoring biodiversity and ecosystem services.

We conducted vegetation surveys at 12 sites in central Germany in paired WFS and margins selected along a gradient of landscape complexity. The sampled WFS had been sown two years earlier with a 30-species wild forb mixture. For all recorded herbaceous plant species, functional traits were used to calculate Rao's quadratic entropy, community-weighted means and functional variance. Phylogenetic diversity was calculated, and correlations among species richness

and functional diversity were analysed. We assessed the effects of habitat type (WFS vs. margins) and landscape characteristics on diversity and functional composition.
Compared to margins, WFS showed higher species richness, phylogenetic diversity and Pollinator Feeding Index. Trait-based analyses revealed contrasting strategies: margins were dominated by conservative traits (e.g., greater plant height and rooting depth) which contribute to resilience and soil stabilization, whereas WFS showed more acquisitive traits (e.g., higher specific root length), supporting rapid nutrient uptake and improved nutrient cycling. Increasing landscape homogenization reduced variance of several traits, such as plant height, seed mass and rooting depth.
In conclusion, WFS are particularly important for restoring biodiversity and supporting pollinator communities in otherwise simplified agricultural landscapes. Although, margins were relatively species-poor, they still provide important erosion control.

The impact of restoration on plant functional traits in nutrient-poor peatlands

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In Europe, approximately 60% of peatlands have been subjected to agriculture, peat extraction, and forestry, leading to substantial deterioration in hydrology, biodiversity, and ecosystem functioning. Ecological restoration - aimed at recovering communities and functions characteristic of undisturbed peatlands - is therefore urgently needed. Although restoration is known to generally improve ecosystem conditions, its effects on functionality of plant species remain poorly understood. Incorporating trait-based approaches into restoration monitoring could provide a more mechanistic understanding of whether restored vegetation occupies similar functional niches as reference communities.
This study aimed to assess how restoration of forestry-drained, nutrient-poor peatlands influences functional traits of vascular plants and *Sphagnum* mosses. For this we compared trait composition at both community and species levels across restored, drained, and undrained sites. At the community level, restoration increased resemblance to undrained peatlands by leading to decreased specific leaf area and height and increased leaf dry matter content in vascular plants in contrast to drained peatlands. These changes indicate a shift towards more resource-conservative strategy. In contrast, *Sphagnum* trait composition at the community level was mostly unaffected by drainage and restoration. At the species level, key vascular species of nutrient-poor peatlands appeared to be characterized by high trait plasticity. This is likely a mechanism behind the observed high resistance to disturbances and rapid recovery upon restoration.

A global synthesis of biodiversity-function recovery after hydromorphological restoration

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Hydromorphological restoration is widely applied to improve ecological conditions in streams and rivers, yet its effectiveness is most often evaluated using biodiversity metrics, with ecosystem functioning rarely assessed. This limits our understanding of whether restoration restores not only community structure but also the processes that underpin ecosystem services. We compiled 582 effect sizes from 57 studies, covering 19 biodiversity attributes and 9 ecosystem functions, to quantify how ecosystem functions responded to hydromorphological restoration and assess whether biodiversity recovery consistently coincided with ecosystem function recovery. Functional responses varied strongly among ecosystem processes and baselines, with no universal trajectory of functional recovery emerging across restoration contexts. Differences in responses between biodiversity and ecosystem functioning varied across functions and did not change systematically with restoration age. Biodiversity–ecosystem functioning relationships were similarly inconsistent across functions and associated with high uncertainty. Together, these results indicate that ecosystem functioning does not recover as a single integrated property following hydromorphological restoration. Instead, individual ecosystem processes appear to recover along partially independent trajectories determined by distinct environmental controls, including nutrient supply, hydrologic exchange, organic matter dynamics, thermal regimes, and catchment-scale stressors. Functional restoration, therefore, requires more than rebuilding habitat structure and biodiversity alone: it requires restoring the environmental process domains under which ecosystem functions emerge.

EDUCATION AND TRAINING

Linking Sustainability, Conservation Biology and Restoration Ecology in Higher Education

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Land use, invasive species, and climate change are the main drivers of global biodiversity loss. Ecological restoration has emerged as a key strategy to counter these threats and help bend the curve of biodiversity decline. Addressing these challenges requires interdisciplinary training that links sustainability, conservation biology, and restoration ecology. In this presentation, I share an integrative teaching approach implemented in undergraduate and graduate courses at Leuphana university in Germany, where ecological restoration and conservation are taught through applied, research-based learning. Students engage in hands-on projects that link theory to practice, including surveys of invasive alien species in urban garden centers and on university campuses, assessments of carbon sequestration potential to offset institutional emissions, and measurements of urban heat dynamics. Through these activities, students develop practical skills in ecological data collection, analysis, and interpretation, while critically evaluating local socio-ecological systems. Student findings consistently emphasize that restoring urban forests and green spaces with native species is essential to enhance biodiversity, improve ecosystem functioning, and increase climate resilience. This approach demonstrates how interdisciplinary learning fosters systems thinking and equips students with both the theoretical grounding and methodological tools needed to address complex environmental challenges. By explicitly linking restoration practice with broader sustainability goals, this model contributes to preparing future scientists and practitioners to respond effectively to the ongoing biodiversity crisis.

An Innovative Methodology for Creating a Global MOOC on Dryland Restoration Using Artificial Intelligence and Expert Networks

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The restoration of dryland ecosystems requires trained practitioners and educational strategies that overcome geographical barriers and democratise advanced technical knowledge. This presentation outlines the rigorous design process for a specialised MOOC, based on the ADDIEM pedagogical model. Development began with a systematic consultation of experts to consolidate the literature base, which was processed using NotebookLM to structure a preliminary thematic index.

This table of contents was validated by dryland specialists from the University of Alicante, whose contributions enabled the scale and logical order of the course to be adjusted in line with the principles of ecological restoration. The course consists of 6 modules, 20 chapters and 79 lessons, covering a total of 23 teaching hours. Interactive materials such as knowledge checks, podcasts, dialogues and videos were created for the lessons, and an assessment quiz was included at the end of each chapter.

To ensure a global scope and mitigate a Mediterranean basin bias, a consortium of international experts enriched the content with transcontinental case studies, ensuring the applicability of the knowledge across diverse geographical contexts.

The final draft is based on NotebookLM's ability to generate content strictly based on the sources provided, eliminating 'hallucinations' and ensuring scientific integrity. Following a final phase of technical editing aimed at enhancing its international relevance, the material has been submitted to the Society for Ecological Restoration (SER) for external review. This methodology illustrates how AI-mediated collaboration between experts can enhance Education for Sustainable Development (ESD), offering inclusive, high-quality technical training on a global scale.

An educational program to train professionals in dryland restoration

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Ecosystem restoration is critical for addressing global environmental challenges and combating desertification. However, the shortage of skilled professionals and the limited availability of education and training opportunities may hinder progress in this field. As part of the Erasmus+ TEAM#UP project, we have developed an open educational program tailored to emerging professionals and practitioners in dryland restoration (DERTO). The program integrates the latest innovations in the field and incorporates an entrepreneurial perspective to foster new business opportunities. In collaboration with AGRESTA, a cooperative consultancy, CIPFP Palmeral, a vocational education and training school, and digital innovation experts from the Regional Government of Valencia, we have developed structured educational content to enhance existing vocational education and training curricula. This content served as the foundation for an expert course and micro-credential program at the University of Alicante. Educational materials will be freely accessible and the key outcomes of this initiative include the development of tutorials on basic and applied topics in ecological restoration, compiling educational resources and programs, assessing business opportunities in the restoration sector, and designing training strategies based on the analysis of practitioners' networks. By bridging the gap in specialized education and training, this initiative contributes to building a skilled workforce capable of tackling the challenges of dryland restoration, fostering innovation, and promoting sustainable entrepreneurship in the sector.

ENABLING RESTORATION: SOCIOECONOMIC PERSPECTIVES

Biological vs socio-economic drivers of restoration site placement in Europe

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As ecological restoration gains increasing attention in Europe, it is important to evaluate the characteristics of past interventions to inform future plans. Hundreds of ecological restoration projects have been implemented across Europe in the last 30 years, but these interventions have typically focused on single habitats, covered limited areas, and lacked a common strategic framework. To date, restoration projects have not been systematically compiled at the continental scale, and their spatial data are fragmented and inaccessible. This knowledge gap poses significant challenges for a risk-informed implementation of the EU Nature Restoration Law. We compiled an EU-wide database of restoration sites from LIFE and Horizon projects on Natura2000 areas. Our dataset covers a wide spectrum of activities, including multiple habitats. Using this dataset, we evaluated whether the location of interventions was mainly guided by biological factors (biodiversity characteristics) or economic convenience (agricultural opportunity cost). Specifically, we tested three non-mutually exclusive hypotheses using GLMM: H1) restoration has mainly occurred in areas with high biodiversity, H2) restoration has mainly occurred in areas facing biodiversity depletion, H3) restoration has mainly occurred in areas with lower agricultural opportunity cost. Our results reveal the processes leading to the selection of restoration sites in Europe, an aspect that has been studied for protected areas but has been overlooked for restored areas. Our dataset is the first large-scale spatially-explicit standardized collection of restoration actions across Europe. Our findings provide evidence-based recommendations for the implementation of Nature Restoration Law, highlighting the need for strategic, climate-informed restoration planning.

Sustainable Grazing and Value Addition: A Pathway to Conservation on the Lori Plateau

Aleksandre Mikeladze, SABUKO – Society for Nature Conservation – Georgia

The Lori Plateau in eastern Georgia is a dryland ecosystem facing the dual challenge of long-term grazing pressure and the need for viable rural livelihoods. The proposed study follows on from applied work in the region, led by SABUKO (Society for Nature Conservation), which has introduced improved grazing techniques, specifically reduced stocking rates combined with rotational grazing, collaborating with herders and reducing pressure on sensitive pasture systems while sustaining livestock-dependent incomes. The latter is addressed by the Dovlati initiative, which aims to consolidate local value chains, linking traditional pastoral production with higher-value markets for products such as cheese and other processed goods. We have applied cost-volume-profit logic to understand the relationship between herd size, costs and income. Value-added products can help increase income per animal and relieve the pressure to grow herd

sizes to stay economically viable. We demonstrate how conservation outcomes in grazing landscapes are dependent on financial structures at a farm level. When better market access and value addition enable farmers to improve returns per animal, it is realistic for them to cut herd sizes or maintain them, without lowering overall income, aiding in the conservation of this semi-arid pastoral system.

Unlocking Finance for Coastal and Marine Ecosystem Restoration: Key Challenges and Opportunities

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Coastal and marine ecosystem restoration is increasingly recognized as essential for reversing biodiversity loss, strengthening climate resilience, and supporting sustainable blue growth. Despite growing policy momentum in Europe, implementation remains constrained by fragmented governance, inconsistent methodologies, and limited, short-term funding. This study examines key barriers, needs, and opportunities in restoration finance through two targeted surveys conducted under the CLIMAREST project, covering 209 responses from practitioners, researchers, and funding stakeholders across 23 European countries. Results show that restoration remains dominated by small-scale initiatives, with 75% of projects covering less than 1 hectare. Practitioners highlighted several key barriers to implementation, including difficulties in securing upfront funding, integrating investment costs into project planning, and budgeting for long-term needs. Funding stakeholders, by contrast, identified biodiversity gains and improved coastal resilience as their leading investment priorities, while expected monetary return ranked lowest. Improved reputation, community support, and innovation opportunities were also identified as benefits. Although many stakeholders reported previous involvement in restoration and 84% expressed a positive outlook for future investment, 68% indicated that their resources are insufficient to cover full project costs. The results reveal both convergence and mismatch: practitioners and funders share a recognition of restoration's ecological value and the need for long-term financing, but diverge in their emphasis on project readiness, measurable outcomes, and financing models. These findings highlight actions to bridge this gap, including capacity building, standardized monitoring indicators, ecosystem service valuation, and cross-sectoral platforms to foster collaboration and trust, supporting Europe's transition toward climate-resilient and biodiverse coastal and marine systems.

Cost effectiveness of European lake restoration: Insights from the EU project FutureLakes

Kamergi Najla, UT-SEMIDE – UT-SEMIDE – France

We analyse the costs and benefits of restoring six major European lakes within the Horizon FutureLakes project: Lake Vesijärvi (FI), Kartuzy Lakes (PL), Lake IJssel complex (NL), Lake Karla (GR), Loch Leven (UK), and Lake Vansjø (NO).
The costs cover the up-front investment required for planning and design activities, permitting and compliance, implementation and construction costs needed to physically implement the restoration solutions, land acquisition as well as site preparation.
On the benefit side, we apply the ecosystem service valuation frameworks from Costanza et al. (1997) and the Millennium Ecosystem Assessment (2005) to systematically quantify provisioning, regulating, and cultural services. The provisioning services provided by the restored lakes include groundwater abstraction (Vesijärvi), food and in-lake wind energy production (IJsselmeer), irrigation and drinking water abstraction (Karla and Vansjø), fisheries (Karla, Vesijärvi and Loch Leven) and P reuse after recycling the removed sediment (Kartuzy). The valuated regulating services include water quality improvement (Vesijärvi), carbon sequestration (IJselmeer), algal blooms and phosphorus reduction (P entering) in Loch Leven. Cultural services are quantified for Lake IJsselmeer and Lake Karla. We further approximate recreational values (boating, bathing, fishing) in Lake Vansjø and Kartuzy Lakes using visitor numbers, summer season length, and average daily activity costs.
The reported costs and economic benefits derive from demo-specific reports and academic studies. Our results indicate that, although costs may vary widely, annual benefits exceed costs by a substantial margin in Lake Vesijärvi, Lake Vansjø, Loch Leven and Kartuzy Lakes, highlighting the strong economic viability for implementing lakes restoration measures.

The " Climatization " of peatlands: actors, timelines and funding

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Today, the ecological restoration of peatlands is the subject of significant social, political, climate-related and economic expectations. In Europe, the EU Nature Restoration Regulation, or in France, the 2022–2026 National Wetlands Plan;

the ecological restoration of peatlands is integrated into climate targets for reducing GHG emissions, and their restoration could even be promoted within the framework of the French voluntary carbon market, through a Low-Carbon Peatland Label (Pinault, 2025).
However, this climate-related enthusiasm is very recent. For example, in 1949 the Ministry of Mines produced an atlas of French peatlands with a view to quantifying a potential fuel resource, against potential shortages (Pinault et al., 2023). As recently as 2013, the Observation and Statistics Service of the General Commission for Sustainable Development was conducting an inventory of peatlands across French mountains on the grounds that they were ”true reservoirs of life and play an essential role in the water cycle as natural infrastructure”(1) ; the climate issue had therefore not yet emerged.
This communication aims to analyse the process of the ‘climatization’ (Aykut, 2020) of peatlands, understood as the reframing of environmental issues within the dominant framework of climate governance – the framing of issues in terms of carbon, the predominance of figures and quantification, and the central role of modelling. How did the ‘climatization’ of peatlands come about? Which stakeholder drove this process, over what timescales, and what were the implications for the politicisation and funding of their restoration?

Socioeconomic benefits of restoration - the case of Croatia’s NRP

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Restoration activities like reforestation, agroforestry, creating green spaces and improved management of protected areas can also generate a wide range of jobs, both low- and high-skilled. Through supporting Croatia with the development of their National Restoration Plan, IUCN EURO provided an analysis of socio-economic benefits and impacts that might accompany nature restoration measures. The analysis considered benefits provided by ecosystem services, economic benefits, economic impacts, and costs of restoration measures. Both quantitative and qualitative data have been analysed, based on data availability. It includes a general analysis that is divided by ecosystems, and where data was available, more specific analyses for concrete restoration measures. The sectors that were considered in-depth are forestry, fisheries, and agriculture, while the report also analyses the main trends of the socio-economic benefits and impacts of restoration measures on the water, energy, and tourism sectors.The analysis was supported by a consultation process facilitated by the Croatian Ministry of Environmental Protection and Green Transition.
The results show that

- Robust evidence for restoration to bring social and economic benefits, massively outweighing costs
- Important data gaps exist which makes it difficult to define baselines
- Stakeholder participation from the start of the process is essential
- Restoration planning must integrate socio-economic realities
- Financing and monitoring systems need early consideration, with focus primarily on public funding.

FOREST RESTORATION

Assessment of forest restoration projects: efficiency of cutting-edge techniques and comprehensive analysis

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Forest restoration projects affect the entire ecosystem; therefore, they require comprehensive environmental monitoring to evaluate their success. In this context, complementary monitoring indicators should be selected based on available budget and time, along with advanced analytical techniques to enable a cost-effective, more comprehensive evaluation of ecosystem modification. Here, we describe how measuring tree community composition, aboveground tree biomass, soil nutrients, and soil microbes using high-throughput metabarcoding can provide a broader understanding of the restoration trajectory, especially when environmental variables are considered together using Machine Learning algorithms. As a successful example of this approach, we report the results of a case study conducted in naturally regenerating *Acacia mangium* plantations in the Philippines. We provide a robust baseline and validation of the efficiency of cutting-edge techniques for studying complementary indicators of forest restoration. Our work encourages researchers and practitioners to implement advanced data collection and analysis methods, such as environmental DNA (eDNA), given the benefits of these approaches. These benefits include direct information on the above- and below-ground states of the ecosystem, which leads to in-sights into the dynamics of its properties. Finally,

this approach promotes collaborations among locals and scientists from different backgrounds, offering a platform for innovative solutions and interdisciplinary perspectives.

Active forest restoration to promote oak regeneration: deadwood manipulation as innovative NBS

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Pedunculate oak (Quercus robur L.) is a primary species in European forest ecosystems, playing a key role in supporting biodiversity and maintaining ecosystem functionality. Recent silvicultural strategies increasingly promote the share of oak species in managed forest stands to enhance resilience in the face of climate change. Nevertheless, the natural regeneration of oak stands remains problematic. Despite periodic mast years, successful seedling establishment is rare, hampering the sustainable management and conservation of oak-dominated forests. Here we present an ongoing experiment conducted on 10 hectares of oak-dominated mixed-species forest located on a mesic site. The study tests various combinations of silvicultural interventions, including selective thinning and gap cutting (primarily by removing alien tree species), in conjunction with the creation of deadwood elements (logs, snags, branch piles) derived from the residual material of the forest operations. Such elements were employed as NBS to promote seedlings survival and growth, assuming that these approaches can enhance the local microclimate by reducing thermal stress and improving humidity conditions, as well as provide protection against browsing. We replicated selective thinning and gap cutting in six different areas, artificially creating deadwood elements where planting oak seedlings in their proximity. Control seedlings have been planted in non-intervention areas. Seedling survival, growth, and microclimate conditions are being monitored over the next two seasons. Preliminary findings already indicate differences between the experimental treatments. The outcomes will support the identification of the most effective NBS for promoting oak regeneration, providing useful information for sustainable management practices in European oak forests.

Progress towards Restoration of the Longterm Regreening Program in the Smelter-damaged Landscape of Sudbury Ontario, Canada

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Since 1978 the globally recognized Sudbury Regreening Program, on the nickel and copper mining and smelter impacted hilly landscape has evolved from application of dolomitic limestone (10 t/ ha dolomitic limestone), 6:20:20 fertilizer, seeding of agricultural grasses, legumes and planting of tree seedlings to a more complete biodiverse restoration strategy using over 88 species of native trees and shrubs. By the end of 2025, over 3500 hectares have received limestone, fertilizer, and seed and 11 million trees and shrubs planted for approximately Can$39.5 million while employing over 4950 part-time individuals and many citizen volunteers. About 0.67 M t of carbon has been sequestered on the regreened land with vegetation showing most of the change over time. Today, the Sudbury landscape supports over 250 species of vascular plants, 75 mosses and lichens, 16 mammals and 80 bird species. In order to assess the completeness of the restoration, plant community indices and dark diversity (absence of key species) were investigated with the assistance of the Canadian Forestry Service. Missing were groups that are less likely to return on their own including tall plants, large seeded species, bird-dispersed species, and ferns and allies. In 2025, sites within the Lake Laurentian Conservation Area (older regreened sites) were assessed using the dark diversity approach and it was determined sites had a general 80% completeness index. This approach also supports more effective restoration practices by guiding the selection of missing species that may need assistance to return and in deciding a site as ‘complete’.

From Carbon to Biodiversity: Evaluating Agroforestry as a Nature-based Solution for Sustainable Forest Development

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Nature-based Solutions (NbS) are increasingly recognised as integrative approaches for addressing biodiversity loss, climate change, and rural livelihood challenges. In forest-dependent landscapes of India, agroforestry systems represent a critical NbS that links sustainable forest development with biodiversity conservation and income diversification for rural communities. This study examines agroforestry-based NbS as practical indicators of sustainable forest development by analysing their contributions to biodiversity enhancement, ecosystem services, and socio-economic resilience.

Drawing on field-based research and ongoing methodological work on agroforestry carbon projects, this paper integrates ecological indicators (species diversity, regeneration dynamics, and structural complexity) with climate mitigation metrics (biomass accumulation and carbon sequestration) and livelihood outcomes. Particular emphasis is placed on how agroforestry systems function as multifunctional landscapes, supporting both material benefits (fuelwood, timber, non-timber forest products) and non-material ecosystem services such as cultural values, microclimate regulation, and landscape resilience. The assessment further highlights the role of Monitoring, Reporting and Verification (MRV) frameworks in capturing biodiversity co-benefits alongside carbon outcomes, addressing a key gap in current NbS and carbon market assessments. The findings underscore that well-designed agroforestry systems can serve as measurable indicators of sustainable forest development, especially in climate-vulnerable rural regions. However, their potential remains constrained by policy fragmentation, limited recognition of non-material ecosystem services, and insufficient integration of biodiversity metrics within climate finance mechanisms. By positioning agroforestry as a biodiversity-positive NbS, this contribution aligns with the session's objective of advancing sustainable forest development while reinforcing the socio-ecological foundations of rural livelihoods.

Assessing the impact of land-use history on soil carbon sequestration and nitrogen across Mediterranean and temperate forests

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Forests in south-western Europe are expanding naturally following the abandonment of croplands and pastures. While long-term secondary forests can recover aboveground biodiversity, biomass, and structural complexity within decades, belowground legacies of past land use may persist much longer. Here, we assess how land-use history influences soil carbon (C) stocks, C persistence, and nitrogen (N) availability. We compared recently established forests-developed after the 20th century Spanish major rural exodus -with long-established forests across three contrasting forest types: Pinus uncinata (pre-alpine, evergreen needleleaf), Fagus sylvatica (temperate, deciduous broadleaf), and Quercus ilex (Mediterranean, evergreen broadleaf).

We collected soil samples to quantify: (i) C and N stocks, (ii) Δ14C of bulk soil C and soil-respired CO2, and (iii) δ15N of bulk soil. Recently established forests showed overall lower soil C and higher N content, although differences varied by forest type. Recently established Holm oak Mediterranean forests had lower and older C (in both soil bulk and respiration), but not higher N. In pre-alpine pine and temperate beech forests, soil C did not differ, while N was significantly higher only in recently established beech forests. Interestingly, there were differences in soil δ15N between long- and recently established holm oak forests, indicating a lasting effect of anthropogenic soil fertilization, despite similar total N. Across forests, respired radiocarbon differed in recently established forests but not in long-established forests, where it closely matched atmospheric values.

These patterns suggest that interactions between land-use history and species functional traits drive long-term soil recovery trajectories.

The trees between the woods: Do trees outside of woodland facilitate plant colonisation to woodland creation sites in agricultural landscapes?

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UK woodland cover is increasing from a historic low of 5% in the early 1900's, to a goal of 16.5% by 2050. New woodlands are often created in agricultural lands, although these woodlands are typically small and isolated, making them difficult for woodland species to colonise. Trees outside of Woodland (ToW) are lone trees, hedgerows, groups of trees and small woodlands (0.1-0.5 hectares), which can potentially host woodland species and reduce isolation of new woodland sites. To test the connective role of ToW features in agricultural landscapes, we surveyed herbaceous plants (forbs) in 20 woodland creation sites – ranging between 0.5-3.7 hectares and 35-175 years since planting – and 285 ToW features within the surrounding 100 metres. 142 forb species were found at the woodlands, including 27 woodland specialists and 55 woodland generalist species, and 151 forb species at the ToW features, including 22 woodland specialists and 54 woodland generalists. Generalised linear models indicate that species richness of the woodland creation sites was positively associated with both connectivity of ToW features to the woodland, and species richness of ToW features in

the landscape. NMDS visualisation shows different ToW feature types had distinct herbaceous plant communities, with larger ToW features having more similar communities to woodlands, but the smallest features still hosting both woodland generalist and specialist herbaceous plants. Further comparisons of these plant species communities between woodlands and ToW features are revealing how connectivity of ToW features influences the presence of particular species at woodland creation sites.

Upscaling Post-Fire Fuel Structure from Plot to Ecosystem Scale for Restoration Monitoring: A Multi-Source Remote Sensing Framework for the Monte Morrone Massif (Italy)

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Mediterranean forests are increasingly affected by recurrent wildfires, with significant consequences for ecosystem structure, functioning, and resilience. The Monte Morrone Massif, located within the Majella National Park (Abruzzo, Central Italy) was affected by two major wildfires in 2017 and 2023. Monitoring ecological restoration remains challenging because recovery processes occur across multiple spatial scales, from plot-level vegetation to landscape-scale patterns. This study proposes a multi-scale remote sensing framework integrating data acquired with a Leica BLK360 terrestrial laser scanner, a DJI Matrice 350 RTK UAV equipped with a LiDAR sensor, and multi-temporal and multispectral Planet data. The sampling design is based on 30× 30 m grid cells, where terrestrial laser scanning surveys are conducted to characterize fine-scale vegetation structure, understory complexity, and vertical fuel continuity. Each TLS plot is embedded within a 90 × 90 m UAV survey unit, enabling the integration of plot-level structural measurements with stand-scale canopy metrics. The structural information derived from TLS and UAV-LiDAR data will be used to classify Prometheus fuel types and investigate their evolution across areas affected by different fire histories. Multi-temporal Planet imagery will then be used to extend fuel and recovery indicators across the entire study area, providing spatially explicit information on vegetation condition, structural recovery, and post-fire regeneration dynamics. Expected outputs include spatially explicit maps of Prometheus fuel types, fuel-type transition metrics, and post-fire regeneration pattern, providing a transferable framework for restoration monitoring and adaptive management in fire-prone Mediterranean ecosystems.

Transformation to climate resilient forests

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In recent years, heat waves have led to increased tree mortality in forests all over Europe, thus highlighting the need to adapt forests to climate change. In our project, we are combining two approaches to make a 47-hectare forest patch more resilient to climate change. Half of the forest is left untouched. In the other half, we are adopting a continuous cover mixed forestry approach, which will enable us to intervene and diversify the forest's structure and composition. This involves increasing the diversity of tree species and replacing trees with species that are better adapted to droughts (assisted migration). All measures are carried out in a way that strengthens biodiversity and carbon capture and storage. Together with local experts, we have developed a holistic action plan and monitoring framework that will allow long-term observation (15 years) of the evolution of the forest and the effectiveness of the measures. Baseline assessments of biodiversity and tree measurement have been carried out. For the monitoring, which is carried out every 5 years, we use the same method as the one used by the Regional nature park in surrounding forest plots. This allows us to compare the evolution of our plot with reference data.
The site is intended to serve as a showcase to motivate other forest owners and managers to implement similar measures. Local partnerships with environmental and forestry associations will promote the site, which will be open to visitors and for training purposes.

A Practical Framework for Monitoring the Impact of Forest Restoration

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Effectively monitoring the impact of forest restoration activities is essential to understand their effectiveness. Whilst tracking restoration activities themselves (such as the number of seedlings planted or invasive species removed) is important, understanding restoration success requires also measuring the outcomes resulting from these activities. This impact-level monitoring generates the evidence needed to assess whether selected interventions are achieving their

intended goals, and to demonstrate positive change to communities, governments and project partners, including donors.
UNEP-WCMC developed the Forest Restoration Impact Monitoring Framework (FRIMF) to provide a structured and practical approach for generating this evidence. Using a series of stakeholder workshops and expert input, this framework was developed to support data collection on ecological, social and economic outcomes of restoration, consistently across site and national levels. This evidence underpins adaptive management, enabling practitioners to refine restoration approaches in response to emerging trends and changing conditions. It also supports national agencies with monitoring progress towards restoration goals and with aligning national monitoring systems with reporting commitments for multiple international agreements.
Originally developed to meet the diverse contexts of different countries in Asia, this framework is designed to be flexible and adaptable to other regions or contexts. By providing a shared structure between users, it fosters harmonization and knowledge exchange, within regions and globally. The framework will be implemented across four countries during 2026 and 2027, providing opportunities to integrate existing monitoring systems and policies, and to move towards harmonized monitoring at the landscape scale.

Conservation-oriented restoration triggers rapid biodiversity responses across multiple taxonomic groups in oak forests

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Conservation-oriented restoration has the potential to reverse the structural homogenisation of European forests and enhance biodiversity. Within the LIFE4OakForests project, active restoration management was initiated in oak-dominated Natura 2000 forests in Hungary to increase structural complexity and support forest biodiversity. At eight study sites, paired 0.64 ha control and treatment plots were established. Restoration interventions in 2020 included tree girdling and felling, resulting in the creation of canopy gaps and increased amounts of standing and lying deadwood. We evaluated the responses of forest structure and multiple organism groups, including vascular plants, epiphytic mosses and lichens, saproxylic beetles, butterflies and woodpeckers. Four years after treatment, as expected, treatment plots showed significantly higher amounts of standing and lying deadwood and greater variability in canopy closure compared to controls. Wood-pecker feeding activity increased significantly on treated trees, indicating improved foraging opportunities. Species richness and total cover of vascular plants tended to increase following the interventions, reflecting the establishment of light-demanding forest species, but plots had high variance in the response. Epiphytic communities, particularly mosses, showed a significant increase in both species richness and abundance, but the response of lichens was less pronounced. Species richness and abundance of butterflies and saproxylic beetles were significantly higher in treatment plots than in control plots, demonstrating the importance of newly created canopy openings and deadwood.
Our results demonstrate that relatively small-scale restoration interventions can rapidly enhance the forest stand structure in formerly managed oak forests, and generate positive responses across a broad range of taxonomic groups.

Survival of tree seedlings protected with recycled plastic tube shelters across contrasting environments in spain.

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Tree shelters are widely used in forest restoration to improve seedling establishment during the most vulnerable stages of development. Within the framework of the RecForest project, individual tree shelters from recycled agricultural plastics were developed following circular economy principles.
These shelters differ in polymer composition and light transmissivity, which may influence the microenvironment surrounding seedlings and plant growth. Six tube shelter types were evaluated: 3 made of polypropylene and 3 made of polyethylene.
To evaluate their effectiveness under contrasting environmental conditions, experimental plantations were established in three locations across Spain on the Iberian Peninsula. This study presents the first two years of field monitoring, focusing on seedling survival. Survival rates were assessed periodically and compared among shelter types, species, and environmental conditions. These results could provide new insights into the use of recycled plastic products and contribute to the development of sustainable solutions that combine waste valorisation with improved forest regeneration outcomes.

Pathways to recovery: state-and-transition models for birch woodland restoration

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State-and-transition models (STMs) are receiving growing attention in ecological restoration as tools to integrate complex ecological information and stakeholder knowledge into conceptual models of ecosystem trajectories. These models provide accessible frameworks for communicating restoration stages and potential endpoints to diverse audiences, while also informing management interventions and helping to identify meaningful indicators for evaluating restoration outcomes. As part of the transdisciplinary EcoBirch project, which aims to support the upscaling of native birch woodland restoration in Iceland, STMs were developed to support the planning, implementation, evaluation, and adaptive management of restoration projects. These models draw on published and unpublished studies of natural and assisted birch woodland succession across a range of environmental conditions. The resulting STMs describe stages along ecosystem trajectories from degraded land toward reference ecosystems or reference models, identify potential deviations from these trajectories, and outline management interventions that may help realign restoration pathways when needed. They can subsequently be used to develop submodels tailored to local initial conditions or restoration contexts.

GRASSLAND, PRAIRIE, STEPPE AND OTHER OPEN ECOSYSTEM RESTORATION

Assessing both sides of pastoralism from degradation to restoration : toward an experimental observatory

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By declaring 2026 as the international 'year of rangelands and pastoralists', the United Nations acknowledged how such socioecosystems carrying domesticated herbivores are crucial to people and ecosystems. Many cultures and civilizations coevolved with large herbivores, often in a nomadic way, especially in mediterranean areas. Many efforts aimed to document the complex effects of pastoralism on rangelands in a goal of ecological understanding but also to improve restoration practices and adaptive management. More recently, pastoralism and the herd of large-herbivores are considered as a useful mean to restore degraded ecosystems in a rewilding framework.
However, global changes as well as inherent paradoxes lead to significant issues involving the sustainability of pastoralism. Oscillating between ecosystem degradation through overgrazing or intensification, and nature-based tool for ecological restoration through rewilding with domestic herbivores, the effects of pastoralism in ecosystem remain debated and need holistic socio-ecological approaches to be assessed. In its annual report of 2026, the French Chamber of Agriculture pointed the need to provide data on vegetation dynamics in rangelands produced by researchers in ecology.
In a complementary view, using more mechanistic and functional lens, we address how the project of an experimental observatory of pastoralism in French prealps (OPaHP; Observatoire du Pastoralisme de Haute-Provence) may help to tackle challenges around pastoralism as a tool for restoration. In an integrated structure, human practices and rangeland ecological systems will be studied and tested through herd management skills, education programs, and multiscaled ecological monitoring based on the exploration of mechanisms of herbivory in semi-natural ecosystems.

Rewilding with Przewalski's horses in Mongolia can contribute to fight against desertification

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In arid environments, climatic variability and grazing management strongly influence plant communities and the vulnerability of Palearctic steppes to desertification. In 2004–2005, twenty-two Przewalski's horses, a native species of Western Mongolia disappeared in 1968, were reintroduced into a 14,000 ha enclosure with exclusive grazing for wildlife, while surrounding areas remained mainly grazed by domestic livestock. In 2010, a vegetation survey using line-point intercept and measurements of basal and canopy gaps was conducted to assess plant communities and degradation risk following the reintroduction. Given the population growth of Przewalski's horses into the reintroduction site and domestic animals outside by 2023, a new survey was conducted to compare vegetation changes over time. The study aimed to assess changes in plant communities in relation to grazing pressure, management practices, and weather conditions. Three habitats were studied with a total of 60 transects (10 for each habitat and modality): speargrass sand steppe, psammochloa sand steppe and mountain steppe. Our results show that weather conditions have strong effect, both on canopy and basal gaps but also on annual species richness and cover. However, the reintroduction of Przewalski's horses, associated with lower grazing pressure leading to higher canopy and basal plant cover, had positive results for fighting against desertification. This study brings new field evidence about rewilding potential.

Habitat suitability modelling of Rhinanthus angustifolius and R. minor as adecision-support tool for grassland restoration.

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Rhinanthus species are widely used in grassland restoration. However, establishment is constrained in fertile grasslands, where dense vegetation limits seedling recruitment. We combined a field experiment with habitat suitability modelling to assess the establishment success of *Rhinanthus angustifolius* and *R.minor* and to test whether differences in predicted habitat suitability are relevant for restoration planning. Field establishment was tested for six years using a randomized block design in the frame of the LIFE Programme project GrassLIFE2 (No. 101073829 LIFE21-NAT-LV-GrassLIFE2). Establishment success depended strongly on site conditions and competition control. Where competition was reduced, establishment rate was 50%. To support restoration decisions, we modelled habitat suitability using MaxEnt and 165 eco-geographical variables in the frame of the project HiQBioDiv: High-resolution quantification of biodiversity for conservation and management (VPP-VARAM-Daba-2024/1-0002). 1,969 occurrences of *R. minor* and 176 of *R. angustifolius* were used. *R. minor* showed broader predicted suitability, whereas *R. angustifolius* displayed a narrower and more selective suitability pattern. These differences imply distinct restoration roles. While *R.minor* may be widely suitable, *R.angustifolius* may require stricter site targeting. Thus, restoration should treat *Rhinanthus* species as functionally valuable but ecologically non-interchangeable. We therefore argue that restoration outcomes can be improved when donor species and seed sourcing are matched to predicted habitat suitability. We also discuss taxonomic uncertainty and hybridisation in wild populations and their implications for restoration practice.

Pathways to recovery: Drivers of long-term grassland restoration success on exarable fields in the Netherlands

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Species-rich semi-natural grasslands support approximately 18% of Europe's vascular plant species and are among the continent's most threatened ecosystems. Nearly half of protected grasslands are currently in poor conservation status, largely due to agricultural intensification. The UN Decade on Ecosystem Restoration and the EU Nature Restoration Law create an opportunity to reverse these losses and restore species-rich grasslands, including on former intensively used agricultural land. Achieving restoration targets requires a clearer understanding of the long-term drivers of restoration success.

We investigated drivers of grassland restoration success across 48 sites in the Netherlands restored from intensive agriculture more than five years ago, and compared them to 17 natural reference sites. At each site, we collected vegetation, soil, and hydrological data to assess biodiversity, community composition, and abiotic conditions. Restoration approaches included frequent mowing, topsoil removal, and topsoil removal combined with green hay transfer.

To evaluate the stability and relevance of reference conditions, we compared present-day vegetation in reference sites with 15 historical surveys from the 1980s. The study includes multiple high-value grassland types, including fen meadows, Calthion palustris meadows, and nutrient-poor heath grasslands, spanning a wide range of hydrological and abiotic conditions.
We assess how restoration strategies influence plant diversity, community composition, and abiotic conditions, and how closely restored sites converge toward present-day and historical reference communities. By identifying effective restoration approaches, this study provides evidence to guide restoration practice and support European restoration policy implementation. These findings highlight context dependency and inform adaptive management under changing environmental conditions across Europe.

Dispersal and clonal growth of mediterranean grasses: implication for recolonisation and resilience of semi-natural grasslands

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The restoration of Mediterranean grasslands is a complex and particularly slow process. Even after several decades of restoration, key species often show poor recolonisation, and the reasons for this failure in restoration are largely unknown. We investigated two complementary processes driving the establishment dynamics of *Brachypodium retusum*, a dominant species of Mediterranean grasslands, whose recolonisation patterns remain poorly understood. Controlled experiments revealed a low dispersal capacity, with a mean and a maximum dispersal distance of 21.2 and 88 cm respectively, at 25 km/h wind speed, suggesting that seed-mediated recolonisation is unlikely to be effective beyond the immediate vicinity of populations. In parallel, we analysed clonal growth and survival of this species in a field experiment testing the effects of early-stage irrigation and sheep grazing. Nine years after experimental establishment, *Brachypodium retusum* showed an average clonal expansion of 36.6 cm and a maximum of 118 cm. The effects of first-year grazing and irrigation were not significant for clonal growth but surprisingly plant survival was higher in initially grazed plots. Taken together, these results reveal a dual recolonisation bottleneck: seed dispersal limitation constrains long-distance spread, whereas clonal growth appears to be an ecologically slow process. Grazing does positively affect recolonisation success through higher survival. We argue that effective restoration of *Brachypodium retusum*-dominated grasslands requires spatially targeted seed introduction combined with early management interventions to enhance establishment success. These findings provide a mechanistic framework for optimizing restoration strategies in Mediterranean grassland ecosystems.

Comparison of soil seed bank in sand grasslands grazed by cattle or sheep

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The effect of livestock type (sheep, cattle) and grazing intensity on the soil seed bank of sand grasslands were studied. We selected 25 grazed grassland sites that were classified into four grazing intensity categories. For grazing intensity, livestock unit per hectare and frequently visited places (e.g., drinking place, resting place) were considered. The soil seed bank was analysed by seedling emergence; germinated seedlings were classified by morpho-functional groups, CSR strategies, and social behaviour types. Grazing intensity had significant effect on more variables than livestock type. Most of the studied variables were affected by the interaction of grazing intensity and livestock type. The total seed bank density was lower in all grazing intensity levels in sheep-grazed sites than in cattle-grazed ones, especially close to frequently visited places. We found that increasing intensity enhances the accumulation of seeds of short-lived pioneers and weedy species in the soil seed bank. We found that sheep grazing sustained a much lower total seed bank density and lower density of species of natural and semi natural habitats regardless to the grazing intensity. Thus, livestock type must carefully be selected and high intensity sheep grazing must be avoided on the long run in managing sand grasslands. Furthermore, special attention must be paid to the frequently visited places.

Restoring Estonian biodiversity hotspots: multitaxon diversity and community completeness in abandoned and resently restored wooded meadows

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Semi-natural grasslands, once widespread across Europe, have lost most of their original extent and now persist largely through subsidised management. Estonian wooded meadows were historically an integral part of rural landscapes, providing a wide range of ecosystem services, including haymaking, grazing, coppicing, and the collection of firewood, medicinal herbs, and berries. Today, the remaining wooded meadows are valued primarily for their high biodiversity, aesthetic qualities, and cultural significance. The Woodmeadowlife project (LIFE20 NAT/EE/000074) aims to restore 700 ha of wooded meadows in Estonia and Latvia. Multi-taxon inventories - including plants, lichens, birds, bees, butterflies, and other groups - across overgrown, recently restored, and continuously managed sites show that most taxa benefit from restoration, with clear increases in species richness. Although species richness increases rapidly following restoration, the recovery of typical wooded meadow species is slower. We apply the concept of community completeness (i.e. the proportion of the species pool present in a community) to quantify the recovery of characteristic community composition. Analysing the traits of missing species (i.e. those absent from the local community but part of the species pool) helps identify which active restoration measures are needed to achieve restoration goals.

Restoration of species rich grasslands on former arable land require restoration of healthy soil processes

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Grasslands restored on former arable land often host only incomplete communities that miss many important plant species. The main obstacle to successful restoration is considered to be the high level of soil nutrients that persist from previous intensive agricultural use, increase productivity, and cause dominance of a few strong competitors. Tillage, however, disrupts many biotic and abiotic soil parameters, which may be detrimental to grassland specialists and thus to the biodiversity of restored sites.
Our research on restored and reference dry grasslands of the White Carpathians region (SE Czechia) shows that restored grassland communities are missing sensitive grassland species rather due to low soil fertility than due to high productivity. Although the formerly tilled soil of restored grasslands has higher phosphorus content, it is compacted, depleted of soil carbon and nitrogen stocks, and has an altered microbial community. The plant community of restored grasslands shows nitrogen deficiency and misses species with higher sensitivity to extinction during drought events. Many of them lack important symbionts.
Successful restoration of grasslands therefore requires recovery of the soil processes that operate in soils of preserved reference sites and provide better nutrition for plants. As the soil is a complex and conservative environment, we so far rely only on the spontaneous development of soil properties. This might be sped up by sowing suitable plant species with desired effects on soil. The commonly used suppression of plant productivity by topsoil removal would be counterproductive in this case, as it would further harm the soil and conditions.

Vegetation development in a grassland restoration experiment in Germany - Key insights after 15 years

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As species-rich grassland in Central Europe has been severely degraded over recent decades, successful restoration interventions are urgently needed. Numerous studies analysed different restoration methods, however the monitoring of long-term restoration success is scarce. In 2010, we set up a block experiment aiming to restore species-rich grassland vegetation on formerly intensively used arable land in Saxony-Anhalt (Germany). For species introduction, we applied direct seed harvesting methods (transfer of green hay and threshing material from a species-rich mesic grassland donor site) and additional sowing of drought-tolerant species from certified regional seed propagation. Ellenberg indicator values for moisture were used to visualize shifts in vegetation composition. Over a period of 15 years, the introduced species successfully established across all four restoration treatments, and considerable vegetation dynamics were observed. Even after 15 years, the initial restoration method continued to exert a strong influence on vegetation composition, with treatments combining direct harvest and additional sowing supporting higher target species richness than those restored solely with direct harvest. A distinct shift in vegetation composition towards drought-tolerant species occurred, particularly in treatments where species from dry grassland habitats were introduced alongside those from mesic grassland habitats. To ensure successful restoration, direct seed harvesting and sowing of regionally propagated species should be combined, resulting in species-rich and therefore more resilient systems. In a climate that is becoming increasingly arid, restoration efforts need to establish species-rich vegetation, which also includes drought-tolerant species, that can respond better to climate extremes and thus ensure long-term restoration success.

Promising biocontrol effects of a native hemiparasitic plant against a non-native C4 grass

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Hemiparasitic plants are known to be able to diversify degraded grasslands by lowering the competitive power of dominant grasses. Recent research indicates that hemiparasites may also be used against invasive alien plants. Here, we tested the effects of *Odontites luteus*, a native European hemiparasite, on *Sporobolus cryptandrus*, a recently established and rapidly spreading C4 grass of North-American origin. We found that *Odontites* considers *Sporobolus* a suitable host and reduces its biomass production (and potentially its competitive ability) by approx. 50%, equaling the effect on its major native host, *Festuca vaginata.* However, *Festuca* showed severe metabolic impairment (reduced photosynthetic capacity and increased physiological stress) under hemiparasite pressure. Our results indicate that the application of hemiparasites is a promising biocontrol tool against *Sporobolus* (and potentially other invasive C4 grasses), but it is not a silver bullet. We cannot expect a full eradication of the invasive species and a recovery of the native community but thinning monodominant *Sporobolus* stands to allow certain populations of native species, particularly those resistant to *Odontites*, to come back is a more realistic goal. This could lead to a partial recovery of the former species composition and an improvement of ecosystem functions, such as providing food for pollinators.

Neighborhood conservation: The potential of north Swedish horse pastures to support plant and butterfly populations

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Semi-natural grasslands, shaped by traditional low-intensity grazing, are biodiversity-rich systems now threatened by both agricultural intensification and land abandonment across northern Europe. In Sweden, abandoned grasslands often shift toward competitive, grass-dominated communities with reduced value for pollinators. Reintroducing large herbivores may offer a viable pathway for ecological restoration. Here, we evaluate the potential of horse grazing to restore plant and butterfly communities in northern Sweden.
We surveyed forb communities in 20 horse-grazed and 20 abandoned grasslands, and conducted Pollard walk butterfly transects alongside measurements of flower abundance and vegetation structure from mid-June to August. Horse-grazed pastures supported more diverse, grazing-associated plant communities, characterized by ruderal species with lower canopy height and seed mass. Abandoned fields were dominated by competitive species with higher specific leaf area. The number of generalist-pollinated plant species increased with grazing duration, indicating enhanced functional diversity of floral resources.
Butterfly responses showed strong seasonal dynamics. Ungrazed fields hosted higher richness and abundance in early summer, whereas horse-grazed pastures became more important later in the season. This shift was linked to higher and more persistent flower richness in grazed systems, while abandoned fields became grass-dominated. Late-season butterfly assemblages in abandoned fields represented a subset of those in grazed pastures.
In conclusion horse grazing promotes functionally distinct, grazing-adapted plant communities and extends the temporal availability of floral resources, supporting more diverse butterfly assemblages. Although restoration of characteristic semi-natural grassland species may be limited by dispersal constraints, horse grazing represents a promising, scalable tool for pollinator-oriented restoration of abandoned grasslands.

Restoration of steppe, dry and seasonally wet grasslands based on monitoring of species of Community interest and other target species distributions in north-western Bohemia.

Romana Prausova, Roman Hamersky, Czech Republic

Restoration of 480 ha of degraded unique dry and semi-dry grasslands in several SACs in the Ceske stredohori region (CZ) was the objective of several projects (incl. LIFE). Restored steppe /forest-steppe meadow and pasture islands within intensively farmed land now serve as species sources for the surrounding areas through recently established interconnections.
SAC Babinské louky is a site with seasonally wet grasslands and *Adenophora liliifolia* occurrence. Improper management resulted in rapid expansion of *Calamagrostis epigejos* and accelareted decrease of species's diversity. Newly applied management methods (mowing, raking, use of hemiparasitic species *Rhinanthus alectorolophus*, fencing against

grazing/ digging of fallow deer, wild boars) led to the increase in the cover of vascular plants. Special management contributed to the spread of several other rare species. Herbs species abundance and the size of *Adenophora liliifolia* population have increased. Abundance at restored plots reaches currently 60 plant species/25 m2; herb cover has increased from 16–24 % (before 2019) to 38–75 % (after 2019).
Several SCAs (eg. Raná-Hrádek, Oblik-Srdov-Brnık) exhibit higher diversity 10 years after the implementation of intensive and subsequent follow-up management. Populations of *Stipa zalesskii* and *Helictotrichon desertorum* (the westernmost population spread limits) are monitored together with other important habitat's key species indicators (ex.: *Stipa* div., *Astragalus* div., *Oxytropis pilosa*). The optimal grazing pressure affecting the abundance and dominance of *Helictotrichon desertorum* was also tested. Botanical releves at dozens permanent plots (managed, unmaneged) are taken and statistically evaluated. Public involvement and participation is strengthen thanks to several different annual events.

Setting Up an Advisory Service for Semi-Natural Grassland Owners: Practices from Estonia

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Semi-natural grasslands are among the most biodiversity-rich habitats in Estonia, yet their area has declined dramatically due to changes in land use. While these meadows were historically shaped and maintained through regular mowing and grazing, today their future often depends on individual landowners facing complex restoration, management and financing decisions.
This presentation introduces an advisory service established in 2022 by the LIFE IP project "ForEst&FarmLand" within the Estonia's Environmental Board to support landowners and managers of semi-natural grasslands. The service provides practical, meadow-specific guidance through on-site consultations, helping landowners assess ecological values of their lands, choose suitable restoration practices, and navigate available support schemes and subsidies.
Estonian Ministry of Climate leads LIFE IP project "ForEst&FarmLand"project and project manager will present the rationale behind the service, its core elements, and experiences in increasing landowner involvement and improving the effectiveness of grassland management. The case demonstrates how targeted advising can increase the awareness of landowners about the values of their lands and bring more people to restore biodiversity-rich grasslands.
It hopefully also offers transferable insights for other regions facing similar challenges.

A synthesis of recovery of biomass and diversity in Cerrado restoration

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Non-forest tropical ecosystems have received less attention when compared to forests, and in some cases are even more degraded than these forest ecosystems. The Brazilian savanna, Cerrado, is a global biodiversity hotspot but its protection is still overlooked. Cerrado has high potential for ecosystem restoration, aiming both at increasing carbon sequestration in comparison to the previous land use, frequently degraded pastures, and at recovering biodiversity. In this context, we aim at synthesizing the literature on the recovery of diversity and biomass in Cerrado restoration, and how they are affected by different restoration methods and management practices. We systematically reviewed peer-reviewed articles, both in English and Portuguese, including studies in passively or actively restored Cerrado areas that present at least one diversity or biomass indicator, and retrieve information about these indicators, location, sampling, vegetation type, landscape context, restoration methods and management. We selected 72 studies, conducted in 9 Brazilian states. Fifty-seven percent of the studies reported biomass indicators, 82% reported diversity indicators, and 38% reported both. The predominant restoration method was passive restoration through natural regeneration (79%). While most studies were carried out in savanna vegetation types (61%), half of the studies assessed only woody individuals for diversity, and only 29% included all growth forms. Biomass was mostly measured in the soil, and only 4 studies measured biomass in all growth forms. This review will allow us to identify the knowledge gaps and synthesize key insights about Cerrado areas under restoration.

Restoring plant diversity in lowland grasslands: Efficacy of different seed addition and soil preparation methods

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The biodiversity of semi-natural grasslands has dramatically declined over the past century. We experimentally tested, at field scale, the efficacy of different assisted (active) restoration methods to enhance plant biodiversity in species-poor, extensively managed lowland meadows. Four restoration treatments, plus one control were randomly allocated to five meadows at 12 spatially-replicated study sites in the Swiss lowlands in 2019: 1) hay transfer from a species-rich donor meadow on a harrowed meadow; 2) the same as 1 but on a ploughed meadow; 3) sowing a directly harvested native seed mixture originating from a species-rich donor meadow on a ploughed meadow; 4) sowing a multiplied native seed mixture on a ploughed meadow; 5) control, i.e. with no soil disturbance and no reseeding. Vegetation surveys were performed before (2018) and after the restoration actions (2021 and 2023). After a pronounced biodiversity rise in 2021, plant species richness had stabilized by 2023 across most treatments with, on average, 29% more species compared to 2018 and 16% more species in restored compared to control meadows in 2023. Moreover, 90% of the restored meadows qualified for the result-based payment scheme in 2023. Harrowing before seeding was as effective as ploughing. While the multiplied seed mixture initially showed a stronger increase, this effect had decreased by 2023, reaching levels comparable to the other treatments. Beta diversity was higher in hay transfer treatments than in the control and other restoration treatments, indicating greater heterogeneity in community composition. Findings provide evidence-based guidance for cost-effective and practically feasible grassland restoration.

Restoring grasslands within French Natura 2000 sites: does-it really work?

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Grasslands are habitats of community interest that host many dependent species. However, agricultural abandonment and subsequent shrub encroachment threaten their persistence.
European Natura 2000 sites are directly concerned by these issues, working with farmers to maintain practices beneficial to biodiversity. As part of a national program about assessment of Natura 2000 effectiveness, we focused on management measures which aim to maintain or restore open habitats.
We developed a methodology for grassland monitoring and provided funds and methodological support to managers from several Natura 2000 sites to apply it over five years on restored grasslands. Between 2019 and 2023, we collaborated with six managers across eight sites. Their objective was to establish or maintain grazing, sometimes combined with mechanical management. We analysed monitoring data and interviewed managers and experts involved in the projects to gather feedback on the measures and their effectiveness.
Although these measures may appear effective at first glance, our results show a more complex situation. Traditional farming practices are declining in many regions, replaced by intensive live-stock farming and crop production. Even when managers find farmers willing to graze livestock on these sites, grazing pressure and timing are not always compatible with ecological objectives.
Monitoring results suggest that management measures generally stabilize grassland encroachment rather than reverse it. Plant composition, however, often shows signs of improvement, which is encouraging. Discussions with managers also highlighted key parameters for implementing successful grassland restoration measures.
This work will continue through ongoing monitoring programmes involving 14 additional Natura 2000 sites until 2029.

Biodiversity monitoring and restoration measures on German golf courses: Implementing a BACI framework to improve the ecological value of multifunctional landscapes

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To address the urgent need to restore degraded ecosystems and implement effective measures across the restoration continuum, secondary habitats in periurban areas should be integrated into European restoration efforts at both local and landscape scales. Additionally, given the limited availability of potential habitats and increasing land-use conflicts, restoration initiatives should engage a broader range of stakeholders. Golf courses, which are widespread and occupy large areas in Germany, may potentially contribute to biodiversity and restoration targets. Nonetheless, their status and potential contribution are unknown. The GolfBiodivers project investigates the status of the biodiversity of German golf

courses and evaluates the effectiveness of restoration measures to improve out-of-play areas, which account for nearly 50% of the total golf course area. We implemented a before-after-control-impact framework to test the status of 35 German golf courses and assess the effectiveness of adapted restoration measures. Multi-taxa assessment was conducted using standardized monitoring protocols. Five complementary measures were developed primarily to rehabilitate grassland habitats and increase the availability of refuges and resources for higher trophic levels. We present the study design and initial in-sights from baseline assessments, which reveal considerable heterogeneity in site conditions and multi-taxa species richness across golf courses. Some sites already support conservation-relevant species and exhibit generally suitable conditions for the establishment of species-rich grasslands. These findings highlight an untapped potential for contributing to biodiversity gains at multiple scales, particularly if the golf sector is engaged through an adaptive and sustainable framework for restoring native ecosystems within multifunctional landscapes.

Tales of the Trojan Mouse and Leapfrog Ecology: Long-term experience for making sustainable species-rich grassland and other habits in the public realm

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Achieving ambitious targets under the EU Nature Restoration Regulation or in UK Biodiversity Net Gain can require a departure from standard methods toward radical or what might be considered unusual methodologies. This presentation evaluates 30 years of creative conservation and ecological restoration across local and national projects, establishing a blueprint for ”leapfrog ecology” using substrate-led approaches. On a larger scale, deep soil inversion techniques are deployed on industrial agricultural sites to bypass highly eutrophied topsoils that block long-term biodiversity. In urban areas, this circular methodology utilises local substrates-including construction demolition waste-to engineer resilient public parkscapes that lock in carbon and withstand shifting climate pressures and address biodiversity crisis.
These physical interventions link directly to the circular economy and the public good economics of Elinor Ostrom and Mariana Mazzucato. Crucially, they are paired with a ”Trojan Mouse” strategy for social and environmental justice. By employing small, highly engaging localised actions like community sowing events or wildflower popups, complex ecological principles are stealthily embedded into public consciousness. It is a case of the tortoise beating the hare. Grounded in the Avignon SERE 2010 ”Eyes Wide Open” statement and the Cultural Soil and Substrate Charter, these actions use high-visibility art, media, and public partnerships to ensure restoration is celebrated. Merging precise soil science and plant knowledge with creative communities care, and land ethics can create successional and sustainable land of rich ecological character.

INVASIVE SPECIES & RESTORATION

Restoration has unsuspected effects on ecosystem diversity and productivity compared to alien plant invasion: insights of a multitrophic approach

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Restoration techniques that reintroduce native plants to outcompete invasive plant species are increasingly applied. By modifying plant diversity and productivity, both invasion and restoration could impact other ecosystem components. Yet, their consequences at a multiple ecosystem components scale remain poorly understood. On seven sites in two watersheds (France), we compared (i) uninvaded reference ecosystems, (ii) ecosystems invaded by Asian knotweeds (*Reynoutria* spp., a group of species that are largely invasive in Europe and North America), and (iii) invaded ecosystems

restored by planting native woody species. We characterized changes in five ecosystem components including plants, soil fauna, soil chemistry, soil microbiology, and pollinators, that we posit to be all affected by invasion/restoration through productivity and complementarity trophic rules. Our results showed significant differences in plant, soil chemistry, and microbiology components between invaded, restored, and reference ecosystems. Invasion increased the variability of the ecosystem components, whereas restoration homogenized them. Unlike restoration, invasion also increased the overall productivity of the ecosystem. Yet, invasion and restoration did not, or marginally, impact trophic rules. We conclude that restoration actions, while effective at controlling the plant component, lead to novel component states with altered soil properties and functioning. Understanding the mechanisms linking different components such as trophic rules is essential, because effects of restoration on targeted components may not translate to other parts of the ecosystem which can remain strongly impacted. Ignoring these off-target responses in other components could lead to misleading predictions about the ecological consequences of invasions and restoration interventions.

Emerging technologies to improve the efficiency and feasibility of restoring islands through invasive mammal eradication

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Invasive alien mammal eradication has long been recognized as one of the most effective strategies for restoring island biodiversity, with over a thousand successful interventions world-wide. Yet, most eradication efforts to date have been implemented on small, uninhabited islands using a limited set of methods that are constrained by logistical, environmental, and socio-political factors. Emerging tools, namely heavy-lift drones for the aerial dispersal of conservation bait and real-time AI-assisted monitoring systems to rapidly detect target species at low densities, are expanding the reach, efficiency, and adaptability of island restoration efforts. Drawing on case studies from across Latin America and the Pacific, this presentation highlights how emerging technology is overcoming key barriers. In sites where helicopter access is limited or prohibitively expensive, heavy-lift drones have enabled eradication projects that would otherwise not have been feasible. On islands with difficult terrain and limited accessibility, thermal drone monitoring and integrated ”smart island monitoring systems” with AI-powered cameras, smart traps, and remote communication networks are enabling island-wide real-time data-driven decision making. Collectively, these results demonstrate that when designed to solve key constraints emerging technology can advance conservation practice. Finally, we will examine the barriers to adopting emerging technologies and illustrate the importance of integrating cutting-edge technology within and alongside local contexts to foster long-term outcomes.

Balancing restoration strategy according to the context of an oceanic tropical island such as Reunion island: a multi-stakeholder partnership and an operational framework for managing plant invasion

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Effective management of invasive species within protected areas requires innovative solutions. In the Mascarene’s archipelago, the largest area of intact vegetation remains in Reunion Island. The natural habitats of exceptional biodiversity face alarming threat, especially from the invasion of alien plant species. Under the leadership of the local government, an inclusive partnership involving decision-makers, managers, and scientists has been initiated in 2018 to address the management of invasive alien plant species throughout the entire island (2512 km^2). An operational framework from monitoring to implementation, shared by all partners, has been established encompassing five key stages: (1) conduct a comprehensive site diagnostic (including threats, habitats, species of special concern), (2) model future threats, (3) prioritise interventions (considering sites, species, actions and operational factors), (4) implement actions through a multi-stakeholder programme spanning multiple years, and (5) evaluate the effectiveness of implemented interventions. This approach provides an in-depth examination of the research-action partnership and the operational framework, and we illustrate outputs for key priority sites. By adapting participatory conservation planning approaches, we developed implementation-level outputs at a scale useful for managers. The partnership exemplifies a transdisciplinary approach co-developing and co-producing outputs with a broad array of stakeholders. Drawing from a

checklist of essential components for successful partnership, we highlight key insights derived from this initiative, providing valuable lessons for the management of invasions in other regions. This framework holds promise for addressing plant invasions in island ecosystems or within landscapes characterized by multi-layered governance.

Expansive native and invasive alien plants in vegetation succession

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Expansive native and invasive alien plants are recognised as drivers of biodiversity change in disturbed landscapes, yet their roles during succession have rarely been compared directly. Expansive natives - taxa exhibiting invasion-like dynamics and recent spread - remain under-studied relative to invasive aliens, particularly in a successional context.
We conducted a large-scale, multi-habitat comparison of both groups across 60 years of spontaneous succession in Central Europe using 1051 vegetation plots from 12 successional series. Community composition, Ellenberg indicator values, and CSR strategies were analysed using ordination and mixed-effects models to assess species richness, cover dynamics, functional strategies, environmental affinities, and community effects.
Successional age had limited influence on species richness but strongly structured dominance. Both groups drew from similar plant families and CSR strategies, yet differed in their successional trajectories, environmental associations, and community effects. Expansive natives were more numerous, maintained higher cover throughout succession, and included more taxa with stronger negative associations with co-occurring species richness. Invasive aliens were restricted to early and mid-successional stages in warmer, base-rich, human-influenced habitats, whereas expansive natives were associated with cooler, moister, and more acidic semi-natural environments.
Although both groups were dominated by competitive strategies, expansive natives occupied broader environmental gradients and reached peak cover later in succession, whereas invasive aliens were largely confined to early disturbed conditions and were functionally narrower. Community assembly in regenerating landscapes is shaped more by ecological strategy and environmental context than by biogeographic origin, with expansive natives and invasive aliens following distinct but partially overlapping successional pathways.

Monitoring riparian vegetation recovery after exotic species removal: a multi-year assessment integrating field traits and satellite data

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Remote sensing (RS) tools have been increasingly used for monitoring, overcoming the spatiotemporal limitations of on-site observations. However, monitoring recovery trajectories remains challenging due to the scale mismatch between classical field sampling and satellite imagery. We present a multi-year assessment of riparian vegetation recovery following eucalyptus removal in a temperate Iberian floodplain forest, combining floristic inventories, functional traits, and Sentinel-2 data collected between 2018 and 2022. Two study sites, previously eucalyptus plantations, represented different recovery stages: the before-and-after restoration EC, restored in 2020; and the longer-recovery EX, restored in 2010. Across the field sampling period, species composition shifted markedly, and species richness increased in both sites, yet functional trajectories differed between sites. In EC, the community shifted from light-demanding exotic species to fast-growing generalist species typical of moist, early-successional riparian habitats. In the longer-restored EX, strong plot-level variation with the development of microhabitat heterogeneity, particularly for moisture- and dispersal-related traits, suggested that environmental filtering structured community composition. Variance partitioning with Sentinel-2 vegetation indices revealed contrasting trends for each site. At EC, differences among sampling plots were strongly related to time since restoration. In contrast, at EX, RS indices explained a substantial portion of the variation, with minimal independent contribution from time since restoration. Lastly, RS-biodiversity correlations differed between sites, reflecting their contrasting successional stages rather than a universal recovery signal. These findings highlight that time since restoration shapes both ecological recovery trajectories and satellite-based monitoring signals, with important implications for designing adaptive, long-term riparian restoration monitoring frameworks.

Suppression of Conyza canadensis is driven by priority and seeding rate, not trait similarity

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Invasion resistance is a key objective in grassland restoration, yet the relative importance of trait similarity, propagule pressure, and priority effects in suppressing invasive species remains unclear. We conducted a factorial pot experiment to evaluate how these mechanisms influence the performance of the invasive annual *Conyza canadensis* across its full life cycle. Four native species differing in functional similarity, as well as their mixture, were sown at two densities and with either simultaneous or delayed timing relative to the invader. We quantified effects using the Relative Competition Index (RCI) for emergence, height, specific leaf area (SLA), seed production, and biomass. Our results demonstrate that suppression of *C. canadensis* is primarily driven by priority effects and propagule pressure, while trait similarity showed no consistent influence. Native priority significantly increased suppression across most response variables, particularly for emergence, height, seed production, and biomass. Higher native seeding density further enhanced suppression, especially for height and biomass, although its effect on emergence was context-dependent. Species identity also played a major role: the native species mixture consistently produced the strongest suppression for biomass and emergence, while *Galium verum* most effectively reduced seed production. In contrast, the highly competitive grass *Festuca vaginata* showed weaker-than-expected suppression in several cases. Interaction effects among factors were common, indicating that outcomes depend on their combined application rather than on single mechanisms. Overall, our findings suggest that restoration strategies should prioritize early establishment and sufficient seeding density of diverse native communities, rather than relying solely on trait-based species selection.

LANDSCAPE SCALE AND CORRIDOR RESTORATION

Applying UAS technology to restoration of fire-prone forests

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Fire presents challenges and opportunities for management of fire-adapted forests. In dry pine forests of southwestern North America, uncrewed aircraft systems (UAS) or drones offer site-specific information supporting restoration activities such as reducing uncharacteristically dense fuels, reintroducing surface fire, and reforesting burned areas. In dense forests, we applied UAS imagery to measure forest structure using structure from motion algorithms and developed simulations of potential fire behavior under current conditions vs. future thinned conditions. In sites where fire is currently being reintroduced through prescribed burning, we used UAS-borne thermal imagery to measure energy release and fuel consumption to evaluate quantitatively whether burn objectives were met. Finally, at sites where seedlings were planted following a severe wildfire, we used UAS imagery to measure the density and size of young trees surviving over a decade after planting. In all three examples, UAS technology required an investment in time and effort, but produced data that improved restoration capability and provided economic and logistical benefits for restoration practitioners.

Mapping social-ecological archetypes to guide woody perennial restoration decisions

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Restoration decisions at the farm and landscape scale such as whether and where to restore woody perennials in agricultural landscapes require understanding potential benefits and adoption exhibited by the existing farming types in the landscape. These farming types, or archetypes represent distinct social-ecological conditions and agricultural management responses to these conditions. We identify variables representing biophysical characteristics, farm operations and landscape structure that drive the adoption and benefits of woody perennial restoration. We then

cluster these social and ecological variables to derive archetypes for the parcels in the Lower Fraser Valley. Preliminary results show the spatial distribution of different archetypes and their relationships with known pro-environmental features and programs. The approach and results are intended to help spatially target and tailor restoration programs to locations where restoration potential is higher and might have a greater positive impact on landscape benefits.

How protected areas connectivity modeling for current times and in the future can support restoration actions prioritization

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Anticipating the effect of climate change on protected areas, and the possibility for species to travel within the network to adapt to it, is key to plan current and future restoration actions. As a case study for the European projet NaturaConnect, the LECA (CNRS) and PatriNat (MNHN-OFB) worked on developing a model predicting the evolution of the suitable habitat localisation under climate change effects, and quantifying the current and future protected areas connectivity.

The method developed to model network connectivity is based both on graph and circuit theories and thus allows to produce ecological continuities maps for our species functional groups and to obtain quantitative indicators on the level of connectivity of the network and for each protected area (Prima et al. 2024 ; Prima et al. 2025). The results can be used to identify key protected areas, isolated sites, and important corridors to protect or restore, and to prioritise scenarios for new protected areas. These analyses are produced at the continental scale for current times (present) and different climate change scenarios (future), for a list of patrimonial species and for various networks, from strict protection or only N2000 to the complete network. We'll present how these results can be used to build efficient restoration plans and prioritize restoration actions, to enhance connectivity today and to anticipate the need and feasibility for restoration within protected areas tomorrow.

Biomonitoring the Klamath River Basin Restoration: From Bees to Stakeholder Actions

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Following the historic 2024 dam removals in the Klamath River Basin (Oregon, USA), large-scale alluvial habitat restoration and tribal land reclamation required robust landscape-scale ecological monitoring.
Using bees as environmental samplers, we analyzed pollen environmental DNA (eDNA) and pollutant concentrations to assess vegetation dynamics and chemical pressures across the watershed. What began as a single baseline site in 2021 expanded to 25 monitored sites using domestic or wild bees by 2026, collectively covering approximately 9,100 hectares.
Botanical eDNA analyses revealed contrasting ecological trajectories. Sites integrating regenerative agricultural practices, including wetland rotations, exhibited increased plant species richness, whereas unmanaged sites showed stagnating or declining biodiversity. Ecotoxicological screening identified elevated chromium concentrations across the landscape in 2025, while cluster analyses highlighted localized pesticide hotspots posing risks to terrestrial and aquatic ecosystems. These pressures particularly threaten salmonid populations, whose recovery is essential for regional biodiversity, economic resilience, and the subsistence of The Klamath Tribes.
Beyond producing high-resolution ecological data, this framework also functions as a socio-ecological catalyst. By providing neutral, standardized indicators, the project helps bridge historical communication gaps among Indigenous tribes, farmers, researchers, NGOs, and public agencies. Through co-creation workshops, stakeholders collectively identify environmental risks and develop actionable restoration strategies, fostering shared stewardship in the post-dam Klamath Basin.

A Realistic Multi-Criteria Approach for Conservation Prioritization in Fragmented Mediterranean Mountain Landscapes

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The Mediterranean Basin is recognized as one of the world's major biodiversity hotspots. However, this region is increasingly threatened by habitat fragmentation, land-use change, climate pressures, and the loss of ecological connectivity. In Lebanon, protected areas currently cover approximately 17.49% of the national territory, leaving major conservation gaps despite the objectives established under Target 3 of the Kunming–Montreal Global Biodiversity Framework (GBF). Unlike conventional conservation approaches that primarily rely on legal protection status or species richness alone, this study develops a spatially explicit and multi-criteria conservation prioritization framework integrating biodiversity inventories, IUCN Red List assessments, ecological connectivity analysis, international conservation designations, governance indicators, and land-use evaluation. The methodology combines the Key Biodiversity Area (KBA) Standard with the Analytic Hierarchy Process (AHP) to produce a reproducible, science-based decision-support framework capable of integrating ecological and socio-institutional dimensions simultaneously. Applied across 35 georeferenced conservation sites in North Lebanon, the methodology assessed and classified sites according to their ecological conservation priority. It lies in its ability to produce a reproducible, science-based decision-support framework capable of identifying conservation priorities beyond traditional protected area systems while integrating ecological and socio-institutional dimensions. Findings identified 23 sites with high conservation importance, including 1 critical site (P1), 15 very high-priority sites (P2), and 4 high-priority sites (P3), many of which currently lack sufficient protection despite their ecological significance. The research proposes an operational framework integrating OECMs, Model Forests and participatory governance into national biodiversity planning, offering a scalable model aligned with the global 30x30 conservation target.

Holistic approach in ecological restoration – what does that entail?

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Ecological restoration has become one of the main means to address and mitigate major environmental challenges, including biodiversity loss, climate change and ecosystem degradation. Restoration Ecology, the discipline encompassing ecological restoration, is relatively young and has developed toward more transdisciplinary approaches over time. This entails a growing focus on the human side of restoration and a broad participation in restoration initiatives within the socio-ecological system, while still emphasising the importance of basing restoration interventions on solid ecological knowledge and restoring ecosystem integrity. In this presentation we address challenges and benefits of integration across different disciplines as learned from the transdisciplinary research project EcoBirch, initiated to support scaling-up of birch woodland restoration in Iceland. The project's results demonstrate a good potential for woodland expansion by natural regeneration that can be enhanced through management of environmental and socio-economical barriers. These range from enhancing ecological processes to land-use manage-ment and direct incentives. The results furthermore show that woodland restoration can lead to significant carbon sequestration, enhance native biodiversity and change visual landscape qualities. Birch and birch woodlands also have a role in cultural identity, evident in their portrayal in art, literature and design, and in how people perceive and experience them. Even with clear national policy backing, woodland restoration is constrained by socio-economic barriers, including competing land uses, limited incentives, weak institutional capacity and an ambiguous position within spatial planning. The results support more effective restoration by identifying barriers and potential solutions, including strengthening public support through art-science and environmental art initiatives.

MARINE RESTORATION

Not just carbon: biodiversity credits for restoration of the marine animal forests

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Marine Animal Forests (MAFs) are ecosystems formed by sessile invertebrates such as corals, sponges, gorgonians, and bivalves, and are biodiversity hotspots that sustain essential ecosystem functions and services but face accelerating threats from human pressures and climate change. Despite their importance, MAFs are absent from most emerging crediting schemes, which prioritize carbon and overlook the structural and functional diversity that underpins resilience. Restoration actions, including transplantation and artificial reef deployment, demonstrably enhance biodiversity by increasing habitat complexity, supporting associated fauna, and strengthening ecological connectivity. To link restoration ecological outcomes with financial mechanisms, we propose the development of biodiversity–carbon credits tailored for MAFs restoration. This framework places biodiversity at the center while acknowledging its positive contribution to carbon sequestration where relevant. It is built from complementary indices that capture multiple dimensions of biodiversity. Among them, the Sessile Transplants Biodiversity Index (STBI) provides a transparent, science-based tool that integrates key biodiversity attributes into a standardized score convertible into credits. The STBI is designed as a first-step tool in restoration, integrating biodiversity gains with restoration efforts. By quantifying biodiversity gains, this framework aligns with international conservation and restoration objectives and creates incentives for stakeholders to invest in restoration. Explicitly valuing biodiversity alongside carbon immobilization offers a pathway to mobilize new resources, bring neglected ecosystems into global agendas, and reinforce the long-term resilience of coastal habitats. Situating MAF restoration at the intersection of ecology, policy, and finance, this approach advances proactive measures to re-establish ecosystem functioning and contribute to a sustainable, biodiverse future.

Public perceptions of marine restoration

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Under the requirements of the EU Nature Restoration Regulation, significant investment in the restoration of the marine and coastal ecosystems will be necessary in EU Member States. A certain level of knowledge among the population will be required to ensure authorities have the required social license to pursue marine ecosystem restoration activities, and awareness raising campaigns will likely be a part of the body of actions taking place to support the delivery of the EU Nature Restoration Regulation. This survey assesses the baseline awareness, attitudes and support for marine and coastal restoration amongst the Irish adult population. Relatively low levels of awareness of both restoration initiatives and the regulation are documented, with approximately 15% of respondents aware of restoration activities and 19% aware of the regulation. While distance to the coast isn't always strongly correlated with awareness and support, connection to the marine – represented by visiting the coast and being concerned about the marine environment – is strongly correlated with these metrics. The results indicate that information campaigns around marine and coastal restoration should attempt to highlight the benefits society receives from the marine and coastal environment and foster a sense of connection with it.

Functional restoration of the reef forming pinnid, Atrina zelandica, using structural mimics

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Historically, *the* New Zealand reef building fan shell (Pinnidae), *Atrina zelandica*, has supported healthy ecosystem functioning in shallow subtidal soft-sediment systems through allogenic and autogenic pathways. Over the past two decades *Atrina* has undergone marked, but largely unquantified, declines in density/extent. In Tauranga harbour (214 km2), towed underwater video surveys of 62 sites showed that only sparse *Atrina* populations remain (occurrences at 12 sites, densities < 1-88 ind. 100 m-2). However, habitat suitability modelling predicted large areas of high habitat suitability (probability of occurrence > 0.6). Reefs formed of *Atrina* emergent shell structure are known to influence local near-bed hydrodynamics in-turn altering ecosystem processes and creating habitat refugia. So, to overcome the lack of *Atrina* to transplant and Allee effects preventing natural recovery, we trialled a novel approach to shellfish

restoration by deploying concrete mimics in areas identified as having high habitat suitability. Four (4 m2) artificial reefs were created using individual *Atrina* mimics (20 ind. m-2). These were deployed for 17 months to evaluate if artificial reefs altered ecological functioning relative to neighbouring natural (but sparse) *Atrina* and bare sediment habitats. Here we discuss how the artificial reefs enhanced fish and epifaunal diversity and altered infaunal community assemblages. The influence of artificial reefs on solute flux was less pronounced, with no significant differences between habitats. However, where live *Atrina* were present, metabolic processes governed ammonium and oxygen exchange. This study demonstrates autogenic functional enhancement by artificial pinnid reefs and indicates that larger-scale, longer-term trials are warranted.

Accelerating reproductive timing in mediterranean fucales: an experimental approach for optimizing restoration strategies.

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Mediterranean marine forests formed by Fucales, such as *Cystoseira compressa* (Esper) Gerloff & Nizamuddin 1975 and the protected species *Ericaria amentacea* (C. Agardh) Molinari & Guiry 2020, are key coastal ecosystems supporting high levels of biodiversity. However, these ecosystems are rapidly declining due to multiple stressors, including climate change. One of the major challenges for their restoration is the limited and highly seasonal availability of fertile material, constraining the transition from small-scale interventions to scalable restoration efforts. Can we anticipate the reproductive period to control and enhance reproductive output? In this study we test an innovative, restoration-oriented approach for *C. compressa* and *E. amentacea*: by manipulating temperature and photoperiod, we simulate an accelerated seasonal transition to induce earlier maturation under controlled conditions. In addition, we assess whether periodic emersion, mimicking natural low-tide exposure, acts as a key ecological trigger to enhance reproductive responses in intertidal species.
The controlled experiment started three months before their reproductive timeframe: we compared natural *vs.* accelerated scenarios, crossed with emersion treatments, while monitoring donor populations along the Ligurian coast (NW Mediterranean, Italy). We tracked maturity, fertility, gamete release and photosynthetic performance, integrating these measurements with metabolic and hormonal profiling to elucidate the physiological mechanisms linking environmental cues to fertility.
By identifying key drivers of reproductive outputs, this work provides a physiological and experimental framework to optimize timing and efficiency of ex-situ cultivation and outplanting. Our findings contribute to the development of scalable, climate-informed restoration strategies for Mediterranean macroalgal forests, supporting active restoration interventions.

Enhancing Posidonia oceanica restoration with nursery-grown seedlings: a seed-based approach exploiting early life history traits

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Seagrasses are habitat-forming organisms providing key ecosystem services in coastal marine environments, including carbon sequestration, habitat provision, and water clarification.
In the Mediterranean Sea, *Posidonia oceanica* meadows have declined over the past century. Therefore, restoration initiatives are increasingly required, exploring several techniques.
Among these, seed-based restoration has emerged as an effective and sustainable approach, since the use of sexual propagules provides ecological, genetic, and evolutionary advantages to restored populations while reducing impacts to donor beds.
Here we evaluate the feasibility of a novel seed-based nursery propagation approach for *P. oceanica* transplantation that exploits the adhesive root hairs of seedlings to achieve fast and secure anchorage to specially designed holders, which stabilize plants during early life stages after field transfer.
P. oceanica beach-cast seeds were collected along the northwestern coast of Sicily and grown in two mesocosms located in Genoa (NW Mediterranean) and Mazara del Vallo (SW Mediterranean), using rocky holders to maximize adhesion

rate. Half of the seedlings were nursery-reared for six and the other half for eleven months to test two transplanting periods: winter and spring. After six months of *ex situ* cultivation under controlled conditions, seedling survival reached 75% and approximately 95% of the plants attached to the rocky holders, similar attachment rates were observed after eleven months. Plantlets, together with their holders, were transplanted at the selected restoration site on dead matte. *In situ* survival was 80.7% one year after transplantation for the winter-planted group, and 77.1% ten months after transplantation for the spring-planted group.

Aquaculture-assisted restoration of Mediterranean macroalgal forests: a scalable approach for Ericaria amentacea

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Macroalgal forests dominated by *Cystoseira sensu lato* (including *Ericaria amentacea*) are key ecosystem engineers in Mediterranean coastal habitats, providing essential ecological functions and biodiversity support. These habitats are experiencing severe declines, prompting the development of active restoration strategies. Among these, aquaculture-assisted restoration represents a promising nature-based solution to scale up production capacity and improve restoration success.
This study assesses an operational restoration pipeline integrating *ex-situ* cultivation and off-shore aquaculture for *E. amentacea* in the Ligurian Sea (NW Mediterranean). In 2024–2025, germlings produced in laboratory conditions were either directly outplanted onto natural rocky substrates (standard protocol) or transferred to a finfish aquaculture facility for a three-month grow-out phase prior to transplantation. The aquaculture system was tested as a platform to enhance seedling robustness and enable large-scale biomass production. Additionally, we evaluated the feasibility of shortening the laboratory phase (13–19 days) to increase operational efficiency. Restoration performance was quantified through survival, percent cover, and growth over one year. While different laboratory phase duration did not significantly affect culture outputs, field outcomes highlight critical bottlenecks in post-transplant survival, particularly under direct outplanting. The aquaculture-based approach proved logistically feasible and offers clear advantages for scaling up propagule production and increasing restoration efficacy.
These findings support the integration of commercial aquaculture infrastructure into restoration practice as a scalable, cost-effective strategy. Optimizing culture duration and pre-deployment conditioning emerges as a key step to improve restoration outcomes and advance the recovery of Mediterranean algal forests.

Restoring Posidonia oceanica in the Mediterranean: lessons from a pilot project in Tunisia and the need for regional integration

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The protection and restoration of *Posidonia oceanica* meadows represent a major challenge for Mediterranean coastal ecosystems. As an endemic habitat, seagrass provides essential ecosystem services, including carbon sequestration, biodiversity support, and coastal protection. However, its decline is widespread across the basin and requires coordinated action beyond national and regional boundaries, involving both northern and southern Mediterranean countries.
The MIAREM project, implemented in Tunisia under the Italy–Tunisia cross-border cooperation programme, represents the first pilot initiative for active *P. oceanica* restoration in the southern Mediterranean. A transplantation experiment covering 1000 m^2 in Monastir was conducted to assess the feasibility of restoring this species under local environmental and socio-political conditions.
The project highlighted several key constraints affecting restoration success. Scientifically, limited baseline data (e.g. habitat mapping) constrained site selection and impact assessment. Technically, transplantation protocols required adaptation to local conditions. However, the most significant limitations were related to governance. The absence of a dedicated regulatory framework for marine restoration, complex authorization procedures, and fragmented institutional responsibilities slowed implementation. Stakeholder engagement was essential but challenging, requiring coordination between public authorities, scientists, fishers, and local communities to build social acceptance. High implementation and monitoring costs further highlighted the lack of sustainable financing mechanisms.
This case study demonstrates that scaling up *P. oceanica* restoration requires more than technical feasibility. It calls for

integrated governance frameworks, improved monitoring systems, inclusive stakeholder processes, and long-term financing. Strengthened Mediterranean-wide co-operation between northern and southern countries is essential to ensure effective and scalable restoration strategies for this emblematic species.

A Meadow Reborn: One Year On - What Our Seagrass Told Us in Tunisia!

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Posidonia oceanica (L.) Delile meadows are among the most ecologically vital coastal ecosystems of the Mediterranean, providing critical marine habitat, long-term carbon sequestration, and shoreline protection. Yet decades of coastal development, pollution, and destructive fishing practices have driven widespread meadow regression, creating an urgent need for active restoration, particularly along the understudied southern Mediterranean coastline.In 2023 Tunisia implemented its first pilot restoration trial for *P. oceanica* in Monastir Bay. Donor shoots harvested from adjacent meadows were transplanted using metallic grid structures anchored to the seabed, a conventional method that provides mechanical stability during the critical early establishment phase. A multi-parameter monitoring programme, encompassing shoot survival, leaf elongation, shoot density, epiphyte colonization, and sediment organic matter content, was conducted quarterly over twelve months.
After one year, shoot survival reached approximately 75%, comparing favorably with northern Mediterranean benchmarks. Mean leaf length increased from 12 cm to 18 cm, reflecting active meristematic growth under local conditions. Shoot density increased progressively, and sediment analyses indicated early belowground biomass accumulation. The colonization of leaf surfaces by diverse epiphytic assemblages further confirmed the functional integration of restored shoots into the surrounding ecosystem.
These results establish proof-of-concept for *P. oceanica* restoration in Tunisia and provide a replicable methodological framework for scaling restoration efforts across the southern Mediterranean.

Early ecological recovery of epifaunal communities one year after Posidonia oceanica restoration in Tunisia.

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The global decline of seagrass meadows, including *Posidonia oceanica*, threatens marine biodiversity and ecosystem functioning. In line with the United Nations Decade on Ecosystem Restoration (2021–2030), restoration initiatives are increasingly implemented to counteract habitat degradation. However, monitoring efforts often focus on the survival of the transplanted seagrass, while associated benthic communities remain largely overlooked. Assessing the ecological success of restoration therefore requires a more integrative approach, including biodiversity monitoring over time. This study investigates the early-stage recovery of epifaunal communities one year after experimental *P. oceanica* restoration in Monastir Bay, Tunisia, conducted within the MIAREM project, a Tunisia–Italy cross-border cooperation initiative. We evaluate the abundance and diversity of motile invertebrates collected with non-destructive methods using artificial benthic collectors (bath sponge traps), deployed across three habitat types: natural seagrass meadows (donor sites), restored meadows, and unvegetated bare sediments. Preliminary results revealed significant differences in community structure and diversity among habitat types. The highest abundance was found in natural meadows followed by replanted meadow and unvegetated area. The restored areas showed progressive colonization over time, indicating early stages of ecological recovery. A diverse assemblage of epifaunal taxa was recorded. The most abundant phylum was Arthropoda, primarily Crustacea, while other phyla included Mollusca, Annelida, Nematoda, and Echinodermata. Benthic communities appear to be sensitive indicators of ecosystem recovery, providing early signals of restoration success. However, full ecological recovery likely requires longer timeframes, emphasizing the need for long-term monitoring to better understand restoration trajectories and support effective conservation strategies.

Quantifying Coastal vs. Estuarine Canopy Dynamics in Mixed Zostera Meadows: Leaf Area Index as a Seasonal Proxy for Habitat Selection and Restoration Site Assessment in the Solent, UK

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Quantifying habitat suitability is underexplored in temperate *Zostera* seagrass restoration. We examined *Zostera* spp. meadow canopy structure across two geomorphological contexts: coastal (Osborne Bay, IOW) and estuarine (Outer Kench, Langstone Harbour), within the Solent from June 2024 to May 2025. Leaf area index (LAI) was used as a proxy for biomass and shoot density to assess seasonal growth dynamics within mixed-species-meadows of *Zostera marina* and *Zostera noltei*. Shoot density and LAI were recorded using a nested transect-quadrat-design. Data were analysed using a GLM model, with seasonal reference LAI estimated via marginal means. No significant difference in LAI was detected between sites during autumn ($p=0.1166$); however, winter estuarine LAI declined substantially relative to coastal LAI ($p=1.10\times10^{13}$), with this divergence intensifying further into spring ($p< 0.001$). Both sites showed a period of spring growth, which increases into summer before senescence in the autumn. However, the timing of this growth–senescence cycle varies. Estuarine system showed a delayed and shortened cycle, suggesting site-specific environmental constraints beyond seasonal forcing. These results indicate that seascape geomorphological context exerts strong temporal controls on canopy development among similar species assemblages. Consequently, we propose a phenological framework that distinguishes four canopy stages in coastal meadows: peak, transitional-decline, low-growth, and recovery, contrasted with the estuarine sequence: accrual phase, transitional-decline and an extended low-growth period. We further recommend the use of seasonally-derived LAI reference envelopes (e.g., 18383x10-4 LAI for spring) from high-quality coastal meadows as restoration benchmarks for buffer zone creation, meadow expansion, and site selection for restoration in Solent.

Restoring macroalgal forests in artificial coastal habitats through active seeding, habitat enhancement and sea urchin control in Monaco.

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Present along Mediterranean rocky coasts, *Cystoseira (sensus lato)* species act as ecosystem engineers, providing essential ecological functions such as habitat provision, nursery areas, and carbon storage. However, these communities have significantly declined on the French Mediterranean coastline. This regression results from the combined effects of anthropogenic pressures, notably coastal artificialization (resulting in habitat loss) and water quality degradation. Further contributing is increased herbivory, particularly from sea urchins whose proliferation is driven by overfishing of their natural predators and urban discharges.
As part of the MARETERRA offshore extension project in Monaco, restoration measures aimed at initiating the colonization of marine infrastructures by *Ericaria amentacea* were implemented. The process employed, based on the seeding of fertile branches, was combined with the installation of protective microhabitats (artificial rock pools). While this approach successfully initiated *E. amentacea* development, sea urchin grazing pressure remains a major constraint on the establishment of a self-sustaining macroalgal forest.
Sea urchin density and biomass were measured to assess grazing pressure, and regulation actions targeting sea urchins were implemented alongside *E. amentacea* seeding operations. The effectiveness of these measures is being evaluated through ongoing multi-year monitoring of *E. amentacea* and sea urchin population dynamics. More broadly, associated marine communities (fauna and flora) were also evaluated.
This study highlights the need to combine multiple restoration approaches, including ecological engineering and herbivorous management, to achieve the long-term recovery of complex marine habitats in urbanized amentacea, Cystoseira, sea urchins, grazing pression, herbivorous management, ecological restoration

The potential for ecological restoration through blue carbon development and ecosystem services on a shallow coastal shelf off SW Tenerife (Canary Islands)

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Carbon sequestration in marine benthic biomass is an Ecosystem Service (ES) that also provides information on the condition of the ecosystem. This carbon is also known as blue carbon. The present study comprised an environmental characterisation of a shallow coastal shelf site off SW Tenerife (Canary Islands), where an artificial submarine structure was installed. The study also included the calculations of the blue carbon generated during 18-month study period, the identification of the biodiversity associated to the installation and the ES provided by its presence. The oligotrophic coastal waters at the studied site permitted a benthic biomass generation between 1.02 g m-2 and 2.88 g m-2, equal to a carbon sequestration between 0.24 g m-2 and 0.40 g m-2. Furthermore, 46 species belonging to 11 phyla were identified during the 4 periodical monitoring dives. The ES, identified by the application of CICES method and the indicators employed in this study, provided by the submarine installation, included primary production, biodiversity maintenance (supporting ecosystem service), carbon sequestration, fish nursery and shelter (regulating ecosystem service) and knowledge (cultural ecosystem service). The environmental conditions (physical, chemical and biological) at the studied site were not a limiting factor for the benthic biomass development. The amount of blue carbon generated was lower compared to the main blue carbon ecosystem and the high-latitude (polar) ecosystems, but similar to the soft-coral gorgonian-based ecosystems. The present study demonstrates that the site is a good candidate for benthic ecosystem restoration efforts due to its provision of multiple ES.

Why marine forest restoration may fail: hidden ecological constraints beyond technical optimization

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Marine forest restoration has rapidly advanced through integrated algaculture and recruitment-enhancement approaches. Yet, restoration success remains difficult to scale up, suggesting that the main bottlenecks are no longer purely technical, but increasingly ecological.
A major limitation concerns the unresolved taxonomy of the *Cystoseira* complex, which hinders species delimitation, donor selection and conservation prioritization, while fostering species-agnostic restoration approaches that overlook fundamental ecological and functional differences among taxa.
Restoration efforts also remain biased toward fast-growing and restoration-responsive species, whereas the most threatened taxa are often characterized by slow growth, delayed sexual maturity, low propagule production and high early-stage mortality. These traits severely constrain restoration scalability, generating distinct recovery trajectories in which restored populations of slow-growing species may survive yet fail to recover their ecological functions for years.
Climate-driven phenological unpredictability further exacerbates these limitations. Narrow and shifting fertility windows reduce propagule availability and complicate restoration timing, emphasizing the need to better understand the ontogenetic mechanisms regulating fertility and to decouple recruitment from natural reproductive cycles. Although algal-derived biostimulants show promising potential, their effects remain highly species-dependent and difficult to standardize across taxa. Moreover, conditions maximizing ex situ growth do not necessarily enhance field performance, highlighting trade-offs between cultivation efficiency and ecological resilience. Overall, restoration success may increasingly depend less on technical optimization than on over-coming intrinsic ecological constraints, raising the possibility that some of the most threatened marine forest taxa may also be inherently the most difficult to restore at ecologically meaningful scales.

Towards efficient offshore native oyster reef restoration: a contractor's perspective

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The European native oyster (*Ostrea edulis*) once thrived as a metapopulation across the North Sea but went functionally extinct due to overfishing and disease. The main obstacles to recovery are lack of suitable settlement substrate and lack of larvae, together leading to insufficient recruitment for natural restoration. To overcome the scarcity of larvae, a recent innovation is the application of (remote) setting of oyster larvae on various substrates to initiate local starting populations on the order of tens of thousands to millions of juvenile oysters at a time.
The efficient implementation of this concept at a large scale involves a series of tradeoffs. These include: remote versus

direct setting, bulk versus piece by piece oyster-carrying object installation, and small versus grown size at outplacement. Drivers of cost and efficiency include permit restrictions, the need for on-site staff presence at the setting facility, production and dispensation of oyster feed, proximity to vessel loading point, oyster disease control, and QHSE requirements for offshore operations. This context leads to a range of different practical oyster reef restoration solutions with their own strengths and weaknesses.
This presentation will introduce the main tradeoffs and cost drivers that are currently the subject of investigation and improvement from a contractor's point of view, illustrated with examples of restoration solutions from ongoing and completed projects.

From Pilot to Scale: Unlocking Native Oyster Restoration in Belfast Lough

Nick Baker-Horne, Ulster Wildlife – United Kingdom

Native oyster (*Ostrea edulis*) restoration is increasingly recognised as a nature-based solution with potential to deliver biodiversity recovery alongside ecosystem service benefits. However, scaling restoration in urbanised, multi-use systems remains constrained by regulatory complexity, environmental pressures, and limited funding pathways. This is exemplified in Belfast Lough (Northern Ireland), where poor water quality and the absence of established frameworks for financing nature-based solutions present significant barriers.
This project charts the transition of native oyster restoration from pilot interventions to a scalable programme, underpinned by close collaboration between an environmental NGO and regulators. Early phases focused on generating ecological evidence, developing biosecurity approaches, and building regulatory confidence to derisk restoration activity.
Building on this foundation, the project is now entering a scaling phase, supported by a demonstrated track record, including our first seabed deployment, and strengthened stakeholder confidence. Attention is shifting towards diversifying funding sources and developing partnerships with industry, while maintaining community engagement as a core component. Community hatcheries are being explored for integration into restoration supply chains, supporting spat production and on-growing for seabed deployment, thereby strengthening connections between local communities and marine recovery.
This case study highlights how regulatory co-development, risk reduction, and cross-sector partnerships can unlock restoration at scale, offering transferable lessons for advancing marine restoration within complex socio-ecological systems.

Scientific knowledge to inform the restoration Plan in France for marine habitats : where do we stand ?

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This presentation reviews the progress made in addressing knowledge needs regarding the distribution, condition, and favourable reference areas (FRAs) of marine groups of habitat types (GHTs) under the Nature Restoration Regulation (NRR). It outlines the data and methods used to characterise these axes and inform the French National Restoration Plan, due to be submitted to the European Commission in September 2026. The presentation also describes ongoing and planned work aimed at improving knowledge and filling gaps by 2030, in preparation for revising the plan.
More specifically, the talk provides an overview of the following : i. the preliminary mapping of the current distribution of the seven GHTs used for the first version of the plan, as well as ongoing updates and new data collection to address spatial gaps by 2030 ; ii. the areas reported as being in poor condition, alongside current efforts to refine and complete this assessment, including the spatial extrapolation of station-based data and the estimation of degraded status based on pressure-impact relationships ; and iii. the initial FRA estimates produced for the first version of the plan, with perspectives for further refinement by 2030.
All these developments are carried out in close consultation with marine experts specialising in benthic ecology. Their expertise supports the interpretation of data, helps to integrate heterogeneous information sources, and ensures the scientific robustness of the assessment.

Multi-species seagrass transplantation in salt-production lagoons: lessons for design, cultivation and restoration.

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Seagrasses are marine flowering plants that form meadows across shallow seabottoms worldwide. These communities provide essential ecosystem services, including coastal protection, support to fisheries, high biodiversity, and carbon sequestration. However, global seagrass decline contrasts with the limited scalability of current restoration efforts, which often rely on harvesting material from natural donor meadows or small-scale cultivation/nursery facilities. This dependency limits restoration potential and places additional pressures on vulnerable ecosystems.
This study focuses on establishing seagrass habitats within salt-production lagoons in southern Portugal. The approach aims to create long-term seagrass sanctuaries in underused lagoons while assessing their seagrass cultivation potential. Three native species, *Cymodocea nodosa, Zostera marina,* and *Nanozostera noltei*, were introduced and monitored. Standardized experiments tested different transplantation densities and fragment spacing configurations for *C. nodosa* and *Z. marina* to assess establishment success and cultivation approaches, including handling practices. For *N. noltei*, transplantation followed a chessboard approach, transferring material from intertidal donor meadow into subtidal lagoon conditions. Preliminary results suggest that sheltered lagoons can provide favourable conditions for early-stage establishment by reducing hydrodynamic stress while enabling survival and growth monitoring. At the same time, practical challenges emerged, including plant loss, breakage, herbivory, and maintaining suitable lagoon conditions.
This work highlights the potential of sheltered lagoon systems to support long-term seagrass establishment while providing practical insights into seagrass cultivation, transplantation density and fragment handling. The findings contribute to the development of scalable and low-impact approaches that can support European restoration targets and future seagrass conservation and restoration efforts across dynamic coastal systems.

Mechanical seagrass relocation within a coastal infrastructure project

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Van Oord Dredging and Marine Contractors – Netherlands

Seagrass ecosystems are increasingly threatened by pressures such as fishing, eutrophication, pollution and dredging. At the same time, coastal protection infrastructure is essential to safeguard communities against erosion, storms and sea-level rise. Where impacts to seagrass cannot be avoided, mitigation is required following the mitigation hierarchy (avoid, minimise, restore, offset). One potential strategy is the relocation of seagrass prior to disturbance; however, conventional labour-intensive methods are often impractical or unfeasible at large scales. This study presents the development and application of a novel mechanical seagrass relocation device, used within a coastal infrastructure project to relocate approximately 0.3 ha of seagrass into recipient sites specifically designed to accommodate abiotic conditions that support their growth and survival. Monitoring after implantation combined in-situ measurements with aerial drone imagery. After 6 months, results varied markedly between sites with one site achieving 83% survival and 200% expansion, while another site showed only 16% survival and no expansion. Further monitoring at 1 year after implantation will also be presented. These initial results demonstrate that mechanical relocation of seagrass is a feasible mitigation option when alternatives are not available, and can achieve rates of several hundreds of square meters a day. However, results also highlight the critical importance of robust site selection in relocation success across environmental gradients.

From application to adaptation: lessons from Posidonia oceanica restoration in support of a marine-adapted Ecological Recovery Wheel

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The SER 5-Star Ecological Recovery Wheel (ERW) is a tool for visually communicating ecosystem recovery relative to a reference model. While conceived as a generic restoration assessment framework, its application to marine ecosystems

has highlighted the need for habitat-specific adaptations.
In 2024, we applied the original ERW to assess recovery during the first year following the restoration of a *Posidonia oceanica* meadow in the Palermo Gulf (Italy). The assessment integrated indicators of seagrass condition, sediment dynamics, fish assemblages and contamination, revealing contrasting recovery trajectories, with ecosystem functions recovering more rapidly than structural attributes. Here, we revisit the Palermo Gulf case study using a revised marine ERW currently under development by the Marine Restoration Working Group (MRWG) TF2 through a collaborative review process, refining terminology, attributes and scoring criteria for marine ecosystems. This reassessment aims to explore both strengths and limitations of the original evaluation and provide insights for the ongoing development of the marine ERW.
The revised framework includes ecosystem components, particularly ecological connectivity, that could not be evaluated in the Palermo Gulf case study, revealing gaps in the original monitoring design. At the same time, most indicators were retained within the revised framework, although several were reassigned to different ecosystem attributes. Despite these changes, the overall recovery trajectory remained consistent with the original assessment. While confirming the main findings about recovery processes and trajectories, the marine-adapted ERW also highlighted ecosystem components that were previously overlooked, helping to identify priorities for future monitoring and assessment.

Climate-smart seascape restoration is strengthened by interconnectivity among coastal blue carbon ecosystems

Martin Gullström, Södertörn University, School of Natural Sciences, Technology and Environmental Studies – Sweden

Coastal seascape mosaics provide critical nature-based solutions for climate change mitigation through blue carbon sequestration. Yet, their functioning, resilience, and spatial connectivity remain insufficiently understood, limiting their integration into climate-smart restoration and conservation efforts. Our research examines how seascape context (based on landscape configuration and composition) and multi-habitat connectivity influence carbon sink capacity across the coastal land–sea interface under cumulative human pressures. Using a multiscale seascape ecology approach, we assess how habitat configuration, environmental gradients, and land-use change regulate blue carbon stocks, source-sink dynamics, and greenhouse gas (GHG) exchange. The analyses integrate diverse coastal ecosystems, from wetlands to seagrass meadows and deeper sedimentary basins, capturing connectivity-driven carbon fluxes, such as lateral export and long-term burial. Carbon sink capacity is quantified through sedimentary stocks, accumulation rates, isotopic source signatures, and air–water–sediment fluxes of GHGs (i.e. CO, CH, and NO), and used to achieve spatially explicit climate–carbon modelling on downscaled regional climate projections at seascape-unit resolution. The models are used for scenario-based simulations to assess responses to cumulative pressures and extreme events, enabling predictions of shifts in carbon sequestration and emissions. Results highlight the importance of intact and well-connected habitats, as well as geomorphological context, in sustaining blue carbon storage, while habitat fragmentation and land-use change disrupt carbon pathways and reduce sequestration potential. Identified carbon hotspots are associated with continuous blue carbon ecosystems and favourable hydrodynamic settings. This research demonstrates that strengthening multihabitat connectivity is critical for enhancing blue carbon sequestration and thereby advancing climate-smart seascape restoration.

Implementation and scaling of marine restoration projects - insights from CLIMAREST

Ida Beathe Øverjordet, SINTEF Ocean AS – Norway

The Mission Ocean project CLIMAREST implemented restoration solutions across five marine ecosystems including seagrass meadows, oyster reefs, rocky bottom algae forests and soft bottom ecosystems influenced by aquaculture and sewage. Replication of the solutions were initiated in six sites across Europe. Across demos implementation success, observed and projected ecological and socio-economic benefits, as well as barriers and enablers for scaling were analyzed. Examples of demonstrated restoration solutions as well as potentials for scaling will be presented.

Seed-based restoration of Zostera noltei in nourished coastal subtidal areas

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Coastal management strategies to address erosion, flooding, and sea-level rise are increasing globally, with projected annual investments of USD 70 billion by the end of the century. Flood risk currently affects 1.6 billion people and is expected to increase to 1.9 billion people by 2100 due to climate and population change. Gray infrastructure such as

seawalls and breakwaters can promote erosion and alter sediment dynamics, negatively impacting surrounding ecosystems.
Within this context, coastal protection works are taking place along the Romanian Black Sea coast. Breakwaters are being built along 9 kilometers of coastline to shield against waves and storm surges, while beach nourishment is being implemented to stabilize the coast. *Zostera noltei* meadows occur in the Romanian Black Sea but are critically endangered, making restoration essential for the persistence of this valuable ecosystem.
Seed-based restoration offers advantages over transplantation methods, including greater scalability, higher genetic diversity, and potentially lower impacts on donor meadows. The Dispenser Injection Seeding (DIS) method has been developed to optimize and upscale seagrass restoration in intertidal meadows, and we investigated its application in nourished subtidal areas along the Black Sea Coast near Constanta, Romania.
We experimentally investigated how seeding depth (3.5/6 cm) and seed density (5/10 seeds inject-1) affect restoration success of *Zostera noltei* on recently nourished sediments (6 /18 months post-nourishment). We demonstrate that the method can be successfully applied for subtidal seagrass restoration. However, our results indicate that the hydromorphodynamic processes following beach nourishment negatively affected seed establishment and plant growth.

From pilot research to national implementation: Building the evidence base for Posidonia oceanica restoration in Greece under the EU Nature Restoration Law.

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Posidonia oceanica meadows are recognised as ecosystems of high ecological importance in the Mediterranean. Greece, with approximately 2,500 km^2 of P. oceanica meadows, bears a particular responsibility for their restoration. The overall conservation status of P. oceanica in the country is assessed as Unfavourable-Inadequate (U1), mainly related to future prospects, extent loss and spatial fragmentation, with documented losses of 20–80% at human impacted sites. The EU Nature Restoration Regulation creates a legal obligation to design and implement time-bound, evidence-based restoration actions for P. oceanica at national scale.
Here, we provide a comprehensive approach to support Greece in implementing its P. oceanica restoration obligations under the EU NRR, integrating systematic, assessment data generated through implementation of the Habitats Directive, Water Framework Directive and Marine Strategy Framework Directive, including historical mapping, reference condition baselines and expert assessments across more than 100 monitoring sites, with results from pilot restoration trials.
Pilot actions allowed for testing methodologies, reducing uncertainties and optimising design before scaling up interventions. Across sites, active transplantation achieved survival rates of 61–83% after 12–36 months, while the absence of natural recolonization after pressure removal confirmed that passive recovery is insufficient. Restoration outcomes were evaluated at the ecosystem level, combining traditional biotic metrics with eDNA monitoring to assess potential biodiversity enhancement.
The findings informed Greece's national restoration measures for P. oceanica meadows under the Nature Restoration Plan, supported by a dedicated governance framework, developed with competent authorities through policy analysis and stakeholder consultations, that clarifies institutional responsibilities and establishes implementation procedures.

Scaling native oyster reef restoration: ecological outcomes from Europe's largest Ostrea edulis habitat creation.

Brecht Stechele, Oyster Heaven – Netherlands

Native European flat oyster (*Ostrea edulis*) reefs are among the most degraded marine habitats in Europe, and the loss of these ecosystem engineers has eliminated the biodiversity, water filtration, and coastal protection services they once provided. Restoration has largely remained at experimental scales, leaving open the question of whether large-scale, commercially viable reef restoration can deliver measurable ecological recovery. We present two-year results from Project Asta (Veerse Meer, Netherlands), currently the largest oyster reef restoration project in Europe. In 2025-2026, more than 4 million hatchery-reared juvenile oysters were seeded onto three-dimensional clay substrates, creating over 6,000 m^2 of new habitat. Monitoring followed the NORA framework and includes experimental techniques including drone and photogrammetry analysis, with pre-installation baselines and a control/reference site. After one year of deployment, oyster survival reached 51%, exceeding values typically reported in the literature. Biodiversity responses

were rapid: species richness rose to > 100, a 256% increase compared to the control site, representing roughly 77% of the species historically associated with these reefs. We discuss the methodological and operational choices that enable restoration at this scale, the role of dense ”starter cultures” in seeding natural reef expansion, and the limitations of early-stage data given environmental variability and the 0–2 year developmental window. These findings offer early evidence that large-scale native oyster restoration can be both ecologically effective and operationally replicable, with implications for scaling marine habitat recovery across Europe.

NATURE RESTORATION REGULATION, FROM PLANNING TO IMPLEMENTATION

Designing a Reproducible Open-Source Database for Ecological Restoration Interventions

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The Nature Restoration Regulation, which came into force on August 2024, combines an overall long-term nature restoration goal for the EU's land and sea areas with binding restoration targets for specific habitats and species. How much land has undergone ecological restoration? Which ecosystems have been restored? What restoration targets have been set? What techniques have been used? It is currently impossible to answer these questions in France (and in most other countries). This is because there is currently no census of restoration practices that takes into account the aims and characteristics of ecological restoration interventions. However, this is essential not only for assessing the achievement of national targets, but also for informing governmental institutions, practitioners, students and researchers about the occurrence of restoration interventions in their areas of expertise or geographical areas. The long-term goal of the BDRest database is to provide a comprehensive list of all ecological restoration interventions and their characteristics in France. After an initial test run in 2025, the actual filling of the database began in 2026. We will present the possible uses and outcomes of the database, a preliminary summary of the interventions already entered into the database and discuss future developments for the database. We will aim to record as many restoration interventions as possible while creating links with the French national restoration plan and the various stakeholders involved in ecological restoration.

Providing support to local authorities for wetland restoration – The example of actions carried out by the Forum des Marais Atlantiques

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Forum des Marais Altantiques – France

Wetland restoration is gaining momentum in France as awareness grows of the importance of these habitats for mitigating extreme hydrological events linked to climate change and for improving water quality.
The Forum des Marais Atlantiques (FMA), a public-sector association which mission is to advise local authorities on wetland issues, has developed a set of approaches and tools to meet the requirements of local territories and lead to restoration projects that are adapted to their specific concerns. These tools cover the planning of action areas at the catchment level, the identification of wetlands to be restored and the prioritisation of actions, site assessments, the definition of restoration methods and monitoring of restoration actions. Governance and regional dialogue, as well as the role of land use strategies to facilitate the implementation of actions are also addressed.
Support for project managers is provided through one-to-one assistance, training, the development of tools and technical guides and network coordination. When necessary, to answer questions emerging from the field, the FMA also coordinates field-based research projects in close partnership with research institutes, technical partners and local

authorities, to fill gaps in knowledge and which also lead to collective capacity-building.
These initiatives, which are always aligned on national wetland policies, are co-funded by the FMA's institutional partners and is provided free of charge to public authorities. Its former experience now allows the FMA to be fully operational to support the implementation of the Nature Restoration Regulation at the local level for wetlands.

Experience from a new regulatory regime in Biodiversity Net Gain (England) to enforce restoration standards.

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RSK Wilding – United Kingdom

Biodiversity Net Gain (BNG) became mandatory in England from February 2024, and as part of this new regulatory system the 10% gain can be fully or in part supplied by an off-site habitat bank market. This market can be enforced via the planning system, or by a new system of Responsible Bodies (RBs). RBs hold conservation covenants as legal agreements (contracts) that bind the land and those who control it to meet obligations over a set time (30 years for BNG). Obligations are defined within agreed management plans, and strict legal and ecological due diligence is required before entering into such an agreement. Over the long-term outcomes for habitat restoration that are directed by the level of Biodiversity Units generated for BNG will be monitoring and enforced by the RB's. As a new regime we share experience of risks and opportunities that this form of agreement can hold for wider ecological restoration and nature finance. This includes examining their potential for application innovative ways, risks in the BNG market, and how ecology and ecological restoration principles can inform potential for enforcement and therefore much wider market or system level assurance.

Setting the baseline: Favourable Reference Area estimates for French marine habitats

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PatriNat (MNHN, OFB, CNRS IRD) – France

This presentation introduces the first estimates of Favourable Reference Areas (FRAs) for marine groups of habitat types (GHTs) under the EU Nature Restoration Regulation (NRR), produced to support the French National Restoration Plan due in 2027. FRAs correspond to the minimum surface area required to ensure the long-term viability of habitats and their associated ecological communities.
This talk provides an overview of the collaborative methodological framework that was developed to produce these initial estimates, despite heterogeneous knowledge levels and strict time constraints. This involved the mobilization of French experts specializing in each GHT through dedicated consultations. It depicts how scientific expertise, literature synthesis, spatial analyses, available habitat distribution datasets, and existing conservation assessments were combined to produce quantitative estimates adapted to the current state of knowledge and ecological characteristics of each GHT.
The presentation also discusses the main uncertainties and limitations of these initial estimates, and the ongoing efforts to improve habitat mapping and scientific knowledge by 2030, in preparation for revising the National Restoration Plan in the future.

"Renaturons!" (Let's bring nature back!) : bridging the gap between policy and action through an integrated territorial ecological restoration framework

Aurélie Jambon, Association Noé – France

While international commitments and regulations for ecological restoration accelerate, scaling up from planning to operational implementation remains a major challenge. Although we must restore ecosystems rapidly, one-size-fits-all solutions are ineffective; long-term success requires strategies tailored to local ecological and socio-economic contexts. To bridge this gap, the French NGO Noé designed "Renaturons!", an innovative, replicable national framework for territorial ecological restoration.
Following a structuring phase and initial success in the Nièvre department in 2025, the program is transitioning to a five-year operational pilot stage (2025–2030) across diverse French regions. A "test-and-learn" approach aims to build a consolidated and scalable model.
To address these challenges, the program integrates three complementary pillars:
Ecological connectivity as an engagement tool: mapping a national pollinator network by combining scientific datasets with socio-economic parameters during local multi-stakeholder workshops. Pollinators serve both as ecological bioindicators and federative symbols to mobilize local communities.

Participatory governance for target setting and implementation: establishing restoration goals via territorial diagnoses and co-creation workshops. This process utilizes an expert-validated assessment wheel (currently in development) aligned with regulatory frameworks across agricultural, urban, and natural matrices while ensuring citizen engagement. Local steering and technical committees oversee customized action plans implemented by local experts.
Innovative financing: deploying hybrid funding mechanisms, including localized microfunds for small-and-medium enterprises, public-private partnerships, biodiversity certificates, and dedicated ”seed funds” targeting overlooked grassland ecosystems.
This presentation will share the methodology, early pilots feedback, and discuss how bridging policy requirements with territorial dynamics can successfully secure the transition from planning to sustainable implementation.

Operational biodiversity indicators for prioritizing wetland restoration: a multi-scale research–action framework applied in France

Fanny Mallard, Passages – Université de Bordeaux, École nationale supérieure dárchitecture et du paysage de Bordeaux,– France

The European Nature Restoration Regulation sets quantified restoration targets and strengthens planning and monitoring requirements, calling for ecologically relevant indicators under climatic uncertainty. A gap nevertheless persists between scientific knowledge and operational decision-making due to feasibility constraints and stakeholder trade-offs.
A multi-scale research–action framework applied to wetland restoration in France is presented, involving researchers, NGOs, and public stakeholders. It relies on spatially explicit biodiversity indicators combining diversity metrics and species of conservation interest to prioritize interventions. Their interpretation remains dependent on biogeographical context and management objectives.
At the macroecological scale, species distribution models are used exploratorily to assess potential climate change effects. An analysis of 70 Odonata species in Nouvelle-Aquitaine highlights potential spatial redistributions and regional diversity changes, with uncertainties related to model structure and environmental data resolution.
At the regional scale, these results support the identification of priority areas, leading to 13 wetland restoration projects in dune systems. At the local scale, monitoring combining standardized field observations, environmental DNA, and drone imagery is used to test complementary approaches for assessing ecological responses, highlighting heterogeneous signals and methodological constraints related to hydrological and landscape conditions.
This work highlights the operational role of indicators in restoration decision-making while explicitly addressing their methodological limitations (scale effects, taxonomic biases, dependence on sampling effort, and weighting). It emphasizes the need for a contextualized and transparent use of indicators in public policy implementation and has informed national restoration strategies, including pond restoration planning in France.

NEW TOOLS AND TECHNOLOGIES

Listening to Recovery: Passive Acoustic Monitoring as a Scalable Tool for Monitoring Ecological Restoration

Carlos Abrahams, Wildlife Acoustics Inc – United Kingdom

Monitoring the ecological outcomes of restoration interventions remains one of the field’s most persistent challenges - traditional survey methods are costly, temporally constrained, and rarely capture the full arc of recovery. Passive acoustic monitoring (PAM) offers a compelling alternative: autonomous recording units (ARUs) can operate continuously across multiple locations, generating rich, longitudinal datasets that reflect biological activity at ecologically meaningful scales.
This talk presents an applied framework for integrating PAM into restoration monitoring programmes, drawing on real-world deployments across a range of ecosystems. This will demonstrate how readily available hardware and species identification software tools - including programs for bird and bat classification- can produce reliable, auditable biodiversity records at a fraction of the cost of conventional survey effort. Alongside species-level data, we show how acoustic indices can provide proxies for ecological community structure, enabling detection of directional change over restoration timescales.
Key findings illustrate how PAM captures restoration trajectories that traditional surveys would miss: early colonisation events, diel and seasonal activity patterns, and shifts in soundscape composition linked to habitat change. We discuss practical considerations for survey design - including recorder placement, deployment duration, and QA workflows - and highlight how standardised acoustic monitoring can be embedded within restoration plans as a cost-effective, repeatable evidence base for restoration evaluation.

Monitoring pollination in restored sand grasslands: can automation replace traditional methods?

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Understanding plant-pollinator interactions is crucial for addressing biodiversity loss and maintaining pollination. However, significant data gaps persist due to labor intensive sampling, limited direct observation of interactions, and the difficulty of identifying diverse pollinator taxa. The SEPPI project seeks to overcome these limitations by testing image-based automated methods using machine learning to compare them to traditional netting method in terms of accuracy, feasibility, and costs.
Our research focuses on sand grasslands in the Pannonian region, where we selected restored, control, and reference sites to investigate pollination dynamics across ecological gradients. Alongside vegetation surveys, pollinating insects from four orders (bees, wasps, flies, and butterflies) were sampled using traditional netting, and automated timelapse cameras to document insect activity, facilitating a comparative analysis of both survey approaches.
Initial results showed clear differences between methods: cameras captured 6,446 pollinator images from 17 plant species during 54 sessions, while netting recorded 1,932 interactions across 31 plant species. Traditional sampling further identified 687 individuals (51 species) in restored sites, 670 individuals (49 species) in control sites, and 606 individuals (20 species) in reference sites. Ongoing annotation of the image dataset will enhance detection algorithms and accuracy. By comparing methods across different habitats and land-use contexts, we aim to determine where automated techniques best complement existing approaches.
Our findings highlight the potential of automated, image-based methods to complement traditional sampling by delivering extensive and detailed information on plant-pollinator interactions in a more cost-effective way, supporting restoration, evaluation and long-term biodiversity monitoring.

The STW: A wheel for the socio-territorial assessment of restoration, designed both to facilitate dialogue and to enhance the scientific and technical scope of the assessment

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The implementation of an ecological restoration project involves numerous stages, among which the assessment phase is essential. This stage is central to restoration processes, as it helps identify discrepancies and highlights the need for adaptive management. However, assessment is generally approached from a technical perspective, falling within the remit of professionals in environmental management and restoration. Yet, such projects do not only affect ecosystems; they also impact socio-territorial dimensions by profoundly modifying landscapes, uses, practices and territorial organisation. Therefore, the assessment of a restoration project cannot rely solely on an ecological evaluation. It must also take into account the socio-territorial processes that accompany its implementation, as well as their effects.
Based on the principles of ecological restoration defined by the International Society for Ecological Restoration (SERi) (Gann et al., 2019), as well as research conducted on salt marsh restoration within the PEPPS and DPM programs, we propose a broader approach to assessing ecological restoration projects. The Socio-territorial Wheel (STW) includes several attributes reflecting stakeholder involvement, controversies around the project, benefits and losses for local communities, integration within territorial projects, knowledge development, and issues of transferability and replicability. The scoring principles are retained but adapted to incorporate potential adverse effects.
The STW is also conceived as a tool that can support territorial dialogue and help move beyond a predominantly technical approach to ecological restoration.

Methodological Guide for a Rapid Assessment Method to assess gain of biodiversity in mediterranean sea: MERCI-Med

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As anthropogenic pressures on coastal and marine environments intensify, the effective implementation of the Avoid-Reduce-Compensate (ERC) sequence is crucial for preserving marine biodiversity. In response, the Occitanie region (France) developed a comprehensive methodological guide in 2025 to standardize the assessment of ecological losses and gains for development projects. This tool addresses the need for a rapid, operational, and harmonized approach to ensure ”No Net Loss” of biodiversity. The methodology focuses on three primary Mediterranean ecosystems: soft substrates, seagrass meadows (notably *Posidonia oceanica*), and rocky reefs. It employs a functional model evaluating

three core ecological categories: refuge functions, biogenic habitat support, and life cycle/connectivity. By comparing the ”initial state” before an impact or restoration with a projected ”final state” after stabilization, the guide quantifies ecological changes. A key innovation is the integration of adjustment coefficients to account for inherent uncertainties in restoration ecology: Heritage Stake (EP) to emphasize rare or protected species, and Risk (R) and Time (T) to discount gains based on restoration failure probabilities and temporal delays. These factors are combined into a unique metric: the Compensatory Unit of Restoration and Renaturation (UCRR). By bridging the gap between scientific research and practical policy, this guide provides legal security for projects and facilitates the monitoring of European and national restoration targets. It offers a cross-disciplinary framework essential for practitioners and policymakers dedicated to the sustainable restoration of marine networks and coastal ecosystems

SeedPOD, the Seed Portal for Online Data

Teagan Hartenthaler, Royal Botanic Gardens [Kew] – United Kingdom

Ecological restoration initiatives are currently hampered by a widely acknowledged global bottleneck in native seed supply. Quantitative and qualitative analysis of this bottleneck is made difficult due to the lack of availability of high-quality, detailed data on collections of native seeds and the wild populations they derive from. In practise, restoration practitioners can struggle to find seed sources, especially sources of high-quality, genetically diverse, native seeds. Compounding these issues, means for knowledge exchange between researchers and restoration practitioners and native seed custodians is often fragmented.
To help address these issues, SeedPOD is a publicly available digitial platform to support seed-based restoration, conservation, and research communities launching this September. SeedPOD will unlock detailed field, processing, seed quantity and availability data on wild plant species throughout their global distribution range and will link related seed collections stored at multiple locations for easy identification and comparison. SeedPOD will also share germination test data, to assist the process of transforming native seed back into thriving plant communities. SeedPOD will link to complimentary resources and information sources. Significantly SeedPOD will include a point of request for seed samples from participating native seed custodians.
Native seed custodians will have in SeedPOD a user-friendly, reliable platform to disseminate their organisation details and seed list easily and for free, while researchers and restoration practitioners will be able to access high-quality data, and to identify appropriate seed sources available for use.

PEATLAND RESTORATION

Landscape Restoration in the UK’s East Anglian Fens: Trade-offs Between Food Production, Nature Recovery, and Climate Change Mitigation

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Restoring degraded ecosystems in working landscapes requires approaches that balance ecological recovery with continued economic activity. This study explores restoration pathways for the UK’s East Anglian Fens, a highly modified and productive landscape where centuries of wetland drainage and intensive agriculture have led to extensive peat loss, biodiversity decline, and greenhouse gas emissions.
We developed spatially explicit land use scenarios to assess how different restoration strategies could reshape ecological and socio-economic outcomes while maintaining food production. The analysis is underpinned by bespoke data collected across the region, ensuring results are grounded in locally observed ecological and management realities. Scenarios combine variations in agricultural yield assumptions with restoration interventions including wetland creation, woodland expansion, wet grassland creation, regenerative agriculture, and paludiculture.
Results show that wetland restoration delivers the largest ecological gains, particularly through substantial reductions in emissions, improvements in water quality, and increases in breeding bird populations. Woodland and habitat expansion further enhance biodiversity and contribute to landscape-scale multifunctionality.
However, restoration of high water table systems increases water demand in this already heavily managed catchment, highlighting the need for integrated hydrological governance to enable successful ecological restoration. Economic

viability is generally maintained where improved productivity and diversified land uses compensate for reductions in conventional agricultural area.
Overall, we demonstrate how scenario-based planning can support ecological restoration at landscape scale, helping identify pathways that deliver gains for biodiversity and climate while maintaining working landscape functions. This supports the growing need for integrated restoration and land use planning frameworks in intensively managed regions.

Habitat restoration, wildfire resistance and resilience in cool, humid temperate ecosystems

Rob Hughes, Royal Society for the Protection of Birds – United Kingdom

Wildfire risk is increasing globally as climate change intensifies fire-prone conditions and land use degrades ecosystems, reducing fire resistance and resilience. In cool, humid temperate systems such as those of the United Kingdom, ecological restoration is increasingly implemented to enhance biodiversity, restore ecosystem processes and mitigate climate change. However, its influence on wildfire resistance (the capacity to limit ignition, spread or severity) and resilience (post-fire recovery of structure and function) remains contested, particularly where restoration involves prolonged transitional states.
Synthesising evidence from the United Kingdom and drawing on studies from comparable cool, humid temperate systems, we evaluate how habitat condition and restoration trajectories influence wildfire resistance and resilience across peatlands, heathlands, grasslands and native woodlands. Across habitats, wildfire resistance and resilience are governed primarily by hydrological condition, fuel moisture, vegetation structure and composition, and fuel connectivity rather than habitat identity alone. Intact, self-maintaining systems-especially wet peatlands and structurally complex native woodlands-tend to limit severe fire and recover more rapidly, whereas degraded or simplified systems with continuous fine fuels and altered hydrology are more vulnerable.
Restoration often passes through intermediate states that differ functionally from both degraded and near-natural conditions, potentially altering wildfire susceptibility while ecological feedbacks are re-established. Although restoration is unlikely to reduce ignition likelihood in the UK, restoring hydrology, increasing fuel moisture and promoting structurally diverse vegetation can reduce wildfire severity and support faster ecological recovery, contributing to more wildfire-resilient landscapes.

Temporal emission trajectories shape the climate benefits of peatland rewetting

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Peatland rewetting is widely promoted as a nature-based climate solution. However, temporal trajectories of post-rewetting greenhouse gas emissions may strongly influence when climatic benefits emerge, introducing uncertainty that conventional static emission-factor approaches may fail to capture. Here, using 59 temperate rewetted peatlands spanning up to 30 years after rewetting, we develop a trajectory-based climate assessment framework to determine when the climatic benefits of peatland rewetting emerge. Results suggest that net cooling benefits from peatland rewetting may emerge substantially later under trajectory-based assessments than predicted by conventional static emission-factor approaches. These findings highlight the importance of incorporating temporal emission trajectories into future climate assessments of peatland rewetting.

Changes in water table depth, tree stand and vegetation are linked in restored boreal peatlands

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Restoration outcomes vary both between and within ecosystem types. In boreal peatlands, drainage for forestry increases water table depth and basal area of the tree stand, making the environment drier and more shaded. Restoration by filling in and blocking the ditches, as well as occasional tree felling, decreases water table depth and increases tree mortality but with variable outcomes. We studied whether variation in how restoration changes the environment (i.e. water table depth and basal area) explain variation in plant community responses to restoration. To answer this question, we used a large-scale monitoring data of 151 restored, drained and undrained sites from six peatland types in Finland extending 10 years after restoration. We found that lower water table depth and higher decrease in basal area after restoration tended to shift plant communities towards those typical in undrained sites in several peatland types. Especially in poor pine mire forests, concurrent changes of water table depth and tree stand basal area seemed to be important in determining the community-level changes. Joint modelling of environmental and

species responses to restoration revealed that responses of many individual species were strongly related to changes in water table depth and basal area. Additionally, changes in water table depth and tree stand were entwined. Our results show that tree stand characteristics likely affect the restoration outcome in all studied peatland types. Hence, while the success of rewetting is of utmost importance, more emphasis should be given for the tree stand.

Immediate impacts of peatland rewetting on environmental variables and GHG fluxes

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Large-scale restoration of degraded peatlands is increasingly promoted to safeguard biodiversity and reverse the impacts of drainage, which can turn peat soils from CO and NO sinks into sources. In forestry-drained peatlands, restoration is commonly achieved by rewetting through ditch blocking. While rewetting is expected to restore the CO sink, it may also increase CH emissions, partly offsetting the climate benefit. However, the rate at which greenhouse gas (GHG) exchange recovers remains poorly understood.

We present the first results of changes in GHG fluxes and related environmental variables, including water table depth, soil temperature and moisture, redox potential, tree sap flow, and CH production and oxidation potentials, following restoration of a fertile forestry-drained peatland. The site, located in Southern Finland, was restored in autumn 2024 by ditch blocking, preceded by thinning of the tree stand.

Ditch blocking rapidly raised the water table from –55 to –15 cm and was followed by a delayed decline in soil redox potential. The ecosystem CO sink, previously dominated by tree uptake, nearly disappeared after thinning. Within a year of restoration, the soil shifted from a small CH sink to a small CH source, whereas soil CO and NO effluxes showed no significant changes. Overall, thinning and rewetting increased warming during the first post-restoration year. Whether and how quickly recovering vegetation can compensate for the loss of the tree-driven CO sink remains uncertain.

Hierarchical environmental filters govern alternative vegetation trajectories in peatlands restored by the moss layer transfer technique

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Canadian peatlands restored after horticultural peat extraction do not uniformly return to a *Sphagnum*-dominated state, despite standardized application of the Moss Layer Transfer Technique (MLTT). Long-term vegetation trajectories were analyzed across 147 restored sectors distributed from New Brunswick to Alberta, spanning up to 20 years of post-restoration monitoring. Discrete-time Markov chain analysis, coupled with information-theoretic metrics, identified three persistent trajectories: *Sphagnum*-dominated (43%), low acidophilous cover (31%) and *Polytrichum*-dominated (26%); and quantified the pace at which each reached compositional stability. Multinomial Elastic Net regression, paired with bootstrap stability assessment, was then applied to determine which initial environmental conditions best discriminated among these outcomes. Residual peat physicochemistry acted as the primary filter, with critical thresholds near pH 4.2 and electrical conductivity around 120 μS cm^{1} beyond which *Sphagnum* establishment was increasingly precluded. Within the ombrotrophic range, mean summer temperature discriminated the two bryophyte trajectories, with a threshold near 17-18 ◦C, below which frost-prone regional climates and associated substrate disturbance by frost heaving increasingly favored *Polytrichum strictum* dominance. Summer drought duration further constrained establishment, with both *Sphagnum*- and *Polytrichum*-dominated trajectories failing to maintain persistent cover beyond 42-43 consecutive effective drought days. The *Polytrichum*-dominated trajectory behaved as an absorbing state, reaching complete compositional homogeneity within 10 years with no spontaneous reversal observed. The window for corrective intervention is therefore confined to the first decade. MLTT should accordingly be directed toward substrates where the *Sphagnum* acidification feedback can be initiated, with fen-oriented restoration strategies preferred where physicochemical conditions are incompatible with ombrotrophic restoration.

From Projects to Restoration Trajectories: What Implementation Cases Reveal for the Nature Restoration Regulation

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The EU Nature Restoration Regulation (NRR) sets ambitious targets for ecosystem recovery across Member States. Delivering these targets requires translating policy commitments into concrete actions on the ground. In practice, however, restoration is implemented through time-limited projects operating under diverse ecological, institutional, and financial conditions. Understanding how such projects contribute to longer-term processes is therefore critical for credible National Restoration Plans.
This contribution draws on 18 implementation cases from the Horizon 2020 MERLIN project, covering river restoration, wetland rewetting, barrier removal, and floodplain reconnection across Europe. Rather than focusing only on ecological outcomes, the analysis examines how projects interact with permitting systems, land access, funding cycles, institutional mandates, and monitoring responsibilities.
The cases show that restoration rarely progresses through isolated projects. Instead, it unfolds as trajectories shaped by successive interventions, evolving governance arrangements, and shifting societal framings. Across cases, restoration is increasingly positioned not only as biodiversity conservation, but also as contributing to climate resilience, regional development, and emerging priorities such as competitiveness and security.
Whether projects strengthen these trajectories depends on structural conditions, including institutional capacity, financial continuity, and effective coordination among actors. Achieving the ambitions of the NRR will therefore depend not only on setting targets, but on building the enabling conditions and ensuring long-term policy relevance needed for restoration to persist over time.

Normative Ethics in Ecosystem Restoration Decision-Making

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Ecosystem restoration has become a key approach to tackling global ecosystem degradation but faces ecological and ethical challenges. The ethical examination of restoration has primarily focused on values and directed ethical analysis toward 'natural' landscapes and ecological relationships. However, normative ethical theories, specifically focused on guiding decision-making and action, have received surprisingly little attention. We review normative ethical theories (consequentialism, deontology, virtue, and relational approaches) to assess how they would guide restoration practice. We aim (1) to provide guidance to restoration practitioners and policymakers on how to apply these theories in the context of restoration and arising trade-offs; and (2) to explore what real-world cases, inspired by mire forest restoration, reveal about the strengths and shortcomings of the theories. We employ methods from philosophical ethics, such as clarifying concepts, rational argumentation, and comparing theories. Our review reveals new insights into the traditional ethical theories, highlighting interesting similarities and differences (e.g., deontology is more cautious about restoration than consequentialism), as well as their advantages and disadvantages (e.g., consequentialism and virtue ethics are more flexible in managing trade-offs, whereas deontology performs better under uncertainty). We found that the definition of system boundaries and the entities included strongly influence how normative theories evaluate trade-offs, emphasising the need for greater sensitivity and critical awareness when portraying these trade-offs. Overall, our review offers valuable insights and tools for applying ethical theories to restoration decision-making and practice.

Restoration to shift Risk to Resilience: Certifying, Financing and Insuring Europe's Climate Ready and Biodiverse Forests

Mateo Carinõ Fraisse, Preferred by Nature – Spain

Europe's forests are on the frontline of climate change and biodiversity loss, increasingly exposed to wildfires, storms, drought, pests and market volatility. Addressing these risks requires more than better forest management practices alone: it calls for integrated governance, credible standards, and innovative financial mechanisms that reward resilience

and adaptation. We highlight key insights from the *Eco2adapt* EU Horizon project, focusing on how certification can connect best practices accountability with biodiversity outcomes, insurance, governance innovation and finance to jointly accelerate the transition towards climate-resilient, socio-ecological forest landscapes.
At the heart of this approach lies the role of Preferred by Nature, leading the development and testing of a certification framework for resilient forests. Building on ecosystem-based adaptation principles and existing certification schemes, it integrates climate adaptation, mitigation, biodiversity, and wildfire resilience modules. Piloted across diverse European contexts, it provides a credible benchmark to identify, reward and scale climate-adaptive forests and biodiversity.
Crucially, certification acts as a connector between forest practices and innovative finance mechanisms. The presentation highlights emerging models such as payments for ecosystem services, bundled and semi-bundled forest insurance products, and premium discounts tied to verified fuel-management and adaptation actions. These instruments demonstrate how verified resilience can reduce risk, unlock investment, and shift the role of public authorities from ”payer of last resort” to market facilitator.
Through standards, eco2adapt finance and risk-sharing tools, eco2adapt illustrates a practical pathway to move from policy ambition to implementation, making forest resilience measurable, insurable and investable at scale.

Landscape Recovery Schemes - the UK's Solution to Restoring Nature at Scale?

Martin Varley, Endangered Landscapes and Seascapes Programme – United Kingdom

The UK aims to protect 30% of its land and sea for nature by 2030. Key goals include restoring 500,000 hectares of wildlife-rich habitat by 2042. These legally binding targets are detailed in its Environmental Improvement Plan.
The UK's exit from the EU opened the door to unilateral policy making for nature restoration. This has resulted in the creation of the Environmental Land Management Scheme to support agricultural in England, replacing the EU's Common Agricultural Policy. It operates on the principle of ”public money for public goods,” paying farmers for benefits like improved biodiversity, carbon sequestration, and flood mitigation alongside food production.
The most ambitious tier of the scheme is Landscape Recovery. This supports large-scale, long-term (20+ years) projects involving groups of farmers working across at least 500 hectares. There are currently 50+ pilot projects delivering habitat restoration, biodiversity enhancement, and net-zero goals covering more than 240,000ha, potentially contributing 50% of the national restoration goal.
Through the lens of a single project this presentation explores the contribution of these schemes to the UN Decade on Ecosystem Restoration. Covering 16,000ha of the Lake District National Park, the Penrith2Kendal Landscape Recovery Scheme is one of the largest and has been developed by Cumbria Connect, part of the Endangered Landscapes and Seascapes Programme. Covering 7% of the park landscape the scheme will transform nature over a generation, including the potential for almost 10,000ha of woodland creation and regeneration. The presentation shares the project's journey and the lessons learned along the way.

Non-governmental organisations as driving enablers for credible National Restoration Plans under EU Nature Restoration Regulation

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The EU Nature Restoration Regulation (NRR) offers a new framework for large-scale ecosystem recovery with legally binding targets. Its impact on the ground will depend on how Member States produce and implement national nature restoration plans (NRPs) with credible priorities, measures, and funding up to 2050. We examine the role of non-governmental organisations (NGOs) in supporting and scrutinising NRP development across the EU through the #Restore-Nature coalition. We present findings from harmonised NGO-led assessments of five enabling conditions for credible NRPs: science base, ambition, inclusiveness, empowerment, and effectiveness. The progress of NRP development is overall uneven, with a small group of frontrunner countries demonstrating transparent, science-based, and inclusive processes. Major gaps concern weak scientific baselines, limited public participation, lack of transparency on how consultation inputs are used, and especially low empowerment, with insufficient political buy-in, staffing, resources, and cross-sector coordination. We argue that NGOs play a triple role in the NRP process by providing data and expertise, mobilising support from diverse actors, and being a critical watchdog to safeguard quality and accountability. We also offer practical lessons for the next NRR implementation phase to be better fit for purpose.

A legal analysis of the pollinator restoration toolbox

Siemen Kalders, Hasselt University – Belgium

The presentation discusses legal research on Article 10 of the Nature Restoration Regulation (NRR), examining the past, present, and future of pollinator restoration. The overarching argument is that Article 10 NRR functions as a legislative toolkit whose effectiveness depends on which tools it contains and which are actually used.
The first part describes the science and policy background prior to the Regulation. Article 10 NRR is the culmination of a long process and is only one piece in the puzzle. This context is essential to understanding both what Article 10 NRR was designed to do and what it was not.
The second part examines the pollinator restoration regime under Article 10 NRR, focusing on the restoration targets (who, what, when) and the related monitoring obligations under Commission Delegated Regulation (EU) 2025/2188.
The third part turns to the future, shaped by two key tensions: the asymmetry between binding restoration targets for Member States and the absence of equivalent EU-level targets, and the broad discretion afforded to Member States in establishing restoration measures. These tensions risk fragmented implementation and limited accountability.
The past, present, and future of Article 10 NRR reveal that pollinator restoration cannot be addressed via a single provision. Several pressures, including pesticide use, nitrogen deposition, and habitat loss, require action by multiple actors across legal sources. In this respect, Article 10 NRR serves as a legislative toolkit, but remains only one component in a broader system that has yet to be fully assembled.

Biodiversity-friendly Afforestation - a legal-empirical analysis of bottlenecks in administrative afforestation practice

Edo Schoone, Hasselt University – Belgium

In my research, I assess whether national afforestation practice aligns with EU Forest objectives and the Biodiversity-friendly Afforestation Guidelines. After identifying and defining EU criteria, I empirically examine three Flemish afforestation policies.
The first pathway involves voluntary afforestation through subsidization. The Flemish legislation establishes criteria that have to be met in order to receive subsidies. Depending on the content of these criteria, different types of forests are enabled. These criteria have changed considerably in the past 30 years, most notably the tree-species to be used, the cultivation and genetic material and the local suitability.
The second pathway considers forest compensation after deforestation through permitting. The Flemish 'compensatieplicht' uses quantitative criteria, but does not incorporate qualitative criteria, meaning that the lost species can be compensated elsewhere with a different species.
The third pathway considers the practice of reforestation after illegal deforestation. In this case, reforestation is imposed through administrative remedial measures. Through content analysis, I analyzed 84 remedial decisions concerning forest remediation through content analysis with the aim to determine the remedial practice.
I end with comparing how the three national pathways align or diverge from the EU afforestation criteria. I conclude that, depending on the regulatory framework and the actors involved, forests of varying ecological quality and resilience are established with some frameworks leading towards more biodiversity-friendly forests than others. The analysis reveals clear discrepancies of afforestation policies between national policies and within national policies themselves, leading to clear recommendations for future small-scale afforestation.

Certifying ex ante biodiversity gains: a checklist-based method for offsets and biodiversity credit schemes

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As global biodiversity loss accelerates, biodiversity credits are increasingly promoted as a mechanism to mobilize private investment for ecological restoration alongside public efforts. In France, mitigation banking and voluntary biodiversity credits are governed under a unified regulatory framework. However, certifying anticipated biodiversity gains ex ante remains challenging, particularly for administrative authorities required to assess projects based on declarative and predictive information.
To address this issue, we identified 20 key requirements for a robust biodiversity credit certification framework, covering regulatory compliance, operational feasibility, and ecological success factors derived from restoration ecology literature. We then conducted a comparative analysis of 10 existing standards, guidelines, and certification approaches in restoration ecology, biodiversity offsetting, and nature credits. None fulfilled all identified requirements, revealing

recurrent gaps in operational applicability, compatibility with offsetting schemes, and assessment of restoration success factors.
Building on these findings, we developed a qualitative, checklist-based certification framework composed of 34 questions structured into four stages: project scope, site characteristics, biodiversity gain strategy, and threat assessment. Each question generates standardized feedback categories supported by scientific references, ecological indicators, and risk identification criteria. The framework was iteratively refined through testing with administrative agents, project developers, and researchers, and applied to the Cros du Mouton SNCRR case study in southern France.
The proposed framework improves transparency, reproducibility, and integration of ecological expertise into administrative decision-making. However, its reliance on expert judgment and declarative data highlights the need for robust ex post controls and safeguards against ecological and market-related risks associated with biodiversity credits.

From policy ambition to local practice: Governance capacity for native birch woodland restoration in Iceland

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Large-scale restoration commitments increasingly depend on governance systems that connect policy ambitions with local land-use realities. In Iceland, native birch woodland restoration is promoted through national climate, biodiversity and land-restoration policies, including the Bonn Challenge target of increasing birch cover from 1.5 to 5% by 2030. Yet implementation takes place within landscapes shaped by grazing, forestry, infrastructure, private ownership and changing livelihoods.
This study examines how policy framings, actor roles and stakeholder relationships shape governance capacity for birch woodland restoration. Drawing on a document analysis of national and regional policies, laws and planning instruments, and interviews with 35 representatives from government agencies, municipalities, consultants, practitioners, farmers and landowners, it combines stakeholder analysis with network-informed reasoning and a governance capacity framework.
Preliminary findings show partial alignment but practical disconnection. National policies frame birch restoration as contributing to climate mitigation, biodiversity recovery and ecosystem resilience, emphasising natural regeneration and landscape-scale approaches. However, legal and planning instruments provide limited operational guidance, and municipal implementation relies on voluntary cooperation, local political will and external expertise. Regional advisors and local actors describe unclear mandates, limited resources, weak follow-up and fragmented knowledge flows. Birch is widely valued culturally and aesthetically but competes with land-use priorities and incentives favouring production-oriented forestry, grazing access and development.
The study argues that scaling up native woodland restoration requires not only ecological knowledge but stronger regulatory, adaptive and integrative governance capacities that support shared problem framing, locally relevant knowledge exchange, and sustained collaboration across governance levels.

SOCIOLOGICAL PERSPECTIVES AND STAKEHOLDER INVOLVEMENT

From Degraded Commons to Resilient Landscapes: Lessons from Rajasthan, India

Bandana Sambyal, Foundation for Ecological security – India

Rangelands are plays central role in integrated production systems-including conventional livestock rearing, crop–livestock integration, and agroforestry-rangelands have historically remained marginal, resulting in widespread degradation.
The study draws on empirical research conducted across 15 villages in Mandalgarh Block of Bhilwara District, Rajasthan, India. Using a qualitative approach-combining field observation, focus group discussions, case studies-the research analyses how community-led planning processes, enable ecological restoration and livelihood enhancement. The findings demonstrate that public programme–supported interventions have contributed significantly towards soil health, biomass productivity, fodder availability, and increase in water table across both pasturelands and adjoining

agricultural landscapes.
Beyond ecological outcomes, the paper foregrounds the role of governance by village institution in shaping ecological restoration processes on complex landscapes. Community involvement from planning to execution emerged as a decisive factor in sustaining restoration outcomes, particularly where rotational grazing, species diversity, and soil conservation practices were collectively agreed upon and enforced. The findings highlights that village institutions exist within formal governance frameworks, can mobilise collective voices. Also adaptive governance emerges when communities are recognised not merely as beneficiaries but as co-governors with ecological knowledge and political agency.
This paper argues that existing government policies and programmes can act as enabling platforms for strengthening decentralised governance, investing in institutional capacity building, fostering convergence, and facilitating knowledge exchange , to transform rangeland restoration from fragmented interventions into durable asset. The study provides practical insights into how community-managed rangelands supported by public programmes can generate sustained ecological, economic and governance benefits in semi-arid landscapes.

Anchors of stewardship: Unpacking forage rationales and participant profiles of semi-natural grassland restorers in the boreo-nemoral zone

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In the boreo-nemoral region, semi-natural grasslands (SNG) are crucial for biodiversity but face threats of intensification or abandonment. Locally, farmers maintaining these extensive practices represent a small fraction of the agricultural community. This study explores their motivations and ”hierarchical relationships between humans and nature” (Chapman and Deplazes-Zemp, 2024) - whether they operate as managers, stewards, or partners. Building on this, their distinct ”forage rationales” (Petit et al., 2022) are investigated to understand the practical anchors of engagement.
Within LIFE Nature projects, private sector leadership is rare – managing only 2% of projects (EASME, 2020) while NGOs and public bodies dominate (Rigo et al., 2022). Consequently, this research underscores farm involvement as formal partners. Using semi-structured interviews (n=17), the study examines SNG restorers in two LIFE projects (GrassLIFE and GrassLIFE 2) led by the Latvian Fund for Nature.
Findings reveal a spectrum of participant profiles: from those for whom profit-making is never a goal or who view SNG management as a ”hobby that breaks even”, to experienced entrepreneurs defining it as a ”stable and secure business model”. While acknowledging SNG are less lush than intensive grasslands, restorers note they provide a broader ”menu” balancing the livestock microbiome. Mirroring human nutrition, they perceive this botanical diversity as foundational for animal health and immunity. A common thread is relying on intuition over empirical data, perceiving forage as naturally balanced. By documenting these subjective realities, the study highlights farmers as ”cornerstones of resilient agricultural landscapes” (Gorris et al., 2025) and enduring partners to nature.

Motivating and supporting semi-natural grassland managers: policy design lessons from Estonian farmers

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Semi-natural grasslands (SNGs) are among Europe’s most diverse ecosystems, supporting unique biodiversity, cultural heritage, and numerous ecosystem services. Appropriate management sustains these habitats, however their area has declined 90% in the past century, due to land use change - intensification, urbanisation, and abandonment. Reversing this trend through restoration and conservation requires consistent management, reliant on motivated and engaged farmers.
Estonia, a small country in northeastern Europe, has retained a significant amount of SNGs, and can offer SNG management policy and stakeholder insights. Data gathered through 280 online questionnaires and 91 structured interviews reveals Estonian SNG managers’ motivations and struggles. Over 900 Estonian farmers apply for SNG subsidies, but motivation is also greatly driven by tradition, conservation, aesthetic landscapes, and enjoyment. Challenges around cost-effectiveness, land tenure, lack of advisory services, and rigid policies threaten long-term restoration and management.
Although restored and managed SNG area is currently increasing, one third of managers are at risk of ceasing activity. Here, policy design matters, as managers look to the state for SNG land rental, simplified and flexible support schemes, and an advisory system. While positive steps are being taken, overarching political change is needed for long-term SNG

restoration, management, and stakeholder engagement.
Looking to the future, sustainable SNG management could be aided by national results-based or hybrid support schemes focused on habitat quality and farmer engagement, accessible advisory services, and strengthened collaboration between farmers, authorities, and experts. The lessons in policy design from Estonia can inform stakeholders across Europe working to maintain similar habitats.

From appreciation of sustainable farming to nature restoration: an example from the Czech Republic

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The ambitions of the EU Biodiversity Strategy for 2030 and Nature Restoration Regulation in restoring habitats and species linked to agricultural land are high. But the future financial framework is uncertain. Therefore, the cardinal questions are: how to motivate farmers and land managers to restore nature and manage their land sustainably.
Various tools are used in protected areas of Czechia, including offers of various subsidies as well as financial compensation for increased difficulty of farming and damages caused by protected animals. Another important tool are public contracts concluded between state nature conservation and landowners. These agreements restore owners' awareness of the value of their land from non-financial perspectives, which is especially important in a post-socialist country where the relationship with the land has been disrupted.
Outside protected areas, the active role of landowners in biodiversity conservation is even more significant and more difficult, especially in the absence of consulting. A successful example is the bottom-up program Varied Landscape" of the Association of Private Farming of the CR, in which farms are awarded for their responsible approach to the landscape and nature. Award-winning farmers are good partners for the discussion on the refinement/elaboration of a result-based oriented scheme. The development of which is one of the objectives of the Prospective LIFE Project. The contribution will focus on the possibilities and barriers to nature restoration from the perspective of "nature-friendly" farmers in changing times and, on using the knowledge for implementation of result-based oriented schemes under the future Czech CAP.

Measuring the reclamation and ecological restoration economy. A practical case from western Canada

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Ecological restoration has gained unprecedented attention as a response to global crises such as ecosystem degradation and biodiversity loss. However, the socio-economic benefits of restoration activities remain difficult to measure and are insufficiently integrated into scientific research and policy frameworks. Survey-based approach can help bridge this gap by collecting data directly from restoration practitioners and companies. The survey was developed as a pilot study in Western Canada, to capture key information on company profiles, human and financial resources, skills and expertise, policy drivers, and the types of restoration activities. Based on responses from 144 respondents, the results indicate that both provinces have a well-established network of restoration practitioners, primarily consultants, regulators, industry and NGO's, with a wide range of activities and skills. Also, the results indicate 2056 employees working at least part-time and 1488 full-time equivalent positions in Alberta and at least 1522 employees, representing a total of 419 full-time equivalent positions in British Columbia. In both provinces, business units' range in size from one person to 400 employees with a wide range of revenues and expenditures, from less than CAD $50,000 to more than CAD $100 million per year. Notably, over 80% of respondents expected a similar or increased workload in the coming years. Although the results offer only a limited snapshot of the activities and expertise involved, they highlight the growing strength of the restoration economy and the need for more comprehensive analyses at the provincial and national levels to fully capture its potential.

Climate Adaptation, Governance Fragmentation, and Socio-Ecological Restoration Pathways in Mountain Regions: Evidence from Caucasus Georgia

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Ecological restoration is increasingly understood as a socio-political as well as biophysical process, particularly in regions exposed to climate change and institutional complexity. This paper examines the governance and adaptation dynamics shaping ecological restoration potential in mountain regions of Georgia, where climate risks, tourism development pressures, and institutional fragmentation intersect. Drawing on a qualitative synthesis of policy documents, secondary

spatial data, and comparative governance literature, the study explores how multi-level governance arrangements influence adaptation capacity and restoration outcomes. Findings highlight three interlinked challenges: fragmented institutional coordination across environmental and tourism sectors, limited integration of climate adaptation into spatial planning, and uneven participation of local communities in decision-making processes. At the same time, emerging community-based resilience practices and NGO-led initiatives demonstrate localized restoration capacity and adaptive innovation. The paper argues that ecological restoration in peripheral mountain regions cannot be separated from governance restructuring and institutional integration. It contributes to socio-ecological systems theory and multi-level governance literature by demonstrating how restoration outcomes depend on cross-sectoral coordination and adaptive governance capacity rather than ecological intervention alone. Policy implications are drawn for strengthening integrated landscape governance, enhancing EU-Georgia cooperation frameworks, and aligning tourism development with restoration objectives under climate change. The study provides insights relevant for European ecological restoration debates, particularly in mountainous and tourism-dependent regions.

Including plural ways of knowing and valuing in oyster restoration in England and The Netherlands

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This study seeks to understand how different oyster heritage and values can support the restoration of native oysters. There is growing interest in bringing the native flat oyster that once covered extensive parts of European coasts back from the brink of extinction. Around these efforts, networks of collaboration are emerging across sectors and disciplines. While mostly studied from an ecological perspective, oyster restoration is also inherently social, cultural, and politically conditioned. The decline and resurrection of oyster reefs is entangled with European and transatlantic cultural history and maritime heritage. Local communities, oyster fishers and aquaculturalists often have deep-seated knowledge and heritage traditions around oysters. Involving these throughout restoration projects is now widely assumed to be both instrumental for restoration success, and a condition for good and just restoration governance. This paper explores how such different values and knowledge are included and excluded in oyster restoration projects. Based on qualitative fieldwork 2022-2025 in Zeeland (NL) and Essex (UK), the paper zooms in on tensions and synergies between oyster fishers/farmers and restoration projects regarding what is 'good oyster care' and identifies common ground for dialogue. It thereby provides an empirically grounded insight in the social and governance conditions that enable or constrain the inclusion of different ways of knowing and valuing oysters in restoration programs to contribute to the development of inclusive collaboration networks.

Applying SER Standards to Ecosystem Restoration in Iceland: The Stóratunga project

Katrín Valsdóttir, Land and Forest Iceland – Iceland

Restoration efforts in Iceland have often focused on improving ecosystem functions and services, but many projects have lacked a clear restoration framework and long-term vision. The restoration of Stóratunga, a 2,100-hectare site in northern Iceland, follows the standards of the Society for Ecological Restoration (SER) and highlights their application in Icelandic ecosystem restoration.

The project is currently in its early stages, with a project team working together with local landowners and stakeholders to develop a site-specific restoration plan that reflects both ecological conditions and local priorities. A key component of the project is the use of SER assessment tools, including the Recovery Wheel, to evaluate restoration progress across different ecosystems within the site. Baseline data, reference ecosystems, and long-term monitoring are being used to guide management decisions and assess ecological recovery over time, allowing restoration actions to be adjusted based on observed outcomes and changing site conditions.

The project aims to support long-term restoration planning and monitoring in Iceland while emphasizing the importance of working with local stakeholders and adapting restoration approaches to local conditions. Overall, the project provides an example of how SER standards can support long-term ecosystem restoration in Iceland.

Do reforestation projects in Spain meet restoration standards? An assessment with recommendations

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Adopting standards-based restoration is essential for reducing ecological, social, and financial risks while ensuring that

ecosystem recovery provides effective, long-term returns for both people and nature. This study evaluates 22 forest restoration projects in Spain against the WWF-SER standards using a semi-quantitative framework of 28 indicators. Results reveal limited alignment, with only 36% of projects surpassing the minimum quality threshold. While projects often performed adequately in technical feasibility, critical deficiencies persist in stakeholder participation, reference ecosystem definition, and long-term monitoring. Statistical analysis demonstrates a significant positive correlation between planning and design investment and project quality, suggesting that higher early-stage analytical spending leads to more robust restoration designs. However, high expenditure alone does not guarantee quality, highlighting institutional capacity and technical expertise as primary determinants of success. These findings underscore the necessity of transitioning from simple tree-planting efforts toward comprehensive socio-ecological processes. We recommend the systematic integration of restoration standards into public investment frameworks to enhance accountability and ensure the long-term effectiveness of ecosystem recovery in Mediterranean contexts.

The impact of restoration actions on ecosystem services considering ecosystem condition

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Evaluating the effectiveness of restoration actions requires tools that capture how changes in both ecosystem extent and ecosystem condition translate into changes in ecosystem service (ES) capacity. Current ES assessment methods based on capacity matrices typically assign uniform scores to ecosystem types regardless of their condition, limiting their sensitivity to management-driven ecological change. We applied and extended the condition-adjusted ES capacity framework of Roche and Campagne (2026) to a French wetland site (Malessard, 18.8 ha) subject to an active restoration plan. The model integrates structural and biological condition indices with expert-based ES capacity matrices across three condition levels, weighted by ecosystem type area, to quantify ES capacity for 17 services. We assessed ES capacity under current conditions and under two restoration projections corresponding to the 10-year management plan horizon and a long-term (˜30 year) target state. ES capacity increased across all 17 services at the site level for both projections, with the largest gains in regulating and cultural services driven by the expansion and condition improvement of wet woodlands, wet shrublands, and reedbeds. A separate analysis of area and condition effects revealed that simultaneous improvements in both dimensions produce amplified ES gains relative to either factor alone, with direct implications for restoration prioritisation. The approach is replicable and provides managers with a forward-looking assessment tool for adaptive management of restoration trajectories.

Nature restoration planning in France - costs and benefits for society and climate change mitigation

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To implement restoration actions within their territories, European Member States must assess the initial state of the ecosystems to be restored and define restoration trajectories toward which these ecosystems can evolve. These trajectories are shaped by climate change, whose impacts are difficult to predict with precision. Moreover, restoration objectives are closely linked to climate change mitigation goals. In this context, IUCN and France developed a scheme to identify restoration measures with climate change adaptation and mitigation co-benefits, where socioeconomic impacts, benefits and costs of such restoration measures were also assessed.
The methodology allowed to bring together the topics of nature restoration and climate change adaptation and mitigation, by highlighting existing knowledge, tools and data.
The results show that:

- nature restoration may lead to short-term income reductions, however, in the long term, it generates more stable and less risky revenues thanks to improved resilience to climate change,
- restoring and protecting ecosystems translates into job growth in ecological engineering, natural-area management for tourism, and maintenance work, and should promote short supply chains,
- providing an estimate for restoration costs at the ecosystem scale is not straightforward, but orders of magnitude can be provided based on the literature and existing feedback, which need to be refined as restoration efforts progress.

The methodology also allowed to engage discussions on nature restoration in France with a broad range of stakeholders, from scientists, public authorities, to NGOs, contributing to the efforts of France to design their nature restoration plan involving stakeholders and local authorities.

From Seed Collection to Ecological Restoration: Forest Seed Networks and Seed Quality Challenges in Brazil

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Ecosystem restoration has become a global priority, with Brazil committing to restore 12 million hectares by 2030. This ambitious goal creates a massive demand for native seeds, estimated at hundreds of tons annually, challenging current production and logistical capacities. This study analyzes the fundamental role of Community-Based Seed Networks, exemplified by the Xingu Seed Network and Redário, which have emerged as sustainable alternatives by promoting high species diversity and social inclusion. Currently, Brazil has more than 60 seed networks involving thousands of collectors, with female participation exceeding 60%, consolidating the concept of the ”Social Seed” as a catalyst for empowerment and ecosystem services. However, the sector faces significant technical and regulatory bottlenecks. Seed selection is still often driven by commercial convenience rather than ecological criteria, resulting in low species diversity in restoration projects. Furthermore, Brazilian legislation remains restrictive: only 138 forest species (27.6% of the existing demand) have officially approved testing protocols under national regulations. There is also a discrepancy between laboratory testing and field performance; in direct seeding methods such as the ”muvuca” technique, seed emergence rates range from only 5% to 10%. It is concluded that, in order to scale up restoration efforts while maintaining quality, it is essential to make regulations more flexible, validate rapid seed vigor testing methods, and expand the accreditation of decentralized forest seed laboratories, integrating scientific knowledge with local expertise to ensure the resilience of restored landscapes.

STANDARDS AND INDICATORS

From ambition to impact: What Independent Audits Reveal About Improving Ecosystem Restoration Quality

Nicolas Pillet, Preferred by Nature – Denmark

As global commitments to ecosystem restoration expand under initiatives such as the UN Decade on Ecosystem Restoration and the EU Nature Restoration Regulation, attention is increasingly shifting from hectares restored to the quality, credibility, and long-term effectiveness of actions on the ground. Independent verification plays a critical role in ensuring that restoration delivers real and lasting ecological and social outcomes.

Preferred by Nature is a mission-driven international NGO with over 30 years of experience providing third-party audits of land-use projects across forestry, agriculture, and ecosystem restoration. Building on this experience, and in collaboration with SER and partners including WWF, IUCN, FAO, FSC, and WRI, Preferred by Nature launched its Ecosystem Restoration Standard. The standard provides a comprehensive framework for planning, implementation, monitoring, and continuous improvement. Pilots were supported by The Nature Conservancy and followed by assessments across Africa, the Americas, Asia, and Europe.

Drawing on six years of ground-based audits across forests, mangroves, rangelands, peatlands, wetlands, and agricultural landscapes, this presentation synthesises key lessons learned and recurring pitfalls observed during verification. Common challenges include unclear long-term objectives, weak monitoring systems, insufficient financial continuity, and inadequate integration of social dimensions such as rights, working conditions, stakeholder engagement, and dispute resolution.

By sharing anonymised insights from both successful and struggling projects, the presentation demonstrates how robust standards and independent audits help identify gaps early, support adaptive management, build funder confidence, and ultimately raise the bar for ecosystem restoration practice-prioritising effectiveness and integrity over scale alone.

Identifying nature restoration opportunities through GIS analyses and field assessment

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Habitat degradation and land-use change are major drivers of biodiversity loss, highlighting the need for effective ecosystem restoration. However, few methods and tools exist to effectively identify areas suitable for restoration, making it difficult to scale up restoration efforts. This study presents a methodological framework for identifying restorable nature areas at a regional and local scale. The primary objective was to develop a spatial analysis methodology that can identify areas with restoration potential.

We combined existing geographic datasets describing ecological condition and connectivity with ecological condition criteria and GIS-based analyses to map potential restoration areas in Akershus County, Norway. Restoration potential was assessed through expert-defined criteria describing ecological degradation and the likelihood of ecological improvement through active restoration measures.
The resulting spatial datasets provided an overview of areas likely to benefit from restoration and a subset of the areas were field-validated to assess the actual restoration potential in the area. The results show that the GIS approach is effective for highlighting candidate areas for restoration, although field verification remains essential due to uncertainties in available spatial data.
The study contributes to ongoing methodological development for identifying restorable nature in Norway and serve as a basis to identify specific areas that local stakeholders can include and prioritize in their restoration work. Future work should focus on how the method can be used to prioritize and implement restoration actions that would contribute to reach international and national restoration goals.

Variable reference states: Interannual biodiversity variations within understudied subarctic peat bogs habitats.

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On the northeastern coast of Canada lies the French archipelago of Saint-Pierre and Miquelon. These understudied islands experience a subarctic climate despite their relatively low latitude (46◦5733.84N), owing to the influence of the cold Labrador Current. Their environmental conditions are unique among French overseas territories and highlight the urgent need to improve knowledge of local biodiversity. Within the MIRANDE project, which aims to restore the ecological connectivity for two diadromous fish species through the reconnection of a coastal pond to the sea, concerns were raised regarding potential impacts on terrestrial habitats in the watershed. To assess these possible impacts, spider assemblages were selected as ecological bioindicators. As a diverse, abundant, readily sampled, and ecologically heterogeneous taxon, spiders have demonstrated strong potential as bioindicators in a wide range of ecological contexts. However, in such an understudied environment, distinguishing natural temporal variation from responses to anthropogenic disturbance can be challenging. Peat bogs were sampled over three years (2021, 2023, and 2024). Twenty-two pitfall traps were deployed at the same locations during the summer months of each sampling year. The effects of habitat type and year on several aspects of alpha diversity were investigated, while the magnitude and nature of interannual variation were assessed through beta-diversity analyses. The results were interpreted in light of the climatic conditions characterizing each year and the ecologies of the indicator species associated with the observed patterns of variation.

Observation errors in botanical surveys: causes and implications for measuring restoration outcomes

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Monitoring plant communities is a cornerstone of ecological restoration assessment, and tracking community trajectories relies on repeated vegetation surveys. Unfortunately, field observations are never perfect: botanists may overlook species that are present (because they are inconspicuous, hidden, or surveyed too quickly) or misidentify them. When such observation errors are ignored during the data analysis process, estimates of community changes risk of becoming biased, and inferences about restoration outcomes unreliable. While this issue is well documented for animals, it remains largely unexplored for plants - a critical gap as the EU Nature Restoration Law will increasingly require robust, quantitative monitoring. In 2025, in collaboration with botanical conservatories, natural area managers and researchers across France, we conducted what is, to our knowledge, the largest study to date quantifying observation errors in plant surveys. At 30 sites distributed across all French regions and covering a wide range of open habitats (grasslands, prairies, heaths and wetlands), 103 botanists carried out thousands of surveys on shared plots to allow for comparison. Whether beginners or experts, botanists detected on average 60–70% of the species present, with strong variation among observers and vegetation types. Such heterogeneous detection is especially problematic for monitoring, as it can mimic or mask real community changes. In this talk, I will explore how botanists perceive the flora, why some species escape detection, and how site occupancy statistical models can account for these unavoidable errors. I will conclude with practical recommendations for designing monitoring protocols that deliver reliable evidence of restoration outcomes.

SER principles as Ecological Restoration process indicators - a global to local perspective

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The Kunming-Montreal Global Biodiversity Framework (GBF) set out restoration target 2, with its target headline indicator in the GBF focuses on hectares under active restoration while the 'effective' component is less straightforward. The SER principles for ecological restoration provide a good framework for developing quantitative and qualitative process indicators on how restoration projects are being planned. Addressing the quality of restoration actions is crucial, within analyses that could be used globally, nationally and locally for measuring enabling factors for restoration effectiveness. This presentation reviews global to local case studies of existing and potential SER principles implementation. Firstly, we start from analysis of target 2 selected indicators from selected 7th national reports submitted to the Convention of Biological Diversity, highlighting the extent in which CBD Parties also refer to enabling restoration effectiveness. Secondly, national level-reporting analysis of the EU Nature Restoration Plans templates and reporting tools showcase to what extent the SER principles are being reflected both within each ecosystem reporting fields and in general. Thirdly, we address how the SER principles have been disseminated within local scale project planning. Since they have been translated and adapted to the local Israeli context in late 2025. Restoration project planning has already started to partially address the principles and standards, promoting a more holistic process in several ecosystems such as coastal wetlands (Kebara swamps), dryland spring oases (Ein Shokek) as well as restoration processes and procedures in war inflicted areas. Lesson learned can formulate a basis for future ecological restoration process indicators.

The Global Biodiversity Standard: Assessing ecosystem restoration sites for impacts on biodiversity

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Ecosystem restoration projects have great potential to protect, enhance, and restore biodiversity. However, to date many interventions, including tree planting, mine rehabilitation, and agroforestry have focused on narrow outcomes, such as carbon sequestration, with some failing to deliver positive biodiversity outcomes or inadvertently causing harm to native ecosystems and local communities. One challenge has been the lack of a standardized system to accurately measure and report biodiversity outcomes of projects, including a globally recognized project certification system. In response, a coalition of global organizations and biodiversity experts led by Botanic Gardens Conservation International and the Society for Ecological Restoration (SER) developed The Global Biodiversity Standard (TGBS). TGBS creates a robust framework that recognises and promotes best practice in ecosystem restoration, providing assurance that projects deliver positive biodiversity outcomes. TGBS is a site-based certification programme that assesses restoration project outcomes through both remote sensing and field-based surveys, ensuring a high level of rigour. What distinguishes TGBS is its site-based assessment processes carried out by regional biodiversity experts, largely housed at partnering botanic gardens, including in Europe; real-time monitoring capabilities, which significantly enhance the accuracy of assessing biodiversity outcomes; and a meticulous assessment methodology underpinned by SER's International Standards and other global guidance.The goal is to elevate good projects and to improve marginal or even harmful projects by providing advice that will bring them into alignment with recognized standards for ecosystem restoration. This presentation will show the TGBS process, methodology, assessment, mentoring, and case studies including European financed and implemented projects).

URBAN ENVIRONMENT RESTORATION

Restoring nature in cities

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Proposal for presenting a method to identify priority urban sealed areas for ecological restoration, along with a practical guide to support project implementation.
Developed by the Regional Biodiversity Agency in Île-de-France (departement of Institut Paris Region) as part of the European REGREEN project on nature-based solutions in urban environments, this method helps local authorities identify priority areas for renaturation.
Three key challenges are used to locate these areas : 1) Restoring biodiversity in target areas that are deficient in terms of biodiversity, by studying the size of green spaces; the percentage of plant cover; and the presence of rare habitats. 2) Adapting to climate change in target areas exposed to climate risk: river flooding, runoff and urban heat islands (UHIs). 3) Improving health and the living environment in target areas that are vulnerable because of lack of green spaces, air pollution and health problems relating to UHIs.
In addition, the method identifies built-up or sealed surfaces with high restoration potential-areas where ecological interventions can significantly enhance environmental performance. These include oversized parking lots, schoolyards, building courtyards, concreted riverbanks, underused public spaces, industrial sites, business parks, and commercial areas.
This work is complemented by the publication of a practical guide outlining the key steps for successfully implementing urban ecological restoration projects. https://www.arb-idf.fr/fileadmin/NewEtudes/000 idF - Renaturing Cities EN - WEB.pdf

Nature-Based Solutions for Climate Adaptation in Urban Coastal Areas: Integrating Remote Sensing and Vulnerability Assessment for Targeted Green Space Restoration

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Urban and coastal areas are increasingly exposed to climate-related risks, including heat stress, flooding, erosion and vegetation degradation. In these environments, nature-based solutions (NBS) are recognized as key instruments for enhancing resilience, yet their implementation often lacks spatial prioritization and evidence-based targeting.
This study presents a methodology developed within the MoreAdaptBSB project for identifying priority areas for nature-based restoration in urban and coastal zones, integrating remote sensing, spatial analysis and field verification. The approach is based on a composite vulnerability index combining exposure, sensitivity and adaptive capacity, derived from indicators such as vegetation dynamics (NDVI, NPP), land use, climate models and socio-economic data .
The methodology was applied across pilot regions in the Black Sea basin and validated through field verification, demonstrating high reliability, with up to 94.7% agreement between modelled and observed vulnerability patterns . Results highlight the concentration of high vulnerability in urbanized and coastal zones, where degradation of green infrastructure limits adaptive capacity.
From a restoration perspective, the approach enables targeted implementation of NBS, including restoration of urban green spaces, coastal buffers and degraded vegetation areas. These interventions contribute to reducing climate risks while enhancing ecosystem services and urban resilience.
Importantly, the methodology demonstrates strong transferability across different geographic and institutional contexts, while allowing local calibration based on site-specific conditions. It provides a practical decision-support tool for integrating NBS into spatial planning and aligns with European policy frameworks, including the EU Climate Adaptation Strategy and Nature Restoration Regulation.

Reducing light pollution in Central Europe: early insights from transnational pilot actions on technical interventions, biodiversity monitoring, and community engagement

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Artificial light at night (ALAN) represents a pervasive but underappreciated threat to nocturnal biodiversity, disrupting circadian rhythms, foraging behaviour, pollination networks, and trophic interactions. Within the Interreg Central Europe project DARKERSKY4CE, five transnational pilot demonstration sites (PDS) were established in Germany, Poland, Italy, Hungary, and Austria to develop and test replicable models for reducing light pollution at the landscape scale. Technical interventions included the modernisation of public lighting systems in Leipzig, Germany and the deployment of Sky Quality Meter (SQM) networks in Germany, Hungary and Austria. In Austria, an innovative non-invasive method combining environmental DNA (eDNA) collection with ultrasonic acoustic monitoring was piloted by comparing sites with contrasting artificial lighting conditions. Social and cultural actions were implemented in Poland (astrotourism and educational programmes in an UNESCO Biosphere Reserve) and Italy (participatory stakeholder dialogue centred on the Fortress of Fenestrelle). The integrated design of these pilots suggests that successful nocturnal habitat restoration requires combining technical measures with community engagement. Each pilot action was designed to ensure long-term continuity through early stakeholder mapping, evidence-based monitoring, and integration into local planning policies. Together, these pilots aim to provide examples within a transferable strategy for policymakers, protected area managers, and restoration practitioners seeking to address ALAN as a key stressor in ecosystem restoration. Beyond individual sites, the project aspires to contribute to a coordinated European network of dark-sky monitoring and restoration actions, where harmonised methodologies and shared data infrastructure could enable comparable assessments of ALAN impacts across diverse ecological and governance contexts.

Strengthening Urban Biodiversity through Harit Mini Forests in Indian Cities

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Habitat restoration plays a pivotal role in reversing biodiversity loss within human-modified landscapes worldwide, with far-reaching implications for urban biodiversity. One of the techniques of habitat restoration is through the plantation of native saplings and the removal of alien-invasive plant species to maintain the ecological balance and enhance biodiversity. So far, 314+ acres of area have been restored through community-led efforts across the Indian geographies by HCLFoundation in collaboration with NGO Partners and other stakeholders. To understand biological diversity at restored sites, systematic surveys have been conducted since 2023 using scientific techniques, viz., point counts, transects, opportunistic surveys, and tools like thermal sensor cameras. A total of 278 species were documented across multiple taxonomic groups, including amphibians (6), damselflies (7), reptiles (12), dragonflies (12), mammals (26), butterflies (51), and birds (164). Among these, six species are categorized as Near Threatened, two as Endangered, and one as Vulnerable as per the IUCN Red List (2026), including the Himalayan goral, Egyptian vulture, and Indian flap shell turtle, to name a few.

Therefore, restored landscapes are identified as vital refugia and movement corridors for fauna, even outside designated protected areas. Despite major afforestation initiatives in India, limited evidence exists on how emerging urban mini forests support biodiversity. These efforts align with national objectives under the NBSAP and global priorities under the KMGBF, particularly those focused on restoring degraded lands and safeguarding biodiversity. However, this remains an ongoing effort, requiring long-term monitoring and ecological consideration to achieve meaningful conservation outcomes.

Night Restoration in Urban University Campuses: A Simulation-Based Engineering Approach for YTU Davutpaşa

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The uncontrolled proliferation of Artificial Light at Night within university campuses which function as vital natural habitats and dynamic living spaces induces severe light trespass, sky-glow, and structural degradation within sensitive local ecosystems. This study establishes a comprehensive, simulation-based engineering methodology for night restoration at the Yildiz Technical University (YTU) Davutpaşa Campus, focusing on mitigating light pollution directly at its source. Expanding upon our previous work presented at the 14th National Lighting Congress, this framework introduces a localized mathematical regression model to establish an empirical correlation between night sky brightness and ground-level illuminance. Synchronized field measurements using Sky Quality Meters and lux meters are systematically collected across campus grid points to derive this predictive relationship, capturing unique localized atmospheric features. To evaluate restoration feasibility, a detailed 3D digital twin of the most ecologically exposed zone is constructed within DIALux EVO, incorporating exact building dimensions and environmental barriers. Field-measured vertical and horizontal photometric data are utilized through strict ground-truthing protocols; core parameters, including luminous flux distributions and mounting tilt angles, are iteratively optimized until the highest statistical correlation coefficient is achieved. A parametric sensitivity study is then conducted to isolate dominant contributors to light trespass. Finally, a sustainable scenario is simulated by retrofitting existing fixtures with fully shielded (full cut-off), warm-color LED luminaires. Feeding the newly simulated, optimized illuminance values directly back into the initial regression model quantitatively evaluates actual skyglow reduction, offering a validated decision-support framework for restoring dark ecological corridors prior to physical infrastructure installations.

From mowing regimes to mindsets in UrbanLIFEcircles project: lessons from urban biodiversity restoration in Tartu, Riga and Aarhus

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Urban restoration takes place in highly contested and intensively used landscapes, where ecological ambition must be translated into everyday maintenance, planning routines, public expectations and political decision-making.The LIFE-programme supported urbanLIFEcircles project, led by the City of Tartu in Estonia together with partner cities Riga (Latvia) and Aarhus (Denmark), tests a systematic approach to biodiversity-oriented urban green-space management. The project aims to create connected networks of restored habitats, green corridors and biodiversity-rich stepping stones that connect periurban nature reserves, Natura 2000 sites, valuable grasslands, parks, roadside verges, schoolyards, courtyards and other urban green areas, allowing species to move from source habitats towards the city centre. Its objectives combine habitat restoration, diversified mowing and management regimes, enrichment of urban grasslands, creation of pollinator-friendly habitats, community engagement, biodiversity-oriented governance, and science-based adaptive management.Key challenges and lessons include moving from isolated demonstration sites to functional connectivity; deciding where intensive use should remain and where there is space for biodiversity; adapting maintenance regimes in highly visible public spaces; addressing perceptions of ”messiness”, neglect and safety; aligning ecological goals with procurement, planning and
management routines; and building trust among residents, land managers, politicians, businesses and practitioners. The project also highlights the importance of monitoring, communication and iterative learning to explain necessity for restoration. UrbanLIFEcircles experience indicates that cities can become active restoration landscapes when biodiversity goals are embedded into governance, maintenance systems, spatial planning, and civic participation, but there are a number of challenges on this path as well.

An operational framework for wetland restoration

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Wetlands provide essential functions and ecosystem services that enhance territorial resilience to global change. However, they remain widely degraded, and feedback on the effectiveness of restoration and conservation actions are still limited. This is partly due to a lack of a shared operational framework within the scientific and technical communities.
To address this issue, an operational framework was developed in 2023 based on a comprehensive review of the scientific and technical literature. 179 ecological actions applicable to wetlands (e.g., excavation, depoldering, ditch filling, clearing, grazing, passive restoration) were defined in terms of their characteristics and expected effects, and classified according to implementation contexts, targeted ecological compartments, and action type (pulse vs. maintenance). Technical feasibility was pre-assessed and decision trees supported the selection of appropriate ecological actions during the design of restoration programmes.
This framework helps harmonize terminology and concepts among researchers, engineers, practitioners, and decision-makers, thereby improving scientific rigor and communication between stakeholders. By covering a wide range of ecological actions, it complements international initiatives such as Conservation Evidence, notably by including a broader diversity of actions.
Integrated into the French National Method for Wetland Functional Assessment (2nd version published in 2023) and used within the regulatory Avoid–Minimize–Compensate mitigation sequence, it enables the evaluation of restoration actions based on initial and target habitats and intervention characteristics. Future developments include extending the framework to overseas territories and producing a guidance document for training purposes to support the implementation of ecological restoration practices.

DSS-AWERE: A decision support system to structure the planning and reporting of Adaptive Wetland Restoration strategies

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Restoration planning faces major challenges, including the inherent complexity of socio-ecological systems, the limited availability of financial resources, the slow recovery rate of some ecological processes, and the uncertain performance of interventions. Structured Decision Making, a methodology based on the Adaptive co-Management framework, is specifically tailored to assist decision-making in complex and unpredictable settings. We present an open-access, web-based Decision Support System specifically tailored to support the collaborative planning of Adaptive Wetland Restoration. DSS-AWERE (awere.adaptiverestoration.eu) follows a seven-step Structured Decision Making cycle and provides users with targeted guidance, decision criteria, and access to a curated library of tools and methods that support the planning and implementation process. Developed and tested in collaboration with 10 Knowledge Sites and 5 Action Sites of H2020 project WaterLANDS, it provides a standardized framework for the planning, refinement and comparison of ecological restoration interventions - particularly suited for the systematic application of comprehensive restoration policies, such as the Nature Restoration Regulation and associated national restoration plans.

How can we assess the status and functions of biodiversity and the effects of ecological restoration in wetlands? A comparative analysis of three methods at Malessard (Isère, France)

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Wetlands are experiencing an alarming global decline, prompting increased involvement of practitioners in their conservation and restoration. In addition to public and non-profit stake-holders, private developers who own land for development purposes are increasingly mobilizing part of their landholdings to implement conservation and restoration actions. Assessing the effectiveness and ecological benefits of these actions is therefore a critical need for all stake-holders. We apply and compare three methods for assessing biodiversity status and wetland ecosystem functions: the *National Method for the Assessment of Wetland Functions* (MNE-FZH), the *RhoMéO* toolbox, and the *ECOVAL* methodological framework.

These methods are implemented at the Malessard site (Isère), a high-value wetland that has been significantly shaped by past industrial and agricultural activities. Since 2020, EDF and the Isère Nature Conservancy (CEN Isère) have carried out voluntary restoration and biodiversity conservation measures at this site.

Our comparative analysis highlights the differences, similarities, and complementarities among the three methods in terms of their ability to characterize biodiversity and ecosystem functions (e.g., spatial and temporal scales, indicators used), as well as their capacity to predict the outcomes of ecological interventions. This comparison allows us to identify the respective strengths and limitations of each approach in providing a comprehensive and operational assessment of both the status of wetlands and the effects of restoration actions.

Finally, we propose recommendations for practitioners and project developers, and discuss how these methods can be used in a complementary manner to improve wetland assessment and management.

From carbon fluxes to conservation priorities: linking carbon cycling, hydrology and habitats in Lake Kerkini

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Wetlands represent highly dynamic socio-ecological systems, where hydrology plays a crucial role in shaping habitat distribution and ecosystem functioning. Understanding the links between water-level fluctuations and carbon exchange can contribute to improved wetland management and restoration strategies, especially under changing climatic conditions. Lake Kerkini, an artificial yet Ramsar-designated wetland exposed to strong seasonal and anthropogenic water-level variability, provides an ideal system for this investigation.

In this study, we investigated how seasonal water-level changes and hydrological zonation influence CO and CH fluxes across major wetland habitats in Lake Kerkini, and how these habitat-specific fluxes scale up to the lake-wide greenhouse gas balance. We conducted stratified field sampling during 2025–2026 across representative habitats and hydrological zones. Fluxes were upscaled using zone- and season-specific median values to estimate habitat-level contributions, which were integrated according to their spatial extent. These were further examined under alternative water-level scenarios according to biodiversity conservation priorities.

Results showed strong spatial heterogeneity in carbon exchange among hydrological zones. In general, wet meadows acted as strong CO sinks, whereas shallow zones exhibited results that were more variable. Scenario analysis indicated that lake-scale carbon fluxes shifted with water level due to changes in the relative extent of carbon sink and source habitats. Findings indicated that hydrological scenarios aligned with biodiversity conservation priorities were broadly consistent with favourable wetland carbon functioning. Outcomes highlighted water-level management as a key mediator linking wetland management, ecosystem functioning, and carbon cycling, with implications for ecosystem - based management and restoration planning.

From demonstration to transfer: Prioritizing Mediterranean wetlands for restoration based on carbon sequestration and flood regulation services

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Mediterranean wetlands are among Europe's most threatened ecosystems despite their essential role in climate regulation, biodiversity conservation and the provision of ecosystem services. Their restoration is increasingly recognized as a key nature-based solution for addressing climate change while supporting the objectives of the EU Nature Restoration Regulation.

This paper presents the results of the wetland4change project and its restoration related outcomes, which were obtained by applying a methodology to assess carbon sequestration and flood regulation across five pilot wetlands in the Mediterranean region, located in Bulgaria, France, Greece, Italy and Spain.

The methodology combines field measurements, remote sensing, spatial analysis and modelling within a tiered structure adapted to different levels of data availability. Its application enabled the identification and comparison of areas with the greatest potential to enhance ecosystem services through restoration, providing a transparent basis for prioritizing restoration interventions.

The results demonstrate that integrating ecosystem service assessment into restoration planning improves the identification of restoration priorities and supports evidence-based decision-making.

The experience gained highlights the importance of combining scientific evidence with stakeholder involvement throughout the restoration process. The developed methodologies provides a practical tool for public authorities and restoration practitioners to support the planning and prioritization of wetland restoration actions. By linking ecosystem service assessment with restoration decision-making, it contributes to more effective implementation of nature-based solutions and to achieving long-term ecosystem resilience, climate adaptation and climate mitigation objectives

POSTERS

The posters are grouped into three thematic areas that will correspond to the display spaces. The numbers correspond to the installation grid.

TERRESTRIAL AND WETLAND RESTORATION

P1.Environmental monitoring using pollen from wild bees

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Nature is increasingly exposed to multiple environmental stressors, and robust biomonitoring tools are needed to better characterise ecosystem conditions and support conservation strategies. Funded by the European Innovation Council, the BeeOmetrics project explores the use of wild bee hotels (BeeOtels) as an innovative biomonitoring tool.
Wild bees are increasingly recognised as relevant bioindicators of ecosystem functioning and environmental quality. Building on this, the BeeOmetrics approach combines the assessment of cavity-nesting bee diversity with the analysis of pollen loads accumulated in nesting tubes, enabling the identification of exploited floral resources and the detection of environmental contaminants, including pesticides and trace metals. Between 2024 and 2025, 200 BeeOtels were installed across Europe in agricultural and urban environments. A participatory protocol was established for photographic monitoring and the standardised collection of nesting tubes. Soil and vegetation samples were also collected within the bees' foraging range to characterise plant diversity and quantify contaminants in surrounding soils. Analyses revealed clear differences in bee diets depending on habitat type, highlighting variations in exploited floral resources between environments. Chemical analyses also enabled the detection of approximately 60 pesticide compounds in pollen loads and nesting material.
These results demonstrate the potential of BeeOtels as integrative biomonitoring tools for assessing ecological conditions and contaminant exposure. BeeOtels could also support the evaluation of ecological restoration outcomes through the detection of target plant communities in bee-collected pollen, while complementing existing monitoring methods such as eDNA and soil surveys.

P2.Climate smart management of heathlands: using microclimates for climate buffering of arthropod fauna

Marijke Thoonen, Research Institute for Nature and Forest – Belgium

Macroclimate change increasingly threatens biodiversity in open ecosystems, yet small-scale microclimatic variation may offer critical refugia for vulnerable species. This study investigates how land management intensity shapes microclimates in Atlantic heathlands and whether these conditions buffer soil-dwelling arthropod communities against heat and drought stress. Paired sampling locations were established across three sites along a north-south European gradient (Belgium, the Netherlands, and Spain) contrasting extensively managed (tall, dense vegetation) with intensively managed (low, open vegetation) plots. At each location, TOMST TMS4 sensors continuously recorded near-ground air temperature, soil surface temperature, subsurface soil

temperature, and soil moisture throughout the growing season. Pitfall traps co-deployed with the sensors targeted soil-dwelling arthropods during spring and late summer sampling windows. Vegetation structure was quantified to characterize canopy openness and litter depth. By linking microclimatic conditions to arthropod community responses, this study aims to determine whether extensively managed heathlands function as thermal refugia during periods of climatic stress. Ultimately, these findings will inform evidence-based, climate-adaptive conservation strategies for heathland managers across Europe.

P3.Taking into account an engineer species in restoration projects, from theory to practice – the case of the beaver in France

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While internationally, working with beaver to restore rivers and wetlands is currently common, in France we have limited information on the interactions between the presence of beavers and restoration projects. Given the expanding range of the species and the increasing number of restoration projects, a better understanding of the species presence and activity and tools to predict them, are essential for developing watershed-scale restoration strategies combining natural and assisted regeneration approaches.
The DAM-IT program incorporates such objectives while studying the effects of beaver and its dams on the environment. One of the program's objectives is to propose ways to integrate this "ecosystem engineer" species into the management of aquatic and wetland ecosystems, particularly in hydromorphological restoration projects for watercourses.
This poster explores how the beaver can be integrated into ecological restoration implementation. Firstly, we examine its effects on natural environments in light of the principles and tools proposed by the SER within its standards (recovery wheel). Secondly, we study how stakeholders involved in river restoration take the species into account in their projects. Our findings are drawn from the DAM-IT program: species' distribution modeling, studies of the characteristics and location of beaver dams, and surveys conducted with restoration project leaders.
Although the beaver can participate effectively in restoration processes, it must first and fore- most be regarded as a protected species within an ecosystem that also needs to be protected. Thus, certain pressures and degradations (such as poor water quality) must be addressed across the watershed to achieve ambitious restoration goals.

P4.The diversity of mineral nutrition strategies in a shrubland on metalliferous soil in New Caledonia

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The island of New Caledonia in the southwest Pacific has particularly large surfaces of ultramafic substrates which are exploited for nickel. Despite the low concentrations of macronutrients (N, P, K) and excess concentration of metals (Cr, Mn, Ni) these soils hosts a rich and unique flora with a unique shrubby vegetation, "maquis minier". The flora encompasses a large number of metal hyperaccumulating plant species, which are able to accumulate in their leaves metals at concentrations 100 to 1000 times higher than normal plants. We established a plot 20 × 20 m plot on Ferritic Ferrasols where we sampled all individual plants exceeding 1 m height. We measured concentrations of 20 elements on 474 individuals representing 37 species and 22 families. The plot included a large diversity of root symbioses and both Ni and Mn hyperaccumulators. We observed a large diversity of mineral nutrition strategies of plants. Nickel and manganese hyperaccumulation can be two different responses to the same soil conditions. Underground niche partitioning for mineral resources could explain the high alpha diversity observed on adverse geological substrates. Ionomics could be a tool to choose complementary species for ecological restoration of nickel mines.

P5.Pink Lady, not so gentle? - Socio-ecological drivers and ecological impacts of *Heterotis rotundifolia* invasion in Martinique

Séverine Ely-Marius * [1]

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Biological invasions represent a major challenge for ecosystem restoration, particularly in insular tropical systems where

anthropogenic disturbances and ecological vulnerabilities interact. This study focuses on *Heterotis rotundifolia*, an invasive creeping herb recently recorded in Martinique and currently classified as "under invasion". We investigate its ecological impact, its relationship with disturbance regimes, and the role of human practices in its local spread. Field surveys were conducted across 30 stations using standardized quadrats (1 m^2), comparing invaded and non-invaded plots under similar environmental conditions. Vegetation composition and species cover were recorded to assess diversity patterns and community structure. In parallel, semi-structured interviews were conducted with local stakeholders and residents to document practices contributing to the species dissemination.
Our results show that *H. rotundifolia* is associated with a significant reduction in species richness and diversity, as well as marked shifts in floristic composition. Its dominance is strongly linked to disturbed environments, suggesting an opportunistic strategy rather than a purely competitive exclusion mechanism. Notably, no evidence of effective sexual reproduction was observed in situ, while vegetative propagation and human-mediated dissemination (e.g. intentional planting and exchange of cuttings) appear to be key drivers of its expansion.
These findings highlight the importance of integrating socio-ecological dynamics into restoration strategies. In the context of tropical islands, managing invasive species requires not only ecological interventions but also consideration of local practices and perceptions. This work contributes to ongoing discussions on restoration planning in overseas territories and emphasizes the need for early, context-specific management approaches.

P6.Systematic indicator selection for assessing ecological restoration success in ecosystems degraded by invasive alien plants: towards a standardised, operational protocol

Soeren Krawczyk * [1], Antoine Becker-Scarpitta [1], Mathieu Rouget [1]
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Biological invasions are among the primary drivers of ecosystem degradation worldwide, accelerated by global travel, human disturbance, and climate change. Evaluating the success of restoration efforts in invaded ecosystems therefore becomes an increasingly urgent challenge. As restoration programmes expand globally and the interest in restoration actions is growing, the need for practical evaluation tools grows in parallel.
Though a considerable amount of literature on ecological indicators to evaluate restoration actions exists, no standardised, widely adopted set of indicators exists for the practical assessment of restoration outcomes, with particular attention to overall ecosystem functioning. Existing frameworks are theoretically robust but often require specialised expertise, laboratory infrastructure, or monitoring timescales incompatible with practitioner constraints.
We address this gap within an ongoing research action partnership with restoration plan for over 10000 ha on Réunion Island. We developed a modular evaluation protocol anchored in the SER International Standards Recovery Wheel, tested in contrasting terrestrial ecosystems. Here we present a global literature review of indicators used to assess restoration success in ecosystems degraded by invasive alien plants identifying potential indicators across the six attributes: Physical Condition, Species Composition, Structural Diversity, Ecosystem Functioning, Absence of Threats and External Exchange; evaluated against dual criteria of scientific robustness and operational feasibility for practitioners.
The resulting minimum core indicator set emphasises ecosystem functioning as a key evaluation dimension. We present the conceptual framework, the indicator selection methodology, and the field measurement design and discuss the conditions under which such a protocol can achieve both scientific rigour and operational relevance.

P7.Carbon Stock Responses to Grass Control and Planting Density in Tropical Forest Restoration

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Tropical forest restoration mitigates climate change, but invasive grass competition severely constrains success. Combining pre- and post-emergent herbicides with green manure may overcome this bottleneck, enhancing carbon sequestration and ecosystem sustainability. This study evaluated the interactive effects of weed control, planting density, and green manure on carbon stocks in tropical forest restoration plantations. The experiment was established in 2017 in São Paulo, Brazil. A randomized block factorial design was implemented across 48 plots (2.88 ha), testing 12 treatments with four replicates: (i) planting density (1,667 vs. 2,222 individuals ha-1;
(ii) weed control (mowing, glyphosate, and glyphosate + indaziflam); and (iii) green manure (with vs. without *Cajanus cajan*). Tree biomass was estimated via local allometric equations and converted to carbon using the IPCC factor (0.47). Management strategies significantly influenced carbon stocks, revealing a critical interaction between green manure

and planting density. Chemical weed control drastically outperformed mechanical mowing, boosting carbon stocks by 79% with glyphosate + indaziflam and 68% with glyphosate alone. High planting density increased carbon accumulation by 48%. Furthermore, within the high-density scheme, the introduction of *C. cajan* enhanced carbon stocks by an additional 41%. Intensive chemical grass control -particularly utilizing pre-emergent herbicides - and higher planting densities substantially accelerate carbon sequestration in tropical restoration. Additionally, green manure acts as a synergistic booster under high-density configurations. These findings provide scalable, management-ready strategies to optimize the climate mitigation potential and long-term sustainability of tropical forest restoration.

P8. Ecosystem Functioning and Biodiversity Recovery Across Post-Disturbance Pathways in a Mediterranean Forest

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The combined action of the alien pest *Toumeyella parvicornis* and the native one *Tomicus destruens* has resulted in the total destruction of close to 1,000 hectares of *Pinus pinea* forest within the last six years in the Presidential Nature Reserve of Castelporziano, Italy. While this represents a major ecological disturbance, it made possible the formation of a living laboratory within the reserve. Although carbon sink strength is often used to quantify the impact of such disturbances, an integrated approach is adopted in our study through biodiversity assessments and realtime ecosystem functioning. Thanks to the coordinated action of major European research infrastructures (ICOS, eLTER, LifeWatch), this unique approach has been fully utilized for the first time, resulting in the establishment of a dedicated experimental design. This design comprises four functional plots. Two of them represent the post- disturbance restoration pathways: active reforestation with some untouched patches (biodiversity islands) and natural succession. The remaining two are the reference plots dominated by deciduous and evergreen *Quercus* forests. Each plot is well equipped with an eddy covariance system for continuous measurements of CO, water and energy exchanges. This setup, alongside the continuous meteorological monitoring allows us to quantify the pace of recovery pathways comparing the net ecosystem carbon exchange and its component fluxes across the plots. The further integration of species-specific traits and structural diversity provides additional insights regarding the recovery of water and energy fluxes, offering a multi-dimensional perspective on evidence-based restoration approaches under the drought and pest-prone Mediterranean environment

P9.Hidden Knowledge: A critical review of biomass assessment in tropical and subtropical forest restoration

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Forest restoration is fundamental to mitigating climate change, driven by global agreements and the carbon credit market. However, biomass and carbon stock estimation in these projects faces methodological challenges and a lack of standardization, which can compromise the credibility of carbon sequestration programs. We conducted a systematic review based on a global literature assessment to evaluate how aboveground biomass and carbon stocks are estimated in restoration projects within tropical and subtropical forests.

We investigated whether the equations used were specifically developed for restoration areas; whether they incorporated wood density, diameter at breast height (DBH), and height; the inclusion criteria used in the forest inventory; the representativeness of the sample plots; and the reporting of sampling errors.

We found that only 28% of the studies were conducted in active restoration areas, with the majority focused on passive restoration and secondary forests, primarily in Brazil and China. Furthermore, the most widely used allometric equation to estimate aboveground biomass was originally developed for primary forests. Conversely, 52% of the studies include wood density in their estimates, and few assess the belowground compartment. This database is expected to serve as a tool for developing protocols and standards, contributing to identifying patterns, improving methodologies, and formulating more robust guidelines on how to estimate biomass and carbon stocks for the forest restoration field.

P10.Soil physical and chemical properties in a tropical agricultural area after 11 years of reforestation

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The lowlands of the Andean Mountains in Colombia are characterized by acidic, low-fertility soils requiring conservation practices to reduce degradation. This study evaluated reforestation effects on soil chemical properties in an agricultural area after 11 years of restoration. In September 2014, three monoculture plots (each 30 x 30 m) of *Cariniana pyriformis* (abarco) and *Schizolobium parahyba* (paricá) were established in Santander, Colombia. A pasture dominated by exotic grasses (*Brachiaria* spp.) and an 80-year-old secondary forest were included as reference ecosystems. A factorial design included four land-use systems, three soil depths (0–10, 10–20, and 20–40 cm), and four replicates per treatment. Data were analyzed using ANOVA followed by Tukey's test or Kruskal–Wallis followed by Dunn's test ($p < 0.05$). The paricá system showed the highest concentrations of carbon (1.70%) and organic matter (2.92%), whereas abarco showed the lowest values (1.18% and 2.03%, respectively). Compared with the reference ecosystems, paricá exhibited soil chemical properties more similar to those of the secondary forest, particularly regarding higher pH, cation exchange capacity, and phosphorus availability. In contrast, the secondary forest presented the lowest phosphorus concentrations (1.29–1.62 mg kg^{1}), whereas the pasture system likely maintained higher fertility levels due to its long history of fertilization. Meanwhile, abarco remained below both reference ecosystems for most fertility indicators. Paricá likely accelerated nutrient cycling and soil recovery through greater litter deposition associated with its rapid growth, resulting in soil chemical conditions closer to those observed in the secondary forest reference ecosystem.

P11.How do forest restoration interventions in temperate oak woodlands benefit epiphyte communities?

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The structure and composition of Central European deciduous oak forests have undergone significant homogenisation in recent centuries due to the long-standing practice of intensive forestry management, leading to decreased biodiversity. Targeted forest restoration strategies (gap openings, deadwood enrichment of the LIFE4OakForests project) may reverse these processes; however, the success of forest restoration aimed at comprehensive biodiversity increases in epiphyte communities is less well known, especially the initial impacts. Our study revealed the early effects of restoration interventions on bryophyte and lichen assemblages and their drivers in formerly managed, later abandoned Central European Natura 2000 deciduous oak forests. Abundance and species richness differed, presumably due to altered light conditions resulting from the altered stand structure. Nonetheless, community composition was slightly changed due to dispersal limitation. Bryophytes' and lichens' responses differed in their pace. Although basal area and tree size were crucial variables for both groups, the age of the forest stand and tree species diversity differed only for lichens, and the relative abundance of admixing tree species differed only for bryophytes, highlighting their different ecological requirements and sensitivities. Our results showed that restoration interventions aimed at increasing the structural and compositional naturalness of deciduous oak forests may positively impact their epiphyte communities from a conservation perspective on a long-term scale; however, epiphytes require more time to respond to interventions than other organisms. Maintaining forest continuity, increasing the old-growth attributes of forest stands, maintaining continuous small-gap openings, increasing tree species diversity, and protecting habitat trees may enhance epiphyte diversity in oak forests.

P12.Experimental restoration of a Mediterranean steppe grassland – what has worked 17 years on?

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After more than 15 years of intensive cultivation, the Cossure orchard was abandoned in 2008. Trees were subsequently uprooted, soils levelled, and two flocks of sheep introduced to facilitate the rehabilitation of a steppe-like habitat. An experiment then began in 2009 to restore the local and historic plant community: a highly diverse plant community, rich in annuals, resulting from millennia of interactions between extensive sheep grazing, Mediterranean climate and

relatively oligotrophic soil. Four restoration techniques were tested: sowing 'nurse' species – intended to limit competitive interactions with weeds from the former orchard, topsoil removal – intended to reduce the seed bank of these weeds as well as soil fertility, hay transfer – intended to increase the dispersal of target species; and finally, soil transfer – intended to increase the dispersal of target species and soil microorganisms, and reduce soil fertility. Physico-chemical parameters of the soil and vegetation composition were monitored regularly until 2026, seventeen years later. We will present the results of these monitoring and discuss what they can teach us about the restoration of a diverse plant communities following a period of intensive cultivation.

P13.How to Restore Degraded Meadow Communities? A Case Study from the České středohoří Mts., CZ

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The study examined the restoration of degraded meadows near Babiny in the České středohoří region (Czech Republic). These species-rich dry, mesophilous, and wet meadows form a unique forest–meadow steppe mosaic dominated by xeromesophytic vegetation and differ markedly from other meadow types in Czechia. Historically known as "orchid meadows", comparable to those in the Protected Landscape Area Bílé Karpaty (Western Carpathian biogeographical subprovince), they lost most rare species during the 20th century. The site is also important for the occurrence of *Adenophora liliifolia*.
Traditional mowing management changed after 2000 to support *Sanguisorba officinalis* as a host plant for *Phengaris nausithous*. These changes accelerated meadow degradation, promoted the spread of *Calamagrostis epigejos*, reduced species diversity, and caused declines in *Adenophora liliifolia* populations.
Since 2019, restoration management has involved modified mowing and raking regimes, temporary use of the hemiparasite *Rhinanthus alectorolophus* to suppress dominant grasses, and fencing to limit disturbance by deer and wild boar. After five years, herb abundance and *Adenophora liliifolia* populations increased significantly. Grass cover decreased from 61% to 24%, while sedges, rushes, and woodrushes increased from 4% to 28%, and herb cover rose from 16% to 75%.
Restored plots now support nearly 60 vascular plant species per 25 m^2, indicating exceptionally high species richness within the Continental biogeographical region. Long-term adaptive management and monitoring remain essential for maintaining these results.

P14.Impact of excessive deer grazing on restored meadows in the White Carpathians

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The Bílé Karpaty (White Carpathians) Protected Landscape Area is known for its extensive meadows, at small scales belonging to the most species-rich in the world. In recent years however, the meadows of Čertoryje National Nature Reserve have been under intense pressure from an overabundance of fallow deer. The meadows were monitored in the years 2024–2025, during which it was found that the vegetation structure of broadleaved dry grasslands had already changed. Populations of some plant species as well as insects depending on flowering plants are now at immediate risk of extinction. This situation also has a negative impact on the meadows in the reserve's buffer zone which were restored over 20 years ago by sowing a regional species-rich seed mixture.

P15.Implications of changing grazing practices for the restoration of Mediterranean grasslands shaped by millennia-old pastoralism

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Traditional extensive grazing has shaped Mediterranean semi-natural grasslands for centuries to millennia, generating fine-scale vegetation heterogeneity and sustaining high biodiversity and ecosystem functionality. However, ongoing socio-economic changes and increasing climatic constraints are progressively transforming pastoral practices, potentially threatening the ecological integrity of these high conservation-value ecosystems.
This study investigated the medium-term effects (3–16 years) of grazing system changes in Mediterranean rangelands of southern France by comparing two sheep grazing practices: traditional itinerant herding with shepherds and herding

dogs, and recently established fenced free grazing systems. Vegetation surveys, mesological measurements, and plant functional trait analyses were conducted over three years across six paired study sites.
Our results showed that the five vegetation zones historically generated by traditional herding remain partially detectable after management change. Nevertheless, the replacement of itinerant herding by fenced grazing induced, for the first time in these millennia-old pastoral ecosystems, a clear homogenization of plant communities. This process was characterized by the spread of xero-mesophilous species and by the gradual disappearance of the historical grazing-intensity gradient that formerly structured vegetation patterns and ecosystem functioning.
These findings demonstrate that relatively recent changes in grazing management can rapidly alter the spatial organization and ecological dynamics of Mediterranean grasslands despite their long pastoral history. They highlight the importance of preserving traditional herding dynamics as ecological processes supporting biodiversity conservation and ecosystem resilience. More broadly, our study provides new insights for ecological restoration and adaptive management of Mediterranean rangelands facing ongoing environmental and socio-economic changes.

P16.LIFE for Jurinea - Rescue of the priority plant species Jurinea cyanoides: The German part of the project in Saxony-Anhalt

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Together with partners from the Czech Republic and Ukraine, LIFE for *Jurinea* is developing the first coordinated international recovery programme for *Jurinea cyanoides*, a priority species under the EU Habitats Directive that is threatened with extinction in Central Europe. The German part focuses on Saxony-Anhalt, one of the species' most important remaining regions in Germany. Since 2008, Anhalt University has led projects to increase population sizes, improve habitat quality and reintroduce the species. Nevertheless, many small, isolated populations remain highly vulnerable due to habitat degradation, invasive species, land-use change and potentially reduced genetic diversity.

The project will secure the genetic resources of all 18 known populations through systematic seed collection and long-term storage in a seed bank. Ex situ conservation cultures will be established and genetic analyses will assess diversity and detect possible inbreeding depression. Experimental hybridisation will evaluate whether controlled gene flow can enhance population fitness. In addition, insect communities at *J. cyanoides* sites, including potential pollinators, will be investigated. Comprehensive habitat restoration measures will also be implemented, including grazing, creation of open soil patches, removal of shrubs and litter, deep mowing and control of invasive species such as *Rubus armeniacus* and *Robinia pseudoacacia*.
Based on genetic results, the project aims to reinforce small populations, reintroduce the species at historically occupied sites and establish new populations within its former range. Close cooperation with landowners, farmers, authorities, NGOs and local communities will ensure sustainable management structures and strengthen the long-term conservation of *J. cyanoides* in Germany and Central Europe.

P17.Restoring wooded meadows through people and practice: lessons from WOODMEADOWLIFE project in Estonia and Latvia

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Fennoscandian wooded meadows are among Europe's most spectacular semi-natural habitats: ancient, tree-rich meadows where the continuity of moderate management through mowing and grazing has enabled extraordinary biodiversity to develop and persist. Estonia and Latvia together host around 60% of the remaining wooded meadows in the Boreal biogeographical region, yet most surviving sites are small, overgrown and dependent on renewed long-term management.
The LIFE Programme-supported WOODMEADOWLIFE project, running from 2021 to 2026, restores and promotes the sustainable management of wooded meadows across Estonia and Latvia, with a target of 700 ha restored: 500 ha in

Estonia and 200 ha in Latvia. A distinctive feature of the project is that restoration takes place on private land, making landowner and manager engagement the foundation of implementation. Trust building, site-specific planning, management agreements, access infrastructure, practical management solutions and tailored communication have been both key features and key challenges of the restoration process.
The project has developed and tested best practices and novel approaches for restoring wooded meadows as functional, manageable landscapes rather than isolated habitat patches. These include restoration designed from the outset for future mowing, habitat-enhancement measures for characteristic species, seed-based acceleration of recovery, and integrated monitoring of ecological and social impacts. A restoration motivation and impact study has explored why landowners join, what concerns they face, and how restoration has changed relationships between people, place and heritage.

P18.Time matters: Short vs. long term vegetation responses to fertilization of an eroded alpine ecosystem

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Natural recovery in alpine and subarctic ecosystems following soil erosion or other disturbances is often slow due to low nutrient availability, limited propagule supply, short growing seasons, and unstable soils shaped by erosion and frost processes. Fertilization is a simple intervention to alleviate nutrient limitation and may indirectly reduce other constraints. We tested its effects in a sparsely vegetated eroded landscape near the Hálslón reservoir in eastern Iceland (640 m a.s.l.), where experimental plots received annual applications of mineral fertilizers (NPK) at three different levels for three years. Vegetation cover and composition were assessed after 1, 6 and 16 years. After 16 years, total vegetation cover in fertilized plots reached 60-80%, depending on fertilizer level, while cover in controls remained below 20%. This indicates the presence of strong barriers to natural recovery that fertilization helped to overcome. However, responses differed among vegetation components. Biological soil crusts, bryophytes and lichens increased steadily to 50-60% cover. In contrast, vascular plants peaked at 20-25% after six years, followed by a decline to 10-15% by year 16, only slightly exceeding pre-restoration levels. These contrasting trajectories suggest that short-term responses may not predict long-term outcomes. The shift towards non-vascular dominance may, however, mark a key stage in ecosystem recovery, as biocrusts and thin mosses are known to facilitate vascular plant establishment. This is supported by slight increases in dwarf shrubs and low-growing willows in fertilized plots over time.

P19.Towards restoring diverse and functional grasslands: what roles for landscape structure and soil organisms?

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The progressive recolonization of organisms within a restored site depends on species' dispersal abilities, on the surrounding landscape acting as a reservoir and ecological corridor, and on active restoration practices such as the introduction of target species. Together, these fac-tors shape the trajectory through which biological communities reassemble. Yet, the combined effects of landscape context and soil biotic processes remain insufficiently understood, despite their central importance for explaining why some restorations succeed while others stagnate.
This poster presents the RESPIR(1) project (2026–2030, funded by the French Biodiversity Agency (OFB)), which aims to fill this knowledge gap by examining how landscape properties, the presence of different edge types (forest-grassland, grassland-grassland), and the type of seed material used (commercial vs. locally sourced seeds) influence the joint dynamics of above- and below-ground communities and the key ecosystem functions of restored grasslands. The study relies on a network of 24 restored grasslands (2–18 years old) and 8 old grasslands (> 40 years old) located in South-West of France (the Gers and Tarn et Garonne department, Occitanie), selected along a landscape gradient specifically constructed for this project.
By presenting the project's conceptual framework, objectives, and early insights from the construction of a landscape gradient using GIS(2), combining the calculation of composition and connectivity metrics, this poster showcases an advanced landscape-oriented approach that is still underused in restoration ecology.
(1) RESPIR: Restauration Ecologique des Systèmes Prairiaux et IntéRactions plante-sol
(2) GIS: Geographic Information System

P20.Ecological Restoration Plan for Tailings-Affected Areas in Bellavista, Chile: Soil Rehabilitation and Biodiversity Recovery

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The Bellavista site, located near San Felipe in Chile, has been heavily impacted by the deposition of copper tailings. The tailings have sandy and silty textures with minimal structure, low nutrient content and negligible biological activity, which makes it highly challenging to establish vegetation.
This project presents a comprehensive ecological restoration plan aimed at restoring soil functionality, reestablishing native biodiversity and integrating the site into the surrounding landscape. Key restoration objectives include:
Biodiversity recovery: Propagation and planting of native herbaceous, shrub and tree species to create an auto sustainable ecosystem and reconnect vegetation patches. Improving soil functionality: incorporating organic amendments (such as compost) to enhance the soil's physical structure, nutrient availability and biological activity. Disturbance control: excluding livestock and managing rodent activity to protect young plants. Erosion mitigation: construction of biowattles and wooden dikes, and gully stabilisation to reduce water runoff and sediment transport. Community engagement: integration of educational activities and volunteer participation through interpretive trails and workshops.
The restoration plan includes a long-term monitoring programme to track plant survival, herbaceous cover, soil nutrients, organic matter and pH levels, ensuring adaptive management over time.
This approach demonstrates a replicable, site-specific methodology for rehabilitating landscapes impacted by mining.

P21.Restore a mosaic of wetlands, grasslands and secondary woods using multiple techniques

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An ecocomplex refers to a set or mosaic of interconnected and interdependent ecosystems within the same territory. These ecosystems interact with each other, forming a functional network that leads to the study of ecological dynamics on a larger landscape scale, often integrating the influence of natural history and human activities on these environments. The ecological restoration of a mountain ecocomplex that integrates wetlands, secondary forests and grazed grasslands requires a systemic, integrated and multifunctional management approach. This is not simply passive conservation, but active management that aims to restore damaged ecological relationships, balancing biodiversity, hydrology and sustainable human activities. The phytocoenoses present refer to *Violion caninae*, *Calthion palustris*, *Rhynchosporion albae*, *Caricion fuscae*, montane green alder scrub and montane birch and larch woods. The conservation status, spatial layout and dynamic relationships of an area located in the Italian Cottian Alps are analysed, together with the restoration prospects for each habitat and the preliminary results of a mycological inventory of this ecocomplex.

P22.Intraspecific trait variability of plants strengthens the effect of soil organisms on litter decomposition in primary succession

Eva Říhová * 1, Ondřej Mudrák, Faculty of Science, Charles University – Czech Republic

Plant litter decomposition is a key process that contributes significantly to the restoration of the ecosystem during primary succession. While interspecific differences in decomposition are well-documented, the role of intraspecific trait variability (ITV) remains largely overlooked.
We conducted a 12-month litterbag experiment across a chronosequence of three spoil heaps (Sokolov, Czechia), representing early (3 years), middle (32 years), and late (57 years) successional stages. We used litter of two contrasting species: forb *Tussilago farfara* and grass *Calamagrostis epigejos*-collecting leaf and litter material from all three sites to specifically account for ITV. Experimental litterbags were either accessible or inaccessible to soil faunal decomposers.
Results showed that decomposition followed a significant non-linear trajectory. The middle successional stage acted as a "bottleneck," where plants produced nitrogen-poor and highly recalcitrant litter in response to soil stress. Conversely, the late stage exhibited the fastest decomposition rates due to a well-developed community of soil macrofauna. ITV was more pronounced in *T. farfara*, with early-successional litter releasing the highest nitrogen levels.

These findings indicate that ITV significantly alters decomposition trajectories and strengthens the reciprocal feedback between soil conditions and plant functional traits. The production of easily decomposable litter by *T. farfara* in early succession appears crucial for initial pedogenesis. Furthermore, the arrival of soil fauna in late succession accelerates nutrient turnover, overcoming the recalcitrance observed in mid-successional stages. Overall, these findings emphasize the importance of ITV and non-linear successional dynamics during ecosystem recovery.

P23.RESTOR'ALP Prairies : Restore mountain hay meadows in the Alps

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Mountain hay meadows offer vegetation rich in highly flowering dicotyledons. This great floristic diversity attracts a rich variety of insects, including leaf-eating, pollen-eating, nectar-eating, and seed-eating species. They are the favorite hunting grounds of many bats and provide nesting sites for birds. This habitat of Community interest is in sharp decline at European and national levels due to the urbanisation of mountains, conversion to temporary grassland, abandonment and reforestation.

The RESTOR'ALP Prairies project (2025-2029) aims to implement ecological restoration operations in degraded meadows caused by wild animals (voles, wild boars, etc.) and climatic events (repeated droughts, floods, etc.) in order to meet the needs of stakeholders in the Alpine massif. The meadows restored with native and local seeds are subject to scientific monitoring: measurements of forage values and productivity to assess the agronomic objective, floristic surveys to estimate the trajectory of vegetation dynamics, physicochemical and biological analyses of the soil (arbuscular mycorrhizal fungi, etc.), and simplified inventories of pollinators.

The RESTOR'ALP Prairies project contributes to the development of the native seeds multiplication sector by offering mixtures of native species for ecological restoration that have a good performance-price ratio. The project also provides training in ecological restoration techniques using native and local seeds for agricultural stakeholders, particularly young people.

P24.Restoration assessment of the world-class Cave Biodiversity Hotspot in Portugal

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Below the ground lives the most rare, endangered and unprotected species. Neglected in conservation policies, cave animals have high endemism patterns and constitute a unique national biological heritage, and simultaneously provide important services for humanity linked with carbon cycling and groundwater quality. Despite being isolated in the underground, they are directly impacted by pollution and environmental changes. Recently, a single cave in the karst area of the Algarve (Barrocal) has been recognised as world hotspot for subterranean biodiversity, due to its incomparable richness in endemic species, many of those only known from this cave. A unique site in Portugal that faces several acute threats, as urbanisation and degradation of surface influence areas. This urges its study, protection and restoration of degraded areas. Barrocal-Cave project is filling this gap, laying the foundations for the conservation and ecological restoration of the world-class cave biodiversity hotspot in Portugal. We have implemented a long-term monitoring infrastructure and assessed the ecological restoration needs in degraded areas of the cave and its surface influence area. The project efforts led to its legal classification as the first protected area for troglobiont fauna in Portugal, regulating the need for future ecological restoration. Here we present the roadmap for its future ecological restoration, which includes integration of the studied biodiversity, land-use at surface, disturbance, threats, taking into consideration the specificity of the habitat 8310 protected by Nature 2000. Resulting in a roadmap for future restoration measures with specific goals, timelines and monitoring measures, directly available for stakeholders' implementation.

P25.Biodiversity trajectories after boreal peatland restoration

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The aim of peatland restoration is to bring biodiversity and the associated ecosystem services back to predrainage levels. In Sweden, projects and incentives to restore peatlands are flourishing, but evidence that peatland restoration successfully leads to biodiversity recovery are surprisingly scarce. I will present a research project that I recently started to predict and quantify trajectories of plant and arthropod diversity following peatland restoration in Northern Sweden. Combining macroecological modelling with field assessments of species responses, my aim is to reveal to which extent local environmental variables and landscape factors explain biodiversity patterns after peatland restoration. I will also present data from two field assessments that we carried out in 2024 and 2025 across restored, drained and pristine peatlands. These first results showed a promising - but incomplete - recovery of plant and ant communities about 6 years after hydrological restoration.

P26.Paludiculture as a nature-based-solution to restore peat soil health and additional benefits

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The EU Nature Restoration Law has the potential to be a game changer for biodiversity and ecosystem services in Europe, shifting the focus from protection to restoration. The At the same time the EU Soil Strategy (and the legally binding Soil Monitoring Law, 2025) shifted the definition of soil health from a simple wet vs dry binary to a functional, ecosystem-service-based definition. Restoration of soil health is at the foundation of any nature-based solutions for peatlands located outside the protected NATURA network and paludiculture is one such solution. Paludiculture, the productive use of rewetted peatlands, offers a dual solution for preserving soil carbon and reducing greenhouse gas emissions, bring about biodiversity uplifts and water improvements whilst offering a form of income for landowners/farmers. Early results from the Palus-Demos European Horizon project demonstrate the need for robust initial site investigations since each peatland is unique and sits within specific regulatory jurisdiction. A set of indicators that need to be monitored during the transition is discussed as baseline for soil health restoration.

P27.The Icelandic Peatland Recovery Wheel

Ágústa Helgadóttir, Land and Forest Iceland – Iceland

Peatland restoration is a key nature-based solution for enhancing biodiversity, improving ecosystem functions, and mitigating climate change. Iceland contains extensive areas of drained peatlands that offer considerable potential for ecological restoration. These degraded peatland ecosystems occur in varying ecological conditions, reflecting differences in land-use history, drainage intensity, and subsequent disturbance. Establishing a baseline assessment prior to restoration is essential for evaluating restoration trajectories and measuring ecological recovery over time. The first adaptation of the Society for Ecological Restoration (SER) Recovery Wheel for Icelandic peatlands was developed to assess and communicate ecological recovery in restored peatland ecosystems, with indicators and assessment criteria tailored to local ecological conditions and restoration objectives. The adapted framework is demonstrated through the Stóratunga Restoration Project, a 2,100-hectare restoration site in northern Iceland that is being planned and implemented using the SER International Principles and Standards for the Practice of Ecological Restoration. Results from the adapted Icelandic Peatland Recovery Wheel assessment of Stóratunga will be presented, illustrating how the tool can be used to establish baseline conditions, evaluate restoration progress, and communicate ecological recovery in a transparent and accessible way.

P28.Set-aside forests as carbon sinks: Which forest types offer the largest potential?

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The “WildCard” research project is investigating, amongst other questions, which contribution the setting aside of managed forests can make to long-term carbon storage. This is highly relevant, as the EU is considering this as a climate change mitigation measure. In the ‘Aboveground Carbon’ working group, we ask:
Compared to managed forests, how much more carbon can set-aside forests store in their woody biomass over the coming century?
Which broad forest types in which regions of Europe show the greatest potential for storing additional carbon?

To answer these questions, we calculated carbon stocks using dendrometric data from around 700 European set-aside forests, many of them from the European Forest Reserves Initiative 'EuFoRIa'. Here, we distinguish broad forest types using two different approaches, and then compare them: First, we use the EEA forest type classification to model the carbon trajectories of forests that currently have the same tree species assemblage. Second, we use 'Potential Natural Vegetation' to fit the same models for forests that are more likely to diverge towards a similar state. Special attention is paid to climate and soil characteristics. The carbon trajectories are compared with carbon stock levels in comparable managed forests (ICP Forests LI-BioDiv database).
Outlook: The results will provide initial insights into which forest types, under which environmental conditions, hold the greatest potential for additional carbon storage in the coming century. Particular attention will be paid to whether decision-makers selecting future forest reserves should focus more on the current tree species composition or on (future) environmental conditions.

P29.Trade-offs between rewilding, proforestation and land abandonment in a Swiss mountain landscape: a robust multi-objective approach to socially acceptable restoration planning

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Achieving EU Nature Restoration Law targets requires difficult land-use decisions where ecological restoration conflicts with economic activities and cultural values. In mountain regions undergoing agricultural abandonment - such as the Surselva Valley, Swiss Alps - rewilding is occurring spontaneously yet remains contested by communities committed to their traditional open landscape. Evidence-based restoration planning demands tools that simultaneously account for ecological outcomes, economic viability, and social acceptability under uncertainty.
This study, conducted within the WILDCARD Horizon Europe project, develops a robust multi-objective optimisation framework to evaluate trade-offs across seven land-use strategies in the Surselva: productive managed forest, active protection forest, forest reserve (proforestation), traditional alpine pasture, biodiversity-oriented meadow management, passive land succession, and assisted reforestation of abandoned farmland. Drawing on LandClim forest growth simulations, we quantify guaranteed performance across three objective bundles - ecological (aboveground carbon, deadwood volume, species diversity), economic (net present value, carbon sequestration value, soil rent), and social (stakeholder preferences from an AHP survey with farmers, forest managers, municipal officials, and conservation organisations) - under stochastic disturbance scenarios including windthrow and bark beetle outbreaks.
Applying robust Pareto frontier methods, we generate trade-off curves revealing ecological, economic, and social opportunity costs of alternative restoration pathways, and identify land-use portfolios guaranteeing minimum acceptable performance across all three objectives simultaneously. Our framework provides a transparent, uncertainty-aware decision-support tool for restoration prioritisation under the EU Nature Restoration Law, demonstrating how robust optimisation can integrate community preferences into restoration planning without requiring stakeholders to precommit to fixed objective weights.

P30.Grazing Activity as a Tool for Conservation and Connectivity in the Iberian Range: Real Cases and Remaining Challenges

Andrea Rodriguez. ACOBIJA Conservación – Spain

The Iberian Range, in Spain, is a natural biological corridor connecting the north-west of the country with the Mediterranean. Extensive livestock farming has shaped this landscape for centuries, sustaining a close ecological relationship with necrophagous birds, which depend on grazing herds for accessible food. It extends across Europe, where Spain hosts around 90% of the vulture population, including all four species. As extensive grazing declines, this link is at risk, threatening trophic resources for necrophagous species and the openness of semi-natural habitats.
This poster presents the work of ACOBIJA Conservación across connectivity zones between Natura 2000 sites in the Iberian Range, through land stewardship and ecosystem-service-based grazing management. Central to this work is the ZPAEN Network of Livestock Farms, supporting the conservation of necrophagous species, comprising 14 farms.
Four case studies illustrate the diversity of grazing models: high-density rotational grazing with seasonal movement between Soria and Zaragoza; planned grazing for riparian and steppe habitat restoration using rescued horses; large-scale sheep grazing integrated into the agrarian landscape with seasonal movement, following a production-oriented model open to conservation contributions; and traditional goat grazing combined with organic farming and direct sales, supporting wildfire prevention and rural livelihoods.
These systems also provide ecosystem services, including pollinator habitats, wool-based soil regulation, and high-nature-value local products.
Key challenges include limited access to land for grazing strategies, the market value needed to sustain extensive systems, the lack of robust indicators to quantify ecological impact, and the potential to replicate these models across the wider Iberian Range.

P31.Restoring Coastal and Semi-Open Habitats through Conservation Grazing: Lessons from Northern Germany

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Across Europe, many species-rich grasslands, coastal habitats and semi-open landscapes have been degraded by agricultural intensification, drainage and the abandonment of traditional grazing systems, resulting in the loss of natural disturbance regimes. Conservation grazing is increasingly recognised as a process-based restoration approach capable of restoring ecological functions while maintaining biodiversity.
This poster presents more than 40 years of conservation grazing practice from Bunde Wischen, a conservation organisation in northern Germany, where year-round grazing with robust cattle and horses has been applied across Natura 2000 and other conservation sites. Examples from Bunde Wischen's conservation sites demonstrate how conservation grazing has been integrated with hydrological restoration and targeted species conservation to restore habitats, re-establish ecological processes and enhance biodiversity.Examples include the restoration of salt marshes in the Geltinger Birk Nature Reserve through controlled rewetting and extensive grazing. Further examples illustrate the development of species-rich grasslands, including areas that have developed into Annex I Lowland Hay Meadows (Habitat Type 6510) under long-term grazing management, and the successful reintroduction of the Marsh Fritillary (*Euphydryas aurinia*) following habitat preparation and host plant establishment. Additional restoration outcomes include habitat creation for Annex species such as the European tree frog (*Hyla arborea*), fire-bellied toad (*Bombina bombina*) and sand lizard (*Lacerta agilis*).
Together, these examples demonstrate how long-term conservation grazing can restore ecological processes, increase habitat heterogeneity and provide practical, transferable approaches for habitat restoration and the implementation of the European Nature Restoration Regulation.

P32.Citizen Science for wetland ecological monitoring: insights from Lille Vildmose, Denmark

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Citizen science (CS) is increasingly promoted to support ecological monitoring. However, its reliability and broader role in detecting ecosystem responses remain insufficiently understood. This work examines the potential of CS to detect ecological changes while evaluating its reliability and implementation conditions, using the peatland ecosystem of Lille Vildmose, Denmark, as a case study.
We applied the Motivations and Abilities (MOTA) framework to assess drivers of participant engagement and how they shape data quality in CS-based wetland monitoring. Citizen observations of soil temperature and water levels were compared with automatic sensor measurements to evaluate consistency and reliability. Results showed that while CS can generate meaningful environmental observations, its effectiveness depends on participant motivation, measurement capacity, and robust validation mechanisms.
To link socio-technical performance with ecological outcomes, we further integrated CS-derived butterfly occurrence data with remote sensing indices and meteorological variables. Comparing an extreme dry year (2018) with an extreme wet year (2024), we detected significant ecosystem-level differences, alongside pronounced biological responses. Butterfly phenology advanced in the dry year suggesting the importance of fine-scale hydrological dynamics.
Overall, the findings position CS in Lille Vildmose as a multi-layered monitoring approach that can simultaneously capture ecological responses to climate extremes and reveal the human dimensions shaping data quality. The study demonstrates the potential of integrating citizen-generated observations with conventional monitoring tools to support adaptive wetland management under increasing climate variability.

P33.Peatland LIFEline: Iceland's First LIFE Nature and Biodiversity Project

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Iceland's lowland peatlands have been extensively drained for agriculture, altering hydrology, degrading habitats, and accelerating carbon loss. The EU LIFE-funded Peatland LIFEline project-the first LIFE Nature and Biodiversity project implemented in Iceland-is restoring 1,397 ha of degraded peatland across three sites through large-scale rewetting and hydrological restoration. The project focuses on the endemic black sedge–brown moss fen, a peatland ecosystem shaped by Iceland's volcanic geology and found nowhere else in the world. Restoration also aims to improve habitat quality for internationally important breeding wader populations, including the target species Baltic dunlin, black-tailed godwit, and redshank, while enhancing wetland habitat and connectivity for the critically endangered European eel.
Restoration begins with detailed site assessments that combine historical information, stake-holder surveys,

groundwater measurements, drainage mapping, drone imagery, and hydrological analysis to understand the extent and impacts of drainage. These data are used to design site-specific restoration plans that account for landscape characteristics, water flow pathways, land use, and stakeholder interests. The principal restoration measure is the interruption of artificial drainage through ditch blocking and infilling, often using excavated spoil banks already present on site. Where full infilling is not feasible, drainage channels are blocked at regular intervals to slow water movement and raise groundwater levels. The goal is to restore natural hydrological processes, enabling the recovery of peatland vegetation, biodiversity, carbon storage, and water-regulation functions. By combining practical field restoration with standardized planning and monitoring, the project is developing a replicable framework for peatland rewetting under Icelandic conditions.

P34.Planning wetland restoration in a multifunctional agricultural landscape: hydrological reconnection and biodiversity objectives at the Gauksmýri farm, Northwest Iceland

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Drainage and land-use modification have altered hydrological connectivity and ecological functioning across many lowland agricultural landscapes in Iceland. At the Gauksmýri farm, a planned wetland restoration project aims to restore hydrological processes surrounding the pond Gauksmýratjörn by raising groundwater levels and reconnecting surface water pathways while minimizing impacts on adjacent cultivated land.
The project addresses the challenge of implementing ecological restoration within an actively managed agricultural landscape. Proposed restoration measures include reconstructing a water-control structure, blocking drainage ditches, reconnecting historical flow pathways, and constructing a semi-natural overflow channel linking the pond system to downstream waters. Limited land modification is required to prevent waterlogging of productive fields, reflecting the practical trade-offs necessary to balance ecological restoration objectives with continued agricultural use.
Enhancing ecological connectivity and biodiversity is a central objective of the project. Restoration planning incorporates the creation of potential fish passage between a nearby stream and the pond system to improve aquatic habitat accessibility. Baseline ecological assessment includes electrofishing surveys in adjacent stream habitats and wetland bird counts focused on species utilizing the wetland area. Post-restoration monitoring is planned to assess ecological responses following implementation.
This case study demonstrates how hydrological restoration planning can integrate biodiversity objectives with agricultural constraints in multifunctional northern landscapes. The project provides a practical example of nature-based wetland restoration design that seeks to reconcile ecosystem recovery with ongoing productive land use and offers transferable insights for restoration planning in similarly modified wetland systems.

P35.Restoration of native ecosystems in the open-pit coal mine of As Pontes, A Corunã, Spain

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Restoration involves the soil modification, for example of open-pit mines, altered by entropic processes through a multidimensional approach that establishes land uses compatible with ecosystem functioning. Its success depends not only on the species choice, but also on waste management, geomorphological reorganization, and the implementation of erosion control measures. Although the establishment of vegetation cover represents the final stage, only ecological regeneration can lead to the development of an ecosystem capable of functionally replacing the original one. In this context, the assumption that stable ecosystems arise through natural evolutionary processes is not applicable, as restoration is understood here as an ecological succession aimed at creating a sustainable and biologically diverse ecosystem. The proximity to the study area (As Pontes, A Corunã) of the best preserved thermophilic Atlantic forest in Europe, located in the Eume river canyon, suggests that the potential vegetation consists of a mixed forest of oaks, chestnuts, ash, birch... In addition, the dense forest cover prevents the penetration of light, thus maintaining stable conditions of humidity and soil temperature, creating an optimal habitat. Over time, the herbaceous-shrub cover is expected to evolve into more developed plant communities. So tree species with a high capacity for adaptation were planted: *Pinus pinaster* Ait., *Pinus radiata* D.Don, *Pseudotsuga menziesii* (Mirb.) Franco, *Betula alba* L., and *Alnus glutinosa* (L.) Gaertn. In addition, with the aim of increasing biodiversity, other demanding species were introduced, such as *Quercus robur* L., *Castanea sativa* Mill., *Acer pseudoplatanus* L., and *Sorbus aucuparia* L.

Soil Amendments for Mitigating Lead-Induced Stress in Medicago sativa. Grown in Simulated Shooting Range Contaminated Soil

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Soil contamination with heavy metals is a significant environmental challenge, particularly in areas affected by long-term anthropogenic activities such as shooting ranges, where lead (Pb) accumulates in elevated concentrations. Pb contamination can alter plant growth and physiological processes; however, its effects may be mitigated through soil amendment strategies that enhance soil quality and reduce metal bioavailability. The aim of the study was to evaluate the ability of biochar and earthworms, applied individually and in combination, to mitigate the effects of simulated shooting range Pb contamination on the growth and physiological performance of alfalfa (*Medicago sativa* L.). Soil was artificially contaminated with Pb at concentrations representing a gradient typical of shooting range environments (0-500 mg/kg). Plants were grown in amended (biochar, earthworms, combined treatment) and unamended soils. Morphological (shoot height, root length, biomass) and physiological (Fv/Fm and performance index, PI) parameters were assessed. Overall, Pb contamination had a limited effect on most growth and physiological parameters, with shoot height being the most sensitive indicator of stress. Biochar and earthworm applications generally improved plant growth and physiological status compared to the unamended control. The combined treatment showed the most consistent beneficial effect across all measured traits, suggesting synergistic interactions between soil structure improvement and contaminant immobilization processes. These findings indicate that biochar and earthworms can contribute to the mitigation of Pb-induced stress in soils simulating shooting range contamination, with the combined application representing the most effective remediation strategy under the tested conditions.

P36.Informal Urban Green Spaces as Assets for Urban Ecological Restoration and Network Connectivity

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In highly urbanized landscapes, natural habitats are increasingly fragmented, generating significant socio-ecological challenges. Ecological restoration appears to be the best solution but is often challenged by natural land scarcity and intensive soil sealing. Planned parks and protected areas are the only biodiversity pool in urban areas, but beyond these limited spaces, spontaneous vegetation developing in unmanaged urban sites known as Informal Green Spaces (IGS), represents a form of passive restoration operating inside cities. While often overlooked in planning policies, these areas may represent strategic leverage points for passive restoration within cities.
This study aims to develop and apply a framework to characterize IGS and evaluate their contribution to urban ecological networks within three post-industrial Belgian agglomerations (Mons, Charleroi, Liège).
The approach combines systematic spatial mapping of IGS, typological classification of IGS based on structural characteristics, quantitative evaluation of vegetation cover contribution, and spatial network analysis to assess structural connectivity at multiple scales.

Preliminary results indicate a high structural and spatial diversity of IGS, including both surface-based habitat patches and dense linear elements. Together, they form a multi-scalar network that significantly contributes to urban vegetation cover and potential functional connectivity. These findings suggest that spontaneous renaturation processes can substantially reinforce urban ecological networks. They can generate ecologically meaningful structures without direct intervention, challenging rigid distinctions between planned green infrastructure and unmanaged spaces. Recognizing IGS as functional components of ecological networks could expand the operational scope of urban restoration while enhancing urban resilience without further land artificialization.

P37. The LIFE project Biodiver'Cité & Résilience (LIFE-BCR): ecological restoration for the benefits of local residents

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In Europe, less than 20% of natural habitats are in a favourable conservation status and species of European interest continue to decline, a phenomenon that is particularly significant in urban and suburban areas. Bordeaux Métropole (France) is not spared by this phenomenon, and deplores the possible disappearance of certain species from its territory. Half of the metropolitan area (58,000 hectares) contains natural and agricultural areas, includes several protection zones and is home to more than two thousand plant and animal species recorded. The metropolitan area is also greatly

attractive with more than 800,000 residents and 450,000 jobs. Preserving ecological diversity and development goals are sometimes at odds with one another.
Selected in 2022 and managed by Bordeaux Métropole ever since, the LIFE project *Biodiver'Cité & Résilience* aims to combat biodiversity loss by motivating action through the use of anthropocentric approaches. Indeed, a focus on biodiversity conservation alone is often not enough, while policymakers are concerned about the living environment and the health of their residents and potential voters. The argument for ecosystem restoration to reduce threats and increase the provision of ecological services enables us to propose actions that combine human needs with those of biodiversity and incorporate an economic component. Five ecosystem restoration actions are considered including two in urban areas: (i) reduction of light and noise pollution and
(ii) de-artificialization and renaturation to reduce the urban heat island effect, enhance urban ecosystem services, and improve the living environment and quality of life for residents.

P38.The "Parc Urbain des Papillons" (Urban Butterfly Park): using ecological landscaping to preserve, restore, and raise awareness of urban biodiversity

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The "Parc Urbain des Papillons" (PUP), established since 2012 in Marseille, is an experimental research initiative aimed at promoting urban biodiversity through a multi-partner approach involving researchers and stakeholder of Marseille, (gardener, landscape manager, naturalists, artists, students). The project integrates ecological landscaping and adaptive management practices including the introduction of host and nectar plants to favor butterflies and their caterpillars. Over the past decade, these actions have led to a twofold increase in butterfly diversity, highlighting the effectiveness of combining spontaneous and introduced vegetation.
Building on this success, the PUP+ network aims to adapt this model in several French cities (Bordeaux, Angers, Rennes, Lille) to improve urban green space management, share knowledge, and promote best practices for restoring urban butterfly communities.

A PUP+ is being implemented at Institut Agro in Angers. The site is designed to restore suitable habitats for butterflies throughout their life cycle, while also serving for training in urban restoration and green space planning. Field surveys were conducted during the summers of 2025 and 2026 to evaluate plant and butterfly communities on and around the campus, along an urbanization gradient. These data were used to identify target butterfly species (28 of the 56 potential species are already recorded), their host and nectar plants to introduce, and recommendations for management practices.
This project aims to create an educational site that balances ecological objectives with campus constraints to promote urban biodiversity. In the long term, it will be opened to the public to raise awareness of biodiversity-friendly management practices.

P39.Biodiversity Action and Ecological Management in the Brest Metropolitan Area

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The Brest metropolitan area is a territory that is both urban, agricultural, and natural, and is subject to significant pressures: habitat loss, fragmentation of ecosystems, and species decline. In the face of these challenges, the metropolitan authority is taking action to preserve and restore biodiversity.
To structure its approach, a "Biodiversity Plan" was developed and adopted in 2018. Within this framework, the metropolitan authority carries out actions to improve knowledge through the Intermunicipal Biodiversity Atlas, raise awareness, and support stakeholders, as well as implement management, maintenance, and restoration activities for natural environments.
These actions notably concern aquatic environments (rivers and wetlands), the Bodonou natural area owned by the metropolitan authority, as well as coastal environments managed on behalf of the French Coastal Protection Agency (Conservatoire du littoral).
Since the 2000s, the metropolitan authority has led a policy dedicated to aquatic environments, structured around two components: the restoration of rivers and wetlands, and their maintenance. The objective is to preserve wetlands-particularly grasslands-in order to maintain a diversity of habitats, and, for watercourses, to improve fish continuity.

Along the coastline, an agreement in force since 2011 with the Department and the Conservatoire du littoral entrusts the metropolitan authority with site management. This includes ecological restoration of natural habitats (heathlands, grasslands, etc.), the renaturalization of newly acquired sites, and the development of facilities benefiting wildlife (such as creating roosting sites for bats in former forts and bunkers).

P40.Early evidence of amphibian responses to inland salt marsh restoration: effects of water conditions, landscape context and grazing management

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Inland salt marshes are among the rarest and most threatened wetland habitats in Central Europe. Their restoration primarily targets halophytic vegetation and associated biodiversity, but restored wetlands may also provide important breeding and foraging habitats for amphibians. However, the effects of restoration management, water conditions and surrounding landscape context on amphibian communities in these habitats remain poorly understood.
This study examines amphibian occurrence, species richness and breeding activity in water-bodies within the LIFE in Salt Marshes project in Moravian Pannonia, Czech Republic. Using monitoring data collected since 2024, we assess amphibian responses across waterbodies differing in restoration status, management regime and environmental conditions. We hypothesise that the introduction of active management supports amphibians by maintaining open, shallow and structurally diverse wetland habitats, with particularly positive effects expected under extensive grazing. Amphibian records are related to management type, surrounding landscape characteristics and key water parameters, including conductivity, temperature and dissolved oxygen concentration. The study tests whether managed waterbodies support higher amphibian diversity and breeding activity than unmanaged sites, and whether local water conditions and landscape context modify amphibian responses to restoration.
By linking amphibian communities with restoration management and environmental conditions, this study provides early evidence on how inland salt marsh restoration can support wetland vertebrate biodiversity. The results contribute to adaptive management recommendations that balance the conservation of salt-marsh habitats with the ecological requirements of amphibians in agricultural landscapes.

P41.How water connectivity influences long term vegetation dynamics of two restored ponds within the Rhine floodplain?

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The european Nature Restoration Law, adopted in 2024 mandates the restoration of 90% of degraded habitats by 2050. Passive restoration is not always efficient for highly degraded habitats. Therefore, active intervention could be required, especially when restoration success is frightened by the presence of invasive plant population nearby the restored sites. Floodplains' ponds are under particularly concerned by strong degradation and invasion pressure.
We studied two ponds situated adjacent to a former gravel pit. They are located within a protected area, situated 1 km from the Rhine in the Alsace plain. These ponds were restored via macrophyte transplanting and propagule bank transfer from a nearby pond, carried out during their initial establishment. Different connectivity conditions were applied to each pond:
(1) early connection to the gravel pit and (2) connection after two years of free evolution.
The evolution of the macrophyte communities in the ponds was monitored using detailed mapping and phytosociological relevés, conducted once per year in July - August from 2012 to 2025. During this period, the site experienced fluctuations in hydroperiod, including a long drought in 2018-2019. Habitat dynamics were spatially analyzed using landscape metrics such as the contagion index, equity index, and intersection–juxtaposition. These metrics were then compared annually.
Different habitats were found in the two ponds, demonstrating a strong influence of an early connectivity to a bigger water body volume. Landscape analysis revealed that the early-connected pond exhibited greater temporal stability, this suggest that the early connection allow more ecological resistance and resilience

P42.Impacts of extreme meteorological events on wetland ecosystem-atmosphere CO2 exchange

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Following climate change, extreme meteorological events, e.g. drought, heatwaves and cold spells are expected to become more frequent. Such events have an impact on the functioning and carbon balance of ecosystems, because they affect the processes which constitute the ecosystem carbon cycles and the exchange of greenhouse gases between ecosystems and the atmosphere: the photosynthetic uptake of CO2 (GPP) and the release of CO2 from ecosystem respiration (Reco). Physiological constraints driven by atmospheric and hydrological stress may decrease the capacity of vegetation to fixate new carbon, as well as affect autotrophic and heterotrophic respiration. In peatlands, where C balance is determined by small differences in production and respiratory losses, prolonged heat waves and/or drought critically shift the balance, threatening the ancient carbon stored in peat. There is, however, only limited data on the stability of peatlands ecosystem CO2 exchange in response to anomalous and extreme environmental conditions. Especially, we need data from restored peatlands, which currently remain underrepresented in greenhouse gas exchange studies. We compiled a synthesis of long-term meteorological and CO2 flux data from 11 wetland measurements stations across Europe, to detect meteorological extremes and CO2 flux anomalies and to identify how and which extreme or compound events impact on wetland CO2 fluxes. We found that events of high vapor pressure deficit (VPD) increase the chance of net C loss anomalies in peatlands, with indications that these responses of the net ecosystem exchange derive from changes in both GPP and Reco.

P43.Landscape structure shapes bird communities in restored and protected wetlands of South Moravia: implications for wetland restoration planning

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Wetland restoration is often planned at the site scale, although many species respond to habitat conditions beyond the restored patch. Birds are useful indicators of wetland habitat quality and can help assess how local conservation outcomes are influenced by the surrounding landscape.

We studied bird communities at wetland sites in South Moravia, Czech Republic, included in the LIFE in Salt Marshes project. These small and fragmented wetlands are embedded in an intensively managed agricultural landscape affected by long-term drainage, land-use change and habitat degradation. Bird communities were surveyed using season-long line transect monitoring, complemented by camera traps. Landscape structure was assessed through selected landscape elements measured at multiple spatial scales.

Bird species richness was most strongly related to landscape diversity at the broadest analysed scale of 1000 m. Ecological guilds showed scale-dependent responses: reedbed-associated species were closely linked to wetland cores, whereas woodland species responded more strongly to the wider landscape context.

These findings suggest that wetland restoration and conservation planning should not focus only on the wetland patch itself. A heterogeneous surrounding landscape mosaic may be essential for sustaining diverse bird communities, while even small wetland patches can contribute to biodiversity conservation and ecological connectivity in agricultural landscapes.

P44.Monitoring the ecological and hydrological response of an alkaline fen restoration project in the Somme Valley (France): The case of Morcourt peatland

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Alkaline fens are among the most threatened wetland ecosystems in Europe despite their role in biodiversity conservation, carbon storage, and hydrological regulation. Restoring their ecological functions requires not only the implementation of restoration measures but also robust monitoring frameworks assessing ecosystem trajectories and restoration success long term.
The LIFE Anthropofens project (2019–2026) aims to restore degraded alkaline fens across 13 Natura 2000 sites in northern France and Wallonia. Ecohydrological investigations have been conducted to identify hydrological alterations, define restoration targets, and guide management actions. Attention has been given to the development of monitoring schemes to evaluate restoration effectiveness and improve understanding of peatland functioning and recovery.
This study focuses on the Morcourt peatland, an alkaline fen in the Somme Valley near Amiens. Drainage, silviculture, and surrounding intensive agriculture have altered hydrological functioning and habitat quality. Restoration actions implemented since 2024 include ditch blocking, hydraulic regulation, water quality improvement, and poplar and shrub removals to induce a recovery of typical habitats (e.g. 7230–6410). Beyond restoration, Morcourt represents a case study for assessing ecosystem responses to large-scale restoration. A monitoring programme has been established before and after intervention, combining groundwater and surface water level monitoring, nutrient dosages, vegetation surveys, habitat mapping, and biodiversity assessments. These datasets provide to evaluate hydrological responses and to assess whether the system is converging towards target reference conditions. Using post-restoration results, we discuss the relevance of ecohydrological indicators, the challenges of monitoring trajectories in anthropized valleys, and adaptive management and long-term evaluation of restoration outcomes.

P45.Does habitat restoration in European temperate ecosystems influence wildfire resistance and resilience?

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Wildfire risk is increasing globally as climate change intensifies fire-prone conditions and land use degrades ecosystems, reducing fire resistance and resilience. In cool, temperate systems including those in Europe, ecological restoration is increasingly implemented to enhance biodiversity, restore ecosystem processes and mitigate climate change. However, its influence on wildfire resistance and resilience remains unclear, particularly where restoration involves prolonged transitional states.
We synthesize evidence from the United Kingdom, where the influence of restoration on wildfire risk is contested, and comparable cool, temperate systems. We evaluate how habitat condition and restoration trajectories influence wildfire resistance and resilience across peatlands, heathlands, grasslands and native woodlands. Across habitats, wildfire resistance and resilience are governed primarily by hydrological condition, fuel moisture, vegetation structure and composition, and fuel connectivity, rather than broad habitat identity alone. Intact, self-maintaining systems- especially wet peatlands and structurally complex native woodlands - more effectively limit severe fire and recover more rapidly, whereas degraded or simplified systems with continuous, flammable fine fuels and altered hydrology reduce fire resistance and resilience.
Restoration often passes through intermediate states that differ functionally from both degraded and near-natural conditions, potentially altering wildfire susceptibility while stabilizing feedbacks between vegetation, hydrology, and microclimate are re-established. Restoration is unlikely to reduce ignition likelihood in these habitats, which is predominantly anthropogenic in origin. But restoring functioning hydrology can increase fuel moisture and limit deep combustion, while promoting structurally diverse, less flammable vegetation can reduce fuel connectivity and support faster post-fire ecological recovery, contributing to more wildfire-resilient landscapes.

P46.Wetland Restoration in Europe – Four approaches

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Global climate policy aims for net-zero greenhouse gas emissions (GHG) by 2050, while the EU targets at least 55% reduction by 2030. Achieving this requires mitigation in land-use sectors, where wetlands provide major climate, biodiversity, and water-related benefits. Many wetlands have been degraded by drainage for agriculture, forestry, mining, and peat extraction, releasing large carbon stores as emissions. Restoration is highly effective strategy to reduce emissions and restore wetlands as carbon sinks while supporting sustainable land use and livelihoods. In 2022, four HorEur projects were launched to address this challenge and advance solutions.

ALFAwetlands (www.alfawetlands.eu), coordinated by Natural Resources Institute Finland (Luke), improves the geospatial knowledge base of wetlands and develops restoration pathways through cocreation, providing indicators to maximise climate mitigation, biodiversity, and ecosystem service benefits.
WET HORIZONS (www.wethorizons.eu), coordinated by Aarhus University (Denmark), applies holistic approach to large-scale restoration by improving datasets from pristine, drained, and rewetted peatlands, floodplains, and coastal wetlands, modelling restoration measures under varying conditions, socioeconomic impacts and delivering guidelines and best management practices.
REWET (www.rewet-he.eu), coordinated by Idener (Spain), promotes sustainable restoration and conservation of terrestrial wetlands using fit-for-purpose technologies to monitor GHG, biodiversity, meteorology, and social sustainability.
RESTORE4Cs (www.restore4cs.eu), coordinated by University of Aveiro (Portugal), evaluated how restoration actions affect the ability of coastal wetlands to mitigate climate change, improve ecosystem services, and support biodiversity. RESTORE4Cs gathered data from six pilot sites across Europe and extended modelling tools to wider ecological and geographical context.

Together, these projects support evidence-based wetland restoration across Europe.

P47.Wetland restoration as a tool to support amphibian conservation.

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Amphibians are among the most threatened vertebrate groups worldwide, largely due to habitat loss, including the disappearance of suitable breeding sites. This issue is particularly severe in the Hungarian Great Plain, where extensive drainage has led to the loss of most natural wetlands. More frequent and intense summer droughts reduce hydroperiod length, negatively affecting the remaining amphibian breeding sites. To mitigate these impacts, 23 wetland pools were created across 13 sites within the “Felsökiskunsági turjánvidék” Natura 2000 site in Central Hungary. We compared amphibian occupancy among restored wetlands, near-natural wetlands, and artificial ditches. Additionally, we examined the effects of hay and mud transfer as restoration techniques and assessed species-specific habitat preferences. Field surveys were conducted in spring 2024 at all 13 restoration sites, alongside 6 non-restored wetlands used as controls and 8 artificial ditches. We applied multispecies occupancy models to estimate amphibian presence and evaluate the influence of environmental variables and restoration methods. According to our results amphibian occupancy was higher in restored wetlands compared to non-restored controls. Both hay and mud transfer had positive effects on amphibian occupancy. Although species exhibited differing habitat preferences, greater water depth generally had a positive influence across species. These findings emphasize the importance of wetland restoration in increasingly arid landscapes and provide valuable insights into the habitat requirements of multiple amphibian species.

P48.What drives early plantation performance? Assessing mixed-species forestation across contrasting European environments

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Mixed-species forestation has been widely promoted for ecosystem restoration and climate change mitigation. However, our understanding of what drives early plantation performance across contrasting environmental gradients remains limited. We monitored 11 mixed-species plantations (˜3 years old) established across Mediterranean and temperate regions of Europe within the framework of Life Terra, a European climate mitigation project (LIFE19 CCM/NL/001200). For each plantation, we assessed survival, basal diameter, height, and crown projection, and estimated tree biomass using specific and generic allometric equations sourced from the literature.
We collected soil samples (top 10 cm of mineral soil) for physical and chemical characterization. We derived daily evapotranspiration from meteorological time series and topographic variables from high-resolution digital elevation

models. In Mediterranean sites, we additionally quantified ground vegetation cover at the individual tree level using image analysis. Survival rates in the temperate region were more narrowly distributed and mostly above 80%, while in the Mediterranean region they were mostly below 80% and showed higher variability and a heavier lower tail in the distribution. Growth differences after three years were striking, both between regions and among species within the same plantation. Based on our preliminary results, we hypothesize that these patterns result from the interaction of multiple factors: species functional traits and autecology, soil and meteorological conditions, interspecific competition, tree shelter type, seedling quality, and planting techniques. These results highlight the complexity of predicting plantation performance and the need for multi-factor monitoring frameworks to inform evidence-based restoration practices.

MARINE, COASTAL AND FRESHWATER RESTORATION

P49.Analysis of the potential for restoring a small diked Breton marsh: the Bassinig marsh. Integration as part of a training program.

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In the context of changing coastal dynamics, sea-level rise, and increasing costs associated with the maintenance of coastal defense structures, important questions are emerging regarding the future of coastal environments. In response to these challenges, the Communauté de Communes du Pays des Abers (CCPA) commissioned Master's students in Biodiversity Management and Conservation to conduct a feasibility and potential analysis for the depolderisation of the Bassinig site, located in Plouguerneau (Brittany, France). This 4-hectare site, mainly composed of reedbeds and wet grasslands, was formerly a salt marsh before being disconnected from the sea through the construction of a road dike to support local uses. The aim of the study was to identify the most suitable scenario for restoring tidal connectivity. First, a comprehensive assessment of the site was carried out, including ecological and socio-economic considerations. Key management issues were then identified based on the ecological functions of the existing habitats. In parallel, sea-level rise modelling was conducted to predict potential habitat evolution under different depolderisation scenarios. The results were subsequently used to apply the IQEL method (Coastal Ecological Quality Index), a decision-support tool designed to compare the current ecological functionality of the site with the potential functionality of future habitats. This approach helps guide managers toward appropriate restoration strategies. In the case of Bassinig, the method highlighted the positive effects of depolderisation on the ecological functionality of the site.

P50.Ecological Restoration Monitoring of the Terrains François Site (Orne Estuary, Normandy): Four Years After Reconnection to the Sea

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Les Terrains François is an ecological restoration site located in the Orne estuary in Normandy. This area is home to remarkable biodiversity and serves as a vital habitat for many species. It is situated within a complex socioeconomic context where various issues such as biodiversity, land use, and landscape coexist. The depolderisation of this site was carried out as part of the compensatory measures associated with the expansion of the ferry terminal at the Port of Caen-Ouistreham. The goal is to restore the salt marsh habitats that once existed there. The site was reconnected to the sea in 2022 through the installation of a sluice gate to regulate water exchange. Since this intervention, ecological monitoring has been conducted to assess the dynamics of the environment's restoration. The protocols rely on a network of permanent, georeferenced transects that allow for the monitoring of vegetation, sedimentation, the seed bank, and terrestrial arthropod communities. Monitoring of fish fauna, benthic communities, and abiotic parameters is also being conducted. A natural area located in front of the dike serves as an ecological reference. Initial results show an increase in soil salinity, accompanied by the disappearance of glycophytic species in favor of halophilic species. Arthropod communities and benthic populations show signs of recolonization.
Finally, the presence of young sea bass (*Dicentrarchus labrax*) suggests that the site's nursery function is being restored.

The observations made this year will make it possible to assess the site's recovery four years after its reconnection.

P51.FEDER action-research program in historical ecology: dynamics and conservation of coastal cliff vegetation

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The European FEDER program, 'Dynamics and conservation of coastal cliff vegetation of Brittany (2025–2028)', is led by the Brittany Region and coordinated by the Geoarchitecture Laboratory of Brest University. Due to its multidisciplinary approach, this program is being implemented in partnership with various public bodies dedicated to natural coastal habitats conservation, as well as research laboratories specialized in archaeology, ecology, sociology, dialectology, and land planning.
Pedoanthracology allows to reveal the historical presence of woodlands in landscapes by identifying and dating charcoal in soils of low-growing treeless vegetation. These findings could attest the historical presence of tree cover as well as the rarer occurrence of heathland climax, and contribute to discussions dealing about non-intervention or rewilding of coastal natural areas.Rural history, as evidenced by maps, photographs, notarial deeds and land registries, as well as contemporary collections of testimonies from people with knowledge of traditional farming activities, provide insight into how the landscape was organised. The outcomes will inform the future management of environmental commons, and traditional ecological knowledge (TEK) will inspire approaches to the agropastoral management of coastal heathlands.
The study of vegetation, including plant communities, composition, dynamics, landscape phytosociology and resurveys, contributes to assess vegetation dynamics related to historical uses and to define potential natural vegetation.
The FEDER action-research program is recognized by natural area managers as useful for prioritising conservation issues and for managing or restoring coastal socio-ecosystem habitats.

P52.Organization of coastal plant communities on sandy beaches in Martinique (Lesser Antilles) and associated factors along an insular supralittoral gradient

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Sandy beaches are dynamic ecological systems characterised by close interactions between substrate and vegetation. Coastal plant communities, including psammophilous formations and their transitions towards backshore vegetation, contribute to ecosystem structuring and sediment stabilisation processes. In Martinique, these systems are characterised by the absence of developed dunes, the presence of embryonic sand ridges and rapid transitions towards backshore vegetation. They are characterised by a diversity of configurations, with supralittoral gradients of limited spatial extent and rapid transitions between vegetation units.
This study aims to characterise the organisation of plant communities along the sea–backshore gradient and to analyse the relationships between floristic composition, substrate properties and disturbances. The sampling procedure, which was conducted between November 2025 and April 2026, was based on a stratified design. To this end, the beaches were subdivided into segments of approximately 200 m. Within each segment, transects perpendicular to the shore were randomly positioned, extending from the highwater mark to a backshore ecotone. Quadrats are used to record floristic composition and to collect surface sediment samples (0–10 cm) for grain-size analysis and estimation of organic matter content (LOI, 375 ◦C).
The analyses aim to describe vegetation units and their distribution along the gradient, and to examine their associations with sediment properties and disturbances. This work contributes to improving understanding of the ecological dynamics of insular sandy beaches in the context of natural and anthropogenic pressures.

P53.Vegetation Recolonization Dynamics in Restored Coastal Salt Marshes: Succession Trajectories and Seed Bank Characterization

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Coastal salt marshes provide critical ecosystem services, including carbon sequestration, coastal protection, and hydrological regulation. However, widespread degradation from human activities has made ecological restoration a global priority. Understanding the ecological dynamics governing these ecosystems is essential to designing effective restoration strategies, particularly following managed realignment (depolderization).
This study examines the early-stage vegetation recolonization dynamics (1–3 years post-depolderization) in small coastal salt marsh systems. We analyze spontaneous recolonization trajectories using Markov transition probability models, applied as both descriptive and predictive tools to characterize succession pathways. This approach allows us to identify distinct vegetation states and quantify the likelihood of transitions between them over time, providing insight into whether restoration follows the continuous, predictable succession patterns documented under natural conditions. In parallel, the soil seed bank was monitored and compared to observed aboveground vegetation, in order to assess species regeneration potential and its contribution to recolonization processes.
Our specific objectives were to: (1) describe the successive vegetation stages occurring after depolderization; (2) compare spontaneous vegetation restoration trajectories; and (3) evaluate the recovery of vegetation cover over time. Results highlight the value of Markov models as decision-support tools for restoration practitioners, enabling prediction of ecosystem trajectories in response to tidal reinstatement. This work contributes to a broader understanding of salt marsh resilience and informs locally adapted restoration and monitoring frameworks.

P54.Dynamics of ecosystem restoration in the Sélune river following the removal of its dams – effects on water quality and biological communities

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The UNLOCK thesis marks the final phase of the Sélune programme, a scientific monitoring initiative launched in 2012 to study the effects of the removal of the Vézins (2017) and La Roche-qui-Boit (2022) dams on the Sélune river in Normandy - one of the largest ecological restoration projects in Europe. The aim is to analyse the dynamics of the river's restoration following these dismantlements, by integrating a wide range of physical, chemical and biological parameters collected by all the programme's teams. The main scientific challenge lies in the high heterogeneity of the available data: multiple sources, variable temporal resolutions and numerous gaps. To address these challenges, it is necessary to develop robust statistical approaches in order to draw reliable conclusions about the trajectories of ecological restoration.

P55.Effects of riparian forest restoration on the structure and ecological processes of tropical streams

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Riparian forest restoration has been the main strategy for conserving and restoring stream health in Brazil. This practice is crucial, as it increases stream habitat structural complexity, thereby supporting greater biodiversity and enhancing stream functioning. However, there is still limited understanding and no clear consensus on whether riparian forest restoration at the width required by Brazilian legislation is sufficient in intensive agricultural landscapes, such as sugarcane plantations. This study aimed to evaluate the effects of riparian forest restoration on the structure and ecological processes along a gradient of restoration and land-use intensity in the Corumbataí River basin, southeastern Brazil. A total of 27 streams were selected, distributed across seven classes, and assessed using habitat structure indicators. Leaf litter decomposition experiments were conducted using fine- and coarse-mesh litterbags deployed for 45 days. Leaf litter decomposition is a key indicator of stream ecological processes, as it integrates physical, chemical, and biological variability, providing a more holistic view of ecosystem functioning. All variables were analyzed using mean comparison tests and ordination techniques. Preliminary results indicate a recovery trend in habitat structure, with increases in the number of runs, riffles, and pools, as well as in leaf banks and woody debris. Decomposition rates in streams with restored riparian forest within sugarcane and pasture matrices approached those of reference streams, suggesting recovery of ecosystem functioning. This study is expected to contribute to improving public policies on riparian forest restoration and to inform best agricultural practices in Brazil and other tropical regions.

P56.Leaf it to the Microbes: Decomposition of Leaf Litter from Native and Non-Native Trees in Streams

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Leaf litter decomposition is a vital ecosystem process in streams, where leaves from streamside trees often accumulate in the water. Microbial communities in European rivers are likely adapted to degrading leaves of native trees. Planting non-native species, such as hybrid-poplars for short rotation plantations, has become increasingly common in riparian zones. Still, effects of their leaf litter input and aquatic decomposition remain understudied. We investigated whether non-native tree leaves are decomposed less efficiently than those of native species and assessed the contribution of different microbial groups (fungi, bacteria) to decomposition processes. The microbial decomposition rate kmicro (d-1) of different species was determined in field and laboratory experiments. In the field, the leaf bag method was applied in a near-natural stream (Triebelbach, Germany) during winter 2023/24 and summer 2024. Decomposition of leaves from the non-native hybrid-poplar clone Matrix 49 (*P. maximowiczii x P. trichocarpa*) was compared with the native black alder (*Alnus glutinosa*). Under controlled laboratory conditions, the total microbial decomposition rate kmicro (fungi & bacteria) and the bacterial decomposition rate kbac (fungi excluded) were analysed. In field and laboratory experiments, hybrid poplar (0.0335 d^1) decomposed at a similar rate to black alder (0.034 d^1). No significant difference (p-value ≥ 0.4375) was detected between microbial and bacterial decomposition rates of hybrid-poplar leaves, indicating that bacteria alone achieved decomposition rates similar to all microbes combined. Despite probable evolutionary adaptation of microbial communities to native trees, hybrid-poplar leaves decompose faster than native poplar species, potentially accelerating nutrient release and increasing eutrophication risks in streams.

P57.Pilot bioengineering restoration to improve river self-purification and riparian ecosystem quality in a WWTP-impacted stream

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River habitat degradation leads to the loss of associated ecosystem services. Here, we present a pilot restoration using nature-based solutions that seeks to improve the self-purification capacity and carbon sequestration of a highly modified, intermittent Mediterranean stream impacted by WWTP effluent.
The restoration has been implemented in a 150m reach of the Vallserena stream (Sant Antoni de Vilamajor, Spain) and has two objectives: first, to enhance the hydromorphological heterogeneity of the river channel; second, to increase the species richness and the structural and functional diversity of riparian vegetation.
To this end, we have applied a novel bioengineering technique based on vegetated vane structures. These are flow deflectors placed at an angle to the river channel, upstream-oriented and inclined from the bank toward the riverbed. Their design and arrangement on both sides of the channel is expected to increase water flow diversity and, thus, both lateral and vertical transport. Additionally, the structures are planted with native macrophytes, shrubs and trees. Four types of deflectors are used, with increasing complexity based on the number of species planted. To evaluate the intervention, we use a BACI experimental design.
The expected results of the ongoing experiment are: 1) To improve river's self-purification capacity by increasing nutrient retention. 2) To enhance riparian plant productivity and, hence, carbon sequestration by increasing species richness and plant functional diversity.
This restoration is part of the "RiparianEcoRest" project (PID2022-141330OB-I00) funded by MICIU/AEI /10.13039/501100011033 and by ERDF, EU. Anne Vallez thanks MICIU the funding granted through contract FPU24/01296.

P58.Functional Trait Structure in Urban Streams Is Primarily Shaped by Stream Identity

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Freshwater ecosystems provide habitat for a substantial proportion of the organisms on Earth, but the average size of feshwater populations is declining more rapidly than in other major habitats, with urban areas being particularly

threatened, due to the strong anthropogenic influence. River restoration aims to improve the situation. The targeted application of methods requires a systematic understanding of urban stressors and the formulation of restoration goals and urban references. A dataset consisting of species lists from 11 sampling sites from three streams across three European countries was used as a basis. Trait modalities of four traits (feeding mode, locomotion, respiration, and voltinism) were used to calculate functional diversity indices and to assess their responses to environmental factors. The stream identity was identified as the largest influencing factor, with electric conductivity and distance to source, which were strongly related to the stream identity, explaining a large part of the variation in the abundance-weighted trait distribution. After excluding stream identity, habitat heterogeneity and canopy cover were identified as environmental factors with a significant influence on average trait expression. Univariate analyses of individual trait modalities and functional diversity indices with the environmental factors impervious surface, canopy cover and habitat heterogeneity lacked significant correlations, thus reinforcing the multivariate approach in a multi-stressor system. In addition, the lack of clear trends between designated reference sites and urban sites, both in functional and taxonomic indices, as well as in the location within the functional trait space, has demonstrated the importance of individual pre-restoration assessments.

P59.Weed, Waste, or Resource? Governance-dependent restoration of a chronically invaded South Asian lake

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Water hyacinth (Pontederia crassipes) is one of the world's most damaging aquatic invasive plants, forming dense mats that degrade biodiversity. Conventional mechanical removal is costly and rarely sustained because harvested biomass is discarded. Utilisation-based management - converting biomass into products - could incentivize regular removal yielding ˜35 euros / kg dry fibers.
We ask whether persistent water hyacinth cover at Sanapur Lake reflects climatic forcing or structural governance failures, and whether community-based utilization can scale to match the pace of invasion.

We studied Sanapur Lake (Koppal, Karnataka, India) using nine years of monthly satellite imagery (Sentinel-2, 2017–2025) alongside field-based biomass estimation and two community-led removal trials. Water hyacinth occupies medium-to-high cover states roughly 86% of the time, and this persistent infestation is not explained by rainfall variability - pointing to structural social and institutional failures rather than climate as the root cause. The lake holds an estimated 3,700 tonnes of fresh biomass on average. Community removal - through a women's craft cooperative removes less than 0.1% of standing stock per intervention due to extensive labor whereas a trial coordinated with the farmers union yielded ten times the output.
Drawing on Ostrom's social-ecological systems framework, we propose a Coordinated Community–Institutional Management (CCIM) model linking formalised biomass-supply agreements, social-enterprise partnerships, and government scheme integration. At Sanapur Lake, persistent infestation appears driven by governance gaps rather than climatic forcing, suggesting that coordinated institutional action - not ecological constraint - is limiting to control in chronically invaded South Asian lake systems.

P60. Nature-based Solutions for Lake Restoration: Promises, Limitations and Research Needs

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Lacustrine ecosystems are complex environments exposed to multiple and interacting pressures, including eutrophication, hydrological alterations, and climate change. Despite their ecological and societal importance, they remain less studied than river systems, usually prioritized by public policies and stakeholders for the implementation of restoration actions.
Concurrently, Nature-based Solutions (NbS) have emerged as an important framework in freshwater ecosystem restoration, encouraging integrative approaches that address ecosystem degradation while supporting biodiversity and human well-being. However, the extent to which NbS serve as operational levers for lake restoration remains uncertain,

given the specific ecological characteristics of lakes and the limited application of NbS in lacustrine contexts.
To fill this gap, a systematic literature review was conducted to analyze how NbS are conceptualized and implemented in lacustrine ecosystems. Among 338 screened research publications, 55 articles were selected for in-depth analysis to identify trends and assess the alignment of projects with key NbS principles.
Preliminary results indicate that NbS approaches in lake restoration remain limited and focused on ecological objectives, with less attention given to societal challenges. Water quality and trophic state improvement, pollution control, and watershed management are the main issues addressed, while habitat diversification and hydromorphological restoration are less integrated. Governance, stakeholder participation, and socio-economic benefits are inconsistently considered.
Overall, lake ecosystems appear underrepresented within documented NbS projects, despite their strong potential to support restoration. However, the review highlights the need for further research, increased NbS awareness among lake managers and better documentation of local restoration initiatives, for instance through surveys at regional scale.

P61.Control of *Baccharis halimifolia*, an invasive alien species present along the Morbihan coastline (France): Control methods and post-treatment monitoring

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Invasive alien species (IAS) are a serious threat to biodiversity. For several decades, *Baccharis halimifolia* has been invading French Brittany's coastline, currently classified by the European Commission as a "Shrub, IAS of concern for the European Union". Native to North American intertidal marshes, this Asteraceae species has been introduced on 4 continents - Europe, Oceania, Australia and New Zealand - mainly for its ornamental value and as a windbreak and soil stabilizer. It is gradually colonizing a variety of coastal environments such as salt marshes, rushes, reedbeds, roadsides and wasteland, susceptible to generate ecological and landscape im-pacts.
For over a decade, coordinated management efforts have been implemented in the Morbihan department (Brittany, France) to limit the spread of this species and eradicate it from particularly sensitive habitats. Control measures have involved uprooting. At several sites, populations have now been contained or locally extirpated. The effectiveness of the management operations and habitat restoration has been evaluated. For this purpose, vegetation surveys were conducted prior to removal works and repeated over the following years. Density measurements of *B. halimifolia* were carried out, alongside an analysis of the soil seed bank. In the first years following the removal of established populations, the seed bank becomes active and *Baccharis* density increases significantly. Over successive removal interventions, this seed bank becomes progressively depleted, allowing the recovery of the native vegetation.
This work has provided valuable insights into the management of this ISA and has allowed us to investigate the resilience of habitats following *Baccharis* invasion.

P62.Assessing *Posidonia oceanica* meadows restoration through the assessment of ecosystem services supply

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Under the Nature Restoration Regulation (EU 2024/1991), which mandates the restoration of at least 20% of the EU's marine areas by 2030, seagrass restoration projects are increasingly implemented. However, their success is often assessed solely based on plant morphology and survival, resulting in incomplete evaluations. A shift toward ecosystem-based approaches is needed, as seagrass meadows are complex systems that support biodiversity, regulate biogeochemical cycles, and provide multiple ecosystem services (ES). This study presents a systematic literature review compiling biophysical variables of *Posidonia oceanica* meadows that relate to ES supply, based on literature since 1975. The aim is to evaluate restoration success using ES supply as a monitoring framework, enabling a more holistic social-ecological assessment, beyond conventional biological metrics. Selection criteria for assessing the suitability of the examined ES were based on a set of indicators corresponding to each individual ES, considering the ecological functions of *P. oceanica* meadows. In addition, criteria related to the systematic monitoring of these ES were considered, including the frequency of data collection, the sampling methodology, and the spatial scale of application. The findings indicate that most references meeting the criteria pertain to four regulating and maintenance services (climate regulation, water purification, life cycle maintenance, and coastal protection), while the primary indicators, aligned with ecological functions, were carbon regulation, coastal protection, water purification, and biodiversity support. Overall, this approach could fill the gap between

ecological restoration and ecosystem functioning by enabling the assessment of functional recovery and associated ecosystem and societal benefits.

P63.Initial approaches to *Posidonia oceanica* rhizome micropropagation: moving towards restoration independent of natural meadows.

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Posidonia oceanica is a seagrass endemic to the Mediterranean Sea that forms meadows of high ecological value, providing numerous ecosystem services. However, these meadows undergo a marked decline, which restoration efforts aim to mitigate. One of the main limitations of restoration is the low availability of transplantable material, as it currently depends exclusively on fragments collected from natural meadows. The aim of this study was to address this constraint by developing a specific micropropagation protocol for *P. oceanica*, enabling the production of plant stock for restoration. To this end, experiments were conducted using rhizomes to evaluate the effect of different disinfection treatments, salinity levels, and the addition of sucrose and growth regulators on explant survival, growth, and division. The rhizome disinfection treatment resulted in the highest axenic culture survival to date (85%). Additionally, salinity level of 35 psu showed the highest survival rate (89%). Sucrose addition had no effect on survival, while a positive effect was observed with the combination of two plant growth regulators, reaching a 50% survival rate. No significant differences in growth were detected among treatments, and no explant division was observed. This study represents a major advance in in vitro culture of *P. oceanica*, achieving for the first time the establishment of axenic rhizome cultures. Altogether, results offer a starting point for the development of a *P. oceanica* micropropagation protocol for ecological restoration of its meadows.

P64.Integrating Clinical and Microbiological Findings from a Rescued Loggerhead Sea Turtle (Caretta caretta) into Coastal Biodiversity Monitoring"

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An adult female loggerhead sea turtle (*Caretta caretta*), estimated to be 10–15 years old, was rescued from coastal waters in the Manfredonia area after exhibiting severe postural imbalance and impaired motor coordination. Clinical assessment suggested neurological impairment consistent with blunt force trauma of anthropogenic origin. Health evaluation included coprological and microbiological analyses conducted under expert supervision. Results revealed the presence of gastrointestinal parasites and bacterial pathogens, including *Escherichia coli*, *Salmonella*, *Proteus* spp., and *Shigella* spp., potentially associated with environmental contamination linked to aquaculture and other coastal human activities. This case highlights the cumulative effects of anthropogenic injury and microbial exposure on marine megafauna and underscores the importance of integrating rescue-based clinical and microbiological data into ecological biodiversity monitoring frameworks. Such integrated surveillance is essential for assessing ecosystem health and informing conservation strategies in human-impacted coastal environments.

P65.Reproductive cycle of natural *Ostrea edulis* populations in the Northern Adriatic sea

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The European flat oyster (*Ostrea edulis*) is an ecologically and economically important key-stone species in different marine habitats. Due to its widespread decline in Europe, with some populations functionally extinct, detailed knowledge of remaining natural populations is essential for conservation and restoration efforts. Understanding the reproductive cycle is particularly important for understanding reproductive strategies including spawning timing, sex ratios, and spawning success, which are crucial for future management. To describe the reproductive cycle of wild *O. edulis* population in northern Adriatic Sea, oysters were sampled approximately monthly from dredge commercial catches during two periods, 2017 – 2018 and 2022 – 2024. In the laboratory gonadal tissue was processed using standard histology methods. Sex and qualitative gonadal developmental stages were established by light microscopy, while photomicrographs were used to quantitatively evaluate oocyte size

and atresia before, during and after spawning. In general, individuals with mature or partially spawned gonads were observed from early spring to winter indicating extended spawning period, with main spawning peak in late spring and less pronounced peak in early autumn. Both prespawning and postspawning oocyte atresia occurred throughout the year, which can negatively affect reproduction success. These first data on the reproductive cycle of wild *O. edulis* populations in the Adriatic Sea will serve as an important baseline for developing conservation strategies and management measures aimed at preserving and potentially restoring natural *O. edulis* in the Adriatic Sea.

P66.Seagrass Restoration on Active Capping Sediments in a Post-Industrial Coastal Environment: One-Year Results from a *Posidonia oceanica* Transplantation Pilot in the Gulf of Naples (Italy)

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Posidonia oceanica meadows are key Mediterranean coastal ecosystems, yet their restoration remains challenging in highly modified environments. This study presents the one-year results of a pilot restoration project conducted within the remediation programme of the Bagnoli-Coroglio Site of National Interest (Southern Italy), where *P. oceanica* was transplanted onto an engineered capping mattress composed of active sandy sediments covering historically contaminated seabed deposits.

Approximately 2,500 cuttings from a donor meadow in good ecological condition were transplanted over 250 m^2 using welded steel grids designed to stabilize mobile sediments under strong hydrodynamic conditions. The restoration site was characterized by coarse sands, high turbidity, active sediment transport and ripple formations reaching 35 cm during winter storms.

Monitoring was performed after 3, 6, 9 and 12 months. Survival decreased from 95.8% at 90 days to 88.8% at 180 days, 76.3% at 9 months and 68.8% after one year, mainly due to storm events and sediment dynamics. Nevertheless, about 30% of surviving cuttings developed visible root systems (5–15 cm), while the predominance of juvenile and intermediate leaves indicated ongoing vitality and adaptation.

Biological colonization progressively increased. Macroalgal cover reached 70%, epiphytic communities became established, and the restored area functioned as a nursery habitat for fish species of ecological and commercial importance. The occurrence of the protected bivalve *Pinna rudis* further highlighted the ecological value of the restored habitat.

These findings demonstrate that *P. oceanica* transplantation on active capping sediments is feasible and can support ecological recovery and biodiversity enhancement in post-industrial coastal ecosystems.

P67.Seagrass restoration: using tissue culture tools to provide sustainable donor material

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Seagrasses are marine angiosperms that form highly productive coastal ecosystems, but they are experiencing global declines driven by human disturbances. Restoration initiatives depend on donor material harvested from natural meadows, creating ecological risks and limiting large-scale recovery. Micropropagation-the *in vitro* production of clonal plant material-offers a promising biotechnological solution for the cost-effective, rapid, and year-round clonal multiplication of seagrasses. However, the development of reliable protocols for seagrass tissue culture has proven exceptionally challenging. This project is an innovative action focused on the development of tissue culture tools that can be used to increase the success and resilience of seagrass restoration efforts. Healthy adult individuals were collected in Ria Formosa lagoon, southern Portugal. Meristematic portions of seagrass plants were used as primary explants for *in vitro* propagation. Several decontamination procedures were tested to clean the explants from epiphytes. Culture medium formulations, supplemented with different auxins and cytokinins, at different concentrations, were tested in order to achieve high multiplication, rooting rates or callus formation. A seawater-based culture medium was tested as a strategy to improve micropropagation rates and, particularly, the success of plantlets transplantation to *ex vitro* conditions. The photo-physiological performance and biochemical condition of plantlets and seedlings were monitored. These developments are essential for enabling sustainable restoration and preserving the genetic diversity of seagrasses.

P68.Sejerø Seascape - Integrated large-scale ecosystem restoration in the Western Baltic Sea

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Sejerø Bay (Western Baltic Sea) represents a multi-habitat marine ecosystem restoration initiative currently underway in Denmark. Despite extensive historical impacts from stone extraction, overfishing, destructive bottom-contact fisheries, and nutrient runoff from land, the bay retains substantial ecological recovery potential and remains an important nursery area for fish in the Danish inner waters.
The Sejerø Seascape initiative applies a seascape-scale restoration framework combining restoration of boulder reefs, eelgrass meadows, and blue mussel biogenic reefs with cod recovery efforts, scientific monitoring, advocacy work for better management, and local stakeholder engagement. The project integrates hydrodynamic modelling, habitat mapping, BACI-based ecological monitoring, and large-scale underwater camera surveys to support adaptive ecosystem restoration and evaluate ecosystem responses across habitats.
By combining active restoration efforts, with targeted policy advocacy, communication and stakeholder engagement, the initiative aims to strengthen ecological functions, enhance habitat connectivity, and support long-term ecosystem recovery. Sejerø Seascape provides a practical example of how integrated marine restoration can be implemented at seascape scale in coastal ecosystems.

P69.In-Situ Seagrass Seed Processing For Scalable Restoration

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Seagrass meadows are among the world's most valuable coastal ecosystems, providing biodiversity support, carbon sequestration, fisheries habitat, and shoreline protection. Despite their importance, large-scale restoration remains limited by the cost, infrastructure requirements, and logistical complexity associated with current seed-based restoration practices, particularly the reliance on land-based seed processing systems.
Seavive is developing an alternative in-situ approach to seagrass seed processing that aims to reduce these barriers by keeping processing within the marine environment where donor material is collected. The system uses passive ocean movement to naturally agitate harvested seagrass material within a compact ocean-deployed unit, allowing seeds to separate and be collected without the need for extensive inland infrastructure, pumping systems, or specialist facilities.
This work explores how decentralised, in-water processing systems could support more scalable and accessible restoration pathways, particularly for community-led and geographically dispersed projects. By reducing transport requirements, simplifying deployment, and integrating with existing marine infrastructure such as pontoons and moorings, the approach aims to lower operational costs while increasing participation in restoration activities.
The abstract presents the design rationale behind the system, outlines the engineering approach taken during development, and discusses the potential role of in-situ processing in supporting scalable seagrass restoration efforts ahead of upcoming multi-site field trials.

P70.Population of European flat oyster (Ostrea edulis) in the Croatian Adriatic Sea: historical data, recent surveys, and citizen science initiatives

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The European flat oyster (*Ostrea edulis* Linnaeus, 1758) is a native bivalve of high ecological and economic importance in European marine ecosystems. Overexploitation, combined with widespread disease outbreaks in the 1970s, has led to a severe decline across its historical range, leaving many populations critically depleted or functionally extinct. As a biogenic reef-forming species with an important ecological role, *O. edulis* has become a focus of restoration efforts across Europe.
Despite this, *O. edulis* persists in the Adriatic Sea, although a marked decline in abundance has been observed in the northern Adriatic over the past decade. To assess the current status and recent trends of oyster populations, field surveys were conducted using beam trawl sampling and remotely operated vehicle (ROV) observations. This study compiles data collected on several occasions between 2008 and 2024, including commercial catches, scientific surveys, and targeted ROV assessments.
Results indicate a significant decline in biomass over the past decade. Moreover, ROV surveys at sites where fishing pressure has been eliminated, including historically productive grounds, show no clear signs of population recovery, suggesting that fishing bans alone are insufficient and that active habitat restoration is required.
To improve spatial coverage along the highly indented Croatian coastline, a citizen science platform has been developed

to collect data on oyster presence, abundance, habitat, and size. These data will support future monitoring and guide conservation and restoration efforts in the eastern Adriatic.

P71.Detecting ecological trajectories in Gyldensteen Coastal Lagoon using remote sensing and unsupervised time-series clustering

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Ecological trajectories are essential for evaluating coastal rewilding outcomes as they provide a temporal perspective on restoration outcomes, revealing spatially variable pathways of ecosystem development in coastal landscape. We use the study case of Gyldensteen Coastal Lagoon, Denmark, due to its managed realignment project where formerly reclaimed land was reflooded and reconnected to the sea. Change may appear as increasing surface water, intertidal development, vegetation change, exposed sediment dynamics, seasonal water variation, or limited response. Detecting these trajectories can support adaptive restoration planning by identifying where ecological development is progressing, where responses are weak, and where targeted monitoring is needed.
Here, we use multi-temporal indicators of vegetation, wetness, moisture, bare substrate and surface-water dynamics derived from satellite time series to detect and classify the existing trajectories. Long-term behaviour and seasonal patterns are analysed to examine how conditions vary across the lagoon and whether different areas follow distinct development pathways. We then combine feature-based K-means clustering with dynamic-time-warping (DTW) to identify locations with similar trajectories.
We expect to identify interpretable trajectory types representing ecological changes and transitions. These may reflect hydrological or intertidal transition, vegetation-related change, exposed sediment dynamics, seasonal wetness variation, or stable aquatic conditions. Preliminary results suggest that Gyldensteen Coastal Lagoon does not follow a single uniform trajectory: some locations show strong wetness and water-related change, while others show weaker responses or remain relatively stable. This approach provides a basis for interpreting post-restoration dynamics and informing targeted monitoring and management in future coastal rewilding projects.

P72.The flat oyster as an agent of marine rewilding? Building a hybrid collective within the "Rewilding the North Sea" project in the Netherlands

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Marine rewilding initiatives that center their approach on the reintroduction of flat oyster (Ostrea edulis) reefs are flourishing across Europe. The case study of the "Rewilding the North Sea" initiative by the Dutch foundation ARK Rewilding Netherlands aims to analyze how the flat oyster has become a key player in marine rewilding. Through an analysis grounded in actor network theory, the study shows that the flat oyster is at the center of the diverse interests of actors who are heterogeneous in nature but who are united by the obstacles they must overcome to ensure the successful reintroduction of the mollusk. This study opens up critical reflections on the formation of marine rewilding initiatives, whose concepts and practices are borrowed from terrestrial models.

P73.Identifying critical early life history stages in cold-water corals to support restoration success

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Recent projects have explored the restoration of cold-water coral (CWC) habitats by transplanting coral fragments into degraded areas, with promising initial results. However, this technique has limitations, including low genetic variability. Additionally, critical knowledge gaps remain regarding CWC reproduction and early life-history stages, and how these processes influence restoration success.
In this study, the spawning and first stages of the early life-history of the octocoral *Dentomuricea* aff.*meteor* were studied under controlled ex-situ conditions. The spawning of nine female colonies was monitored between November and January. Samples were collected daily, encompassing different developmental stages. Larvae were monitored to assess survival and settlement rates. In addition, the effect release timing (early, mid and late spawning) was studied,

as long-term survival and settlement success appear to depend on this factor.
The studied species showed high fecundity, with more than 58,000 eggs spawned throughout the study period. Larvae experienced high mortality (90%) and preliminary results indicate that survival probability dropped by more than 70-75% within the first 20 days after spawning. This high larval mortality severely affected the settlement rates, which are approximately 5%. Moreover, eggs released during the middle of the spawning season showed the highest survival and settlement rates, suggesting differences in egg quality. Future analyses of particulate organic carbon will help assess potential nutritional drivers of these variations.
By elucidating early life history processes and identifying the most critical developmental stages of CWC, this study provides key insights to inform and optimize conservation and restoration strategies for these vulnerable ecosystems.

P74.Methods for obtaining, culturing, and rearing early life stages of deep-sea octocorals for multi-stressor studies and future restoration initiatives

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Access to early life stages of deep-sea octocorals remains limited by the difficulty of maintaining reproductively active colonies in captivity, and sustaining highly sensitive early developmental stages once spawning occurs. As a result, obtaining early life stages in sufficient quantity and consistency for experimental applications remains challenging in deep-sea corals.
Here, a methodology is presented for broadcast-spawning deep-sea octocorals that enables the controlled acquisition and rearing of successive early life stages, from gamete release to the establishment of early recruits. The approach is designed to operate within the constraints of limited reproductive output and relies on the coordination of colony maintenance, the monitoring of reproductive maturity, the optimization of fertilization conditions when necessary, and the *ex-situ* culture of embryonic, larval, and early post-settlement stages.
By intervening at all key phases of the reproductive cycle and during early development, this methodology improves the availability of early life stages under controlled conditions. It provides a practical experimental framework for applications requiring reliable access to sensitive developmental stages, including multi-stressor experiments, and supports the exploration of sexual reproduction as a complementary component of future deep-sea coral restoration initiatives.

P75.Spatial and temporal variability of epibenthic motile assemblages across Mediterranean vulnerable marine ecosystems

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Mediterranean vulnerable marine ecosystems (VMEs) hosted within fishery no-take zones (FNTZs) provide structurally complex habitats that support diverse benthic communities and may promote ecosystem recovery processes. However, the temporal dynamics of associated megabenthic motile assemblages across VMEs and environmental conditions remain poorly understood.
Within the LIFE ECOREST project, three benthic landers equipped with cameras and environmental sensors were developed to investigate how megabenthic motile assemblages respond to passive restoration measures in FNTZs. In June 2023, landers were deployed in three FNTZs hosting contrasting VMEs across a depth gradient: (1) soft coral and sea pen meadows at 100 m depth, (2) hydrozoan forests at 180 m depth, and (3) cerianthid beds at 350 m depth. These habitats were selected because they persist within FNTZs while being absent or highly degraded in surrounding trawled grounds.
Due to battery limitations and logistical constraints associated with oceanographic field campaigns, image acquisition was conducted across three deployment periods spanning 1.5 years. During each deployment, landers collected imagery every 30 minutes, while environmental variables (temperature, salinity, current velocity, and fluorescence) were recorded when available.
The study will assess megabenthic motile assemblage composition and functional diversity across diel and seasonal scales in contrasting environments, while evaluating relationships with environmental variability where data are available. The methodological setup will be presented, and preliminary observations on temporal activity patterns and assemblage differences among VMEs will be included.
This work contributes to understanding how environmental heterogeneity influences megabenthic motile assemblages

and passive restoration dynamics in Mediterranean FNTZs.

P76.Standardized landers: From a plurality of structures to monitoring deep-sea restoration

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The recovery of damaged deep-sea habitats is a key objective on ongoing restoration efforts. Alongside these initiatives, monitoring programs are essential to provide indicators of ecosystem responses and to inform conservation decisions. Among the available tools, benthic landers, typically deployed as self-contained, standalone static platforms for defined periods, are widely used due to their cost-efficiency and capacity to host diverse sensor payloads. However, lander systems remain highly heterogenous across study sites, raising questions about the feasibility of standardising and optimising their design for restoration-focused monitoring. To address this, we conducted a meta-analysis to review deep-sea lander configurations and deployment objectives. This analysis integrates data from over 40 lander types, complemented by detailed specifications from four systems (ALBEX, SLM, ASDERS, TURBOT) currently used to monitor restoring deep-sea coral habitats. Our results highlight the versatility of landers, which are predominantly used to assess Essential Biodiversity Indicators related to abundance and spatial distribution. Across both short- or long-term monitoring, landers are mainly deployed in vulnerable or poorly understood ecosystems, such as deep coral habitats and abyssal environments. In parallel, we evaluate the cost structure of lander deployments and propose payload configurations and technical solutions aimed at reducing operational expenses. Overall, our findings suggest that structural design has limited influence on standardisation potential, while the main challenge lies in harmonising sensor payloads and experimental protocols to ensure comparability across deployments.

GOVERNANCE, STRATEGY AND TOOLS

P77. Restoring Nature in France: 10 Strategic Recommendations from the French National Botanical Conservatories

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7 : Service santé de la faune et fonctionnement des écosystèmes agricolesOFB Direction de la recherche et de l'appui scientifique

As scientific and technical referents for flora, fungi, and habitats, the National Botanical Conservatories (CBN) play a vital role in supporting public environmental policies through their government-approved missions. As part of the public consultation for the implementation of the Nature Restoration Regulation, the CBNs have put forward ten strategic recommendations aimed at successfully implementing the National Restoration Plan within the context of climate change.
The CBNs emphasize that effective restoration must be rooted in territorial knowledge. This involves updating vegetation reference systems and diagnosing the conservation status of priority habitats. A primary strategy is the non-deterioration of existing high-value sites, prioritizing the "avoidance" principle and natural regeneration wherever possible. When assisted regeneration is required, the CBNs advocate for the exclusive use of wild, local plants to preserve genetic diversity and ecosystem resilience.
To support practitioners, the network develops innovative tools such as "restorability" indices and standardized monitoring protocols to evaluate project success. Rare and threatened species are stored in their conservatory centers to restore habitats of species. Most common species are available through the “label Vegetal local” supported by the

French Biodiversity Agency. Furthermore, the recommendations highlight the need for storing monitoring data in public databases, sharing feedback on restoration projects and the need for cross-sector collaboration between researchers, land managers, and farmers, alongside training programs for all stakeholders. Finally, mobilizing ambitious and sustainable funding is essential to deploy these projects.
By integrating scientific expertise with field-based action, the CBNs aim to restore functional ecosystems in a sustainable manner.

P78.Restoration from Within: Linking Traditional Ecological Knowledge to Governance and Practice in Uttarakhand

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In the remote highlands of Uttarakhand Western Himalayas in India, which see very harsh winters and a slow growth of life, people for long have been shaping resource care out of belief, memory, and shared rules. Not given out but lived out season after season, practices which do not deplete the land went first. Instead of cutting down trees they practice careful trimming of branches; instead of taking what they want they wait for what time allows. In the soil of habit decisions come from what is passed down through the generations regarding balance which is the key. With firewood for example it is taken only what is needed. Fodder is given in measured out bundles which are collected at designated times. Water moves as it has always moved, channeled by what the patient eye has learned over time. Faith's practice is calm restraint; drawing lines. She threads care into her movements. Here, healing takes years, and each gesture is aimed at renewal. Acts are nudged by not law, but legacy. Ancient, spiritually revered, and theologically protected, Dev Vans are Sacred Groves that culture reverence for nature. Starting new, the Van Panchayats of Uttarakhand innovate new governance of proximity forests and the patterns they encourage weave custom into daily acts of those who live by them. In past generations which had very defined roles for each group and uptalked about rules which took care of the woodlands and tended the soil, hand off hand through time.

P79.RESTOBS, a ten-year network for the restoration and observation of coastal environments in Brittany: focus on the rehabilitation of coastal landfills.

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The RESTOBS workshops, focusing on the restoration and observation of coastal environments, were launched in 2017 as part of a research project led by the University of Brest. These meetings aim to bring together managers and researchers to share expertise, scientific knowledge, and feedback on fieldwork related to the restoration and management of coastal environments. Since 2021, the University of Brest and the Brittany Biodiversity Agency (ABB) have coordinated this network, with support from the French Coastal Protection Agency (Conservatoire du littoral). These meetings bring together between 20 and 40 people and are organized every two years in partnership with a natural area management organization. (2017 : Communauté de communes de Belle-Île-en-Mer, 2019 : Communauté de communes de la presqu'île de Crozon – Aulne Maritime, 2021 : Grand Site Cap d'Erquy-Cap Fréhel, 2022 : Grand Site de la Pointe du Raz en Cap Sizun, 2024 : Commune de l'Île de Groix, 2026 : Parc naturel régional d'Armorique). The last edition, held on the island of Ouessant, explored, in particular, the theme of ecosystem rehabilitation following the deconstruction of infrastructure (buildings, landfills. Here we present some feedback on coastal landfill rehabilitation projects, illustrating the technical and financial complexity of certain operations depending on the site configuration (cliff, slope, accessibility. Results from ecological monitoring show that it is possible to regenerate heathland and coastal grassland communities in about fifteen years, provided that a poor mineral cover substrate is used with a moderate input of organic matter (hay and heathland litter).

P80.AQUArestore Project: Promoting dynamic riverine ecosystem restoration in Portugal's transboundary regions

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AQUArestore is a three-year project focused on implementing and promoting adaptive ecological restoration strategies

for river ecosystems in the vulnerable transboundary region of Portugal. The project responds to pressing environmental challenges across this territory, including severe habitat degradation, climate vulnerability, declining water security, and biodiversity loss. The AQUArestore consortium aims to develop a replicable framework for the restoration of Mediterranean transboundary riverine habitats, not only to fulfill requirements established by the EU Nature Restoration Law (NRL) but also to serve as a cost-effective solution that yields high socioeconomic returns and counters rural depopulation. The project kick-off meeting included an overview of the status of NRL implementation in Portugal, followed by a detailed discussion of task development. The project activities began with compiling information on previously restored or protected sites (Task 1), including the restoration actions implemented, the total area restored, and the indicators used. This will support the development and validation of biodiversity and environmental indicators of riverine restoration outcomes to riparian vegetation and fish communities (Task 2). The project will also establish Living Labs to test nature-based solutions and restoration monitoring in collaboration with scientists, stakeholders, and local communities (Task 3). In parallel, AQUArestore will strengthen technical capacity through targeted training for practitioners and public authorities (Task 4). Finally, dissemination will be supported through citizen science, communication activities, and stakeholder engagement (Task 5). Together, these tasks provide an integrated, science-based, and participatory framework that includes partners from environmental NGOs and private companies, to support adaptive river restoration.

P81.Assessing Habitat Sensitivity to Pressures: a Framework to Guide Restoration Planning for Annex I Habitat Types

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The EU Nature Restoration Regulation (NRR) requires Member States to restore degraded Annex I habitat types to good condition and to assess habitat condition across at least 90% of their distribution by 2030. Meeting these targets calls for a thorough understanding of the relationships between anthropogenic pressures and habitat condition, in order to identify degradation drivers and design effective restoration and pressure-reduction strategies.
We present an harmonized methodological framework, developed at PatriNat, to systematically assess the sensitivity of continental Annex I habitat types to pressures. Pressures are defined according to the PressRef reference system, independently from the human activities generating them. Sensitivity is characterized through two complementary components: resistance, the ability of a habitat to withstand a given pressure without degrading, and resilience, its capacity to recover once the pressure is removed. The assessment draws on literature, habitat management documents, and structured expert consultation.
Overlaying sensitivity data with spatially explicit pressure data and habitat distribution maps further enables the identification of potentially degraded areas, providing a consistent basis for prioritizing restoration efforts across France. Despite inherent limitations, this framework offers a structured and reproducible tool for understanding degradation processes and guiding evidence-based restoration planning.

P82.Controversial EU Funding: Does It Truly Ensure Sustainable Water Management? The Case of Lake Lubāns in Latvia and an Urgent Need for Policy Changes

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Analysis of EU and national policy documents, funding allocation reports, and semi-structured interviews with local authorities, environmental experts, and economic stakeholders were used in this study, as well as our experience in planning processes for development of River basin management and Nature management plans for Natura 2000 sites.
The findings reveal significant tension between water management (and nature conservation) goals and the economic interests of different stakeholders. EU funds for water management are primarily directed toward satisfying economic interests by maintaining outdated, 20th-century engineering projects, often ignoring modern, nature-based solutions like the restoration of natural floodplains as advocated by the EU Floods Directive, applying “Stage Zero” strategy for river restoration or restarting anastomosing of rivers.
The spheres of responsibility of the institutions has to be reviewed, as the current system creates obstacles to the implementation of a modern and holistic water management system in Latvia. We recommend concentrating water management under the different, away from current structures, which have proven themselves unable to modernize water management.
It is necessary to carry out institutional capacity building within VARAM to prevent the current practice where river basin management and nature management plans include digging and clearing works of historically altered but well naturalized river stretches without proper and comprehensive analysis and without looking for modern solutions.
Currently greenwashing terms such as “flood risk” and “climate change” are widely used to secure EU funding for the reanimating of outdated projects, without the need to seek more modern and sustainable solutions.

P83.Corporate Stewardship of Wetlands in Arid Landscapes: A Scalable Model for Biodiversity Conservation in Saudi Arabia

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Wetlands in arid environments provide critical biodiversity and ecosystem services despite their limited extent. Saudi Arabia lies at the convergence of major migratory flyways supporting approximately three billion migratory birds annually. However, wetlands face increasing pressures from land-use change, hydrological alteration, and industrial development.
This study presents a corporate biodiversity stewardship framework implemented within an industrial landscape and aligned with the Ramsar Convention, UN Sustainable Development Goals (SDGs 13, 14 and 15), and the Kunming–Montreal Global Biodiversity Framework (GBF). The framework integrates wetland inventory and mapping, biodiversity significance assessment using 13 ecological criteria, designation of Biodiversity Protection Areas (BPAs), ecological restoration, hydrological enhancement, invasive species management, and stakeholder engagement.

By 2025, 35 BPAs had been established, including 22 wetlands supporting migratory water-birds associated with the African–Eurasian flyway network. Monitoring indicates improved habitat quality, enhanced ecological integrity, and increased use by wetland-dependent species. Collectively, these sites support more than 400 plant species, 300 bird species, 47 mammals, 35 reptiles, and 119 invertebrate taxa.

The framework contributes directly to GBF Targets 2 (restoration), 3 (conservation areas), 5 (sustainable use), 8 (climate resilience), 14 (mainstreaming biodiversity), and 15 (corporate accountability), while advancing Ramsar's wise-use principle and supporting climate and biodiversity objectives.
This work demonstrates how biodiversity conservation can be effectively integrated into corporate governance and operational systems, providing a replicable, science-based model for private-sector leadership in wetland conservation and restoration within arid landscapes.

P84.Afforestation/Reforestation/Revegetation projects within the Voluntary Carbon Market: an in-depth, data-based assessment.

Angie Lisseth, Bernal Torres, AgroParisTech Alumni – AgroParisTech – France

The present study analyzed around 200 certified ARR (Afforestation, Reforestation, and Revegetation) projects from the four main Voluntary Carbon Market (VCM) standards: VERRA, Gold Standard, Cercarbono, and ACR. The findings highlight significant gaps in transparency and standardization within project documentation, especially regarding technical itineraries and monitoring reports. Despite the wide range of publicly available information, inconsistencies and lack of clarity persist. Geographic distribution shows a concentration in the Global South, with varying preferences for native and exotic species across regions. Overall, 590 different species are used by ARR projects worldwide with a prevalence of Teak, Eucalyptus, Pinus Guava, and Silky Oak as the most used. The study also emphasizes the environmental impacts of certain site preparation and management practices, such as clear-cutting and herbicide use. Statistical models revealed the influence of previous land use and planting density on carbon accumulation, though their predictive accuracy varied. The growing demand for carbon credits underscores the need for stricter reporting standards and more detailed project assessments, including species distribution, soil analysis, and social design considerations.

P85.Beyond ecological recovery: How stakeholders perceive the benefits of large-scale restoration projects in Iceland

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There is a growing call for a better examination of the outcomes of restoration projects, not only ecologically but also in terms of how stakeholders perceive and value their benefits. We examined stakeholder perceptions of the benefits of six large-scale ecosystem restoration projects in Iceland through 39 semi-structured interviews and analysed them in two steps: first, using content analysis, and second, using grounded theory analysis. The findings were organised according to the International Panel on Biodiversity and Ecosystem Services (IPBES) value typology framework, encompassing intrinsic, instrumental, and relational benefits. The analysis revealed a wide range of restoration benefits, totalling 21 categories across all benefit types. However, the results also show that these benefits are often expressed only indirectly. Relational benefits emerged as the most prominent type overall, especially in projects with stronger local engagement and community involvement, indicating that project outcomes are context-dependent and shaped by

management approaches and stakeholder engagement. Conversely, intrinsic benefits were more prominent in projects led by governmental institutes and involving less stakeholder engagement. Overall, instrumental benefits were the least frequently mentioned, indicating that direct utilisation is of lesser importance to stakeholders. The study suggests that restoration projects should be designed as co-created collaborative processes, with governmental institutes providing scientific and technical guidance, but emphasises engaging stakeholders from the outset and throughout the process. Such transformations may improve future restoration projects, leading to outcomes that strengthen ecosystem recovery, stakeholder engagement, and long-term restoration governance.

P86.Should human disturbances be part of restored ecosystems? Insights from the ethnography of three restoration projects.

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In a context of biodiversity erosion, ecological restoration is of crucial importance. With the UN Decade of Ecosystem Restoration (2021 – 2030), and the Nature Restoration Law, ecological restoration is increasingly implemented at different scales. However, what is considered a valuable ecosystem for biodiversity can vary. In particular, whether some human disturbances can be beneficial for biodiversity and part of restored ecosystems, or, on the contrary, whether they are detrimental and should be limited as much as possible, is a matter of debate. Different understandings of this question can largely influence restoration trajectories, and thus both the biodiversity of restored ecosystems, as well as human societies living nearby (by fostering or on the contrary limiting human practices that create disturbance within ecosystems). I explore this question around three restoration projects located in the estuarine wetlands of the Gironde Estuary. Located in South-Western France, these wetlands are complex socio-ecosystems that have been invested by humans for thousands of years and can support unique biodiversity, while others have been turned into "biological deserts". Using participant observation as well as open and semi-structured interviews, I study how different restoration actors position themselves on this debate, and how their understandings and practices give shape to different restored ecosystems. Grounded in ethnoecology, this work contributes to a critical and reflexive approach to the practice of ecological restoration, by situating it within the wider context of our society's relationship with ecosystems.

P87.The Farmers Heal the Land Program

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The Farmers Heal the Land program in Iceland.
The Soil Conservation Service of Iceland (now Land and Forest) had limited financial resources around 1990 and had to come up with new approaches to attain it goals in soil conservation and restoration. One of the approaches is the Farmers Heal the Land program, where farmers and other landowners participate in soil conservation, sustainable land use and vegetation and soil restoration.
The program is a step in reaching the long-term goal of making land users the true custodians of the land.

Participants provide the land and labor and Land and Forest coordinates the program. Participants are visited on regular basis where success is estimated, and records of location, methods and amount of fertilizer are kept in our database.
The prerequisite for participation is degraded land and moderate or no animal grazing. Participants are around 450 all over the island with a vast and varied range of project. While chemical fertilizer remains the standard, we are shifting the program toward organic matter and hay. The program pays participants based on the amount and type of fertilizer applied and offers higher funding to those who use organic matter.
The program not only restores degraded land and mitigates erosion, but also fosters positive relationships with landowners while enhancing public awareness of sustainable land use and land literacy.

P88.Understanding the balance between local acceptance and societal needs for establishing possible ecological restoration scenarios: the Grand Barachois in Saint-Pierre and Miquelon

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In Saint-Pierre-et-Miquelon (French territorial collectivity), which is located about 20 km south of the Canadian province of Newfoundland, the BarachoiSPM project was initiated in 2024 to better understand why this lagoon experienced green algae blooms (*Chaetomorpha linum*) since the early 2010s. This project was motivated chiefly because, due to these blooms, several traditional human activities (e.g., angling, swimming...) have been modified or even discontinued related to the nauseating odour that develops during their decomposition in the summer. In this context, sociological surveys were conducted in order to understand the desired future of this socio-ecological system from the perspective of nearly all site users. These surveys targeted both governance institutions and lagoon users. The results reveal an apparent dichotomy between either passive evolution or the restoration of the pre-disturbance ecosystem to support ecological balance and human activities as they were. Those observations raised several questions regarding the potential application of ecological restoration methods to this ecosystem. What is the degree of acceptability of ecological restoration among local stakeholders and users? What are the relationships between public perception of the disturbances and their ecological realities? Can passive evolution be considered in this case as a "natural trajectory", given that one of the key possible causes of the algal bloom is climate change resulting from global anthropogenic disturbances? How past human activities (e.g. fisheries) has shaped the ecological trajectory of the site, which could influence the different perceptions of the current dynamic?

P89.Restoring Ecological Connectivity Between Natura 2000 Sites: A Local-Scale Framework for Identifying Restoration Priorities in Southern Italy

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The EU Nature Restoration Regulation highlights the need to restore ecological functionality not only within protected areas but also across the wider landscape. Ecological connectivity is a key component of restoration planning, particularly in fragmented territories where infras-tructure and urban development may limit ecological processes and species movements.
This contribution presents a local-scale case study from Basilicata (Southern Italy), focused on ecological connectivity between the Natura 2000 sites Monte Li Foi (SAC IT9210215) and Lago Pantano di Pignola (SPA/SAC IT9210142). Although both sites host valuable habitats and species, the intervening landscape is affected by major transport infrastructures, industrial development and scattered urbanisation.
Previous field investigations identified potential ecological corridors linking the two protected areas. Building upon these findings, new GIS-based analyses are being developed to identify restoration opportunity areas and prioritise interventions aimed at improving ecological connectivity. Habitat permeability, infrastructure barriers, ecological bottlenecks and landscape structure are assessed to support the identification of restoration priorities at local scale.
The expected outcomes include the identification of critical connectivity areas and spatially explicit restoration opportunities, such as riparian habitat enhancement, ecological stepping stones and measures to improve wildlife passage across fragmented landscapes.
This work demonstrates how local ecological knowledge and spatial analysis can support the implementation of the EU Nature Restoration Regulation and contribute to restoration planning beyond the boundaries of Natura 2000 sites.

P90.Rapid mangrove monitoring tool to support restoration efforts and detect ecosystem changes

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Mangroves, despite their global importance for climate change mitigation, are consistently threatened by sea-level rise, development, nutrient loading, and deforestation. Restoration efforts are ongoing across the globe, but there is a need for simplified and approachable methods for mangrove status assessment, using indicators that provide a holistic look at mangrove ecosystem health. Countries of the Latin American-Caribbean (LAC) region are increasing their planting and ecological restoration efforts to fill priority needs as stated by the Regional Environmental Framework Strategy (ERAM), the Central American Commission on Environment and Development (CCAD), country-specific Nationally Determined Contributions (NDCs), and regional action plans. Here, we present preliminary results from a regional effort to trial new methods for assessment of mangrove health in monitoring sites with country partners, Centro de Estudios Marinos (CEM) in Honduras, Turneffe Atoll Sustainability Association (TASA) in Belize, Foundation for Eco-development and Conservation (FUNDAECO) in Guatemala, and more. Rapid monitoring protocols (adapted from the Point Centered Quarter Method) are able to differentiate health, biodiversity, and changes between countries, highlighting separate goals and strategies for each restoration location, and providing information of subtle changes that act as warning signals to underlying issues. This project is building regional ties for collaboration, determining critical baselines to

increase restoration success, and co-developing an online tool so country partners could improve data processing time for applicability in policy and management. These methods have been trialed in 8 countries to date, each with a different data application, including restoration success, annual reporting standards, storm impact, and disturbance evaluation.

P91. From Species to Landscapes: a Plant Synanthropy Index for evaluating large-scale ecological restoration project

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Human-driven land-use change is reshaping biodiversity across Europe, altering not only species richness but also the composition and integrity of ecological communities. Yet, most biodiversity indicators remain habitat-specific or rely on discrete conservation categories, limiting our ability to assess ecological trajectories across heterogeneous landscapes. We propose the development of a continental-scale synanthropy index for European vascular plants, aimed at quantifying species affinity along gradients of anthropization. The approach combines large biodiversity databases with high-resolution anthropization maps to position species along a continuous gradient from disturbance-sensitive to human-associated taxa.
The originality of the project lies in scaling these indices from species to communities and landscape species pools. This framework makes it possible to evaluate ecological integrity across habitats and spatial scales by analysing both the species potentially present within landscapes and the communities effectively assembled locally.
Beyond biodiversity assessment, the project is designed to support ecological restoration and rewilding strategies. Community-level synanthropy indices could help identify degraded landscapes, evaluate restoration trajectories, and prioritize areas where passive or active restoration actions may most effectively restore ecological functionality.
Ultimately, this work aims to provide a simple, transferable, and operational indicator for large-scale conservation planning, biodiversity monitoring, and landscape restoration policies across Europe.

P92.Leucena.Earth: A Nationwide Citizen-Science Platform for Rapid Mapping of Invasive Leucaena Across Brazil

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Leucaena leucocephala is listed among the IUCN "100 of the World's Worst Invasive Alien Species" and is expanding faster than most monitoring programs can document, particularly across large and heterogeneous tropical landscapes. Here we present leucaena.earth, a collaborative WebGIS platform designed to mobilize citizen science for mapping this invasive tree across the entire territory of Brazil. The platform combines satellite imagery, occurrence records from multiple biodiversity databases, real-time conflict-free grid cell editing, advanced polygon drawing tools, and administrative dashboards for monitoring progress and data quality.
In less than two months after launch, the project registered 174 users, including 5 core team members and 169 collaborators. Participants mapped more than 2,000 polygons, covering over 1,500 ha of suspected or confirmed Leucaena occurrence. These data feed directly into a deep learning pipeline as training and validation samples, demonstrating that a targeted citizen-science workflow can rapidly generate invasive-species maps at scales that would be difficult to achieve by a small research team alone.
Beyond data collection, leucaena.earth is structured as a bridge between public participation, ecological monitoring, and artificial intelligence. The mapped polygons are being used to support semantic segmentation models for automated canopy detection, while the platform continues to enable nationwide collaboration, quality control, and transparent data export. This approach offers a scalable model for engaging society in the detection and management of invasive woody species in restoration landscapes.

P93.Achieving Global Standards through Urban Biodiversity Conservation & Community Stewardship

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Relational ecology is the (re)building of reciprocal relationships among biodiverse species, ecosystems, people, and place. On southern Vancouver Island (Victoria, British Columbia,Canada), the traditional territories of the lkn-speaking and WSÁNEĆ Peoples, stands Swan Lake Nature Sanctuary. Established in 1975, this urban Nature Sanctuary protects

a rare wetland and critically imperiled oak meadow ecosystem just 6km from an urban centre. This Nature Sanctuary is a Key Biodiversity Area that supports 231 bird species along the migratory Pacific Flyway and protects 33 rare species. It serves as a central, accessible urban gathering place and has sustainably advanced ecological integrity, community well-being, and long-term stewardship capacity. Through cost-effective and locally adaptive programs, diverse communities are engaged through a socio-ecological restoration model. Biodiversity conservation goals are achieved through invasive species management, native plant recovery, participatory monitoring, environmental education, and long-term, place-based stewardship. Swan Lake Nature Sanctuary is a model for how international restoration goals can be met by fostering enduring relationships between ecosystems and the local communities that care for them.

P94.Marine habitat restoration in a marine french protected area: developing a five-year operational strategy – the example of the Parc naturel marin de l'estuaire de la Gironde et de la mer des Pertuis (PNM EGMP)

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Ecological restoration is an issue that, to date, has been driven more by legislation (compensation requirements) than by voluntary action. The European Nature Restoration Regulation, adopted in July 2024, marks a tipping point by requiring the restoration of 90% of degraded terrestrial, aquatic, and marine habitats of European interest by 2050.
The PNM's engagement for habitat restoration aligns with both the objective of improving the ecological status of marine habitats listed in the MPA management plan and the goal of contributing to the implementation of the European Nature Restoration Regulation.

One of the solutions proposed is the development of a medium-term (5-year) operational strategy for the restoration of marine habitats in the Marine Nature Park, based in particular on the removal of the main sources of habitats degradation (mainly sediments, seagrass beds, and salt marshes).
This work was based on a comprehensive inventory to characterize areas subject to physical degradation in the intertidal zone: artificial development and waste accumulation. The analysis and prioritization of the acquired data, combined with technical and legal expertise, made it possible to establish the strategy's ecological and operational objectives, as well as the associated indicators and monitoring protocols to evaluate habitat evolution and effects of restoration. A methodology developed for terrestrial environments was also adapted to assess "the potential ecological gain at sea" and to define the necessary conditions-including legal ones-for ensuring the sustainability of restoration measures. These measures complement the MPA's overall management to limit other anthropogenic pressures, offering an integrated approach.

P95.The demonstration sites network: 16 years of monitoring to assess the effectiveness of hydromorphological river restoration in France

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French rivers have been largely altered by human activities. Hydromorphological restoration aims to re-establish their physical and dynamic characteristics, supporting the good ecological status required since 2000 by the European Water Framework Directive.
The increasing number of restoration projects and effectiveness studies shows overall positive effects on certain biological indicators (taxonomic richness and diversity), but ecological responses remain variable.
Since 2010, the French Biodiversity Office, the Water Agencies, INRAE and technical partners, including river managers, have developed a network of demonstration sites for hydromorphological restoration. This network includes around fifty restored sites, covering seven ambitious types of restoration: remeandering, removal of cross-cutting obstacles, modification of bed geometry, ponds bypass, return to the talweg, removal of bed and bank fixations, addition of sediments.
Within this network, standardised monitoring, known as minimum scientific monitoring, is implemented. Protocols are

defined to collect data based on BACI design over ten years on three compartments: hydromorphology (channel geometry, habitats, riparian vegetation, granulometry), physico-chemistry (pH, temperature) and hydrobiology (fish, macroinvertebrates).
An appraisal of 26 restored sites highlights the wide variability in ecological and hydromorphological responses, depending on restoration types, objectives, time since works, and local context. Works restoring the alluvial mattress or removing cross-cutting structures offer faster ecological responses, while remeandering, appears to have more lasting effects.
Long-term monitoring is highlighted for a proper assessment of restoration effectiveness. The aim is to improve practices and enable to design appropriate, ambitious and replicable projects to achieve good ecological status.

P96.A Data-Driven GIS Framework for Candidate Damaged Land Detection in South Korea: Advancing Green Restoration under GBF Target 2

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Target 2 of the Kunming-Montreal Global Biodiversity Framework commits nations to re-store at least 30% of degraded terrestrial ecosystems by 2030, yet operationalization requires prior establishment of a candidate damaged-land inventory. In South Korea, restoration planning has conventionally relied on ad-hoc, bottom-up nominations from local governments, yielding inconsistent spatial coverage and leaving substantial national territory unassessed. To address this, we developed a top-down, data-driven GIS framework using nationally available geospatial datasets.
The framework applies a six-step, sequential multi-criteria screening workflow. Step1 compares the 1980s national Land Cover Map against the 2025 Sub-classified Land Cover Map (1 m resolu-tion), extracting parcels that transitioned from ecologically significant cover (forest, grassland, wetland) into bare land or grassland with no designated ecological function. Step2 removes parcels legally committed to non-restoration uses. Step3 merges adjacent patches within 25 m-a standard road width-into single candidate units. Step4 applies the area filter as two indepen-dent cases: one candidate inventory excludes parcels below 2,500 m^2, while a separate inventory screens small-scale damaged lands of 1,000 m^2 or larger, targeting private-sector engagement in line with rising corporate interest under TNFD and ESG frameworks and amended domestic legislation enacted in 2026 to incentivize private-sector participation. Subsequent steps refine candidates through legal-use screening, land-registry filtering, and ecological value assessment. Preliminary nationwide application produced a spatially explicit candidate inventory directly applicable to Korea's 2024–2028 phased field-verification schedule. This two-case approach op-erationalizes GBF Target 2, institutionalizes private-sector participation, and lowers barriers for non-governmental engagement in ecological restoration.

P97.SeedPOD, the Seed Portal for Online Data

Teagan Hartenthaler, Royal Botanic Gardens [Kew] – United Kingdom

Ecological restoration initiatives are currently hampered by a widely acknowledged global bottleneck in native seed supply. Quantitative and qualitative analysis of this bottleneck is made difficult due to the lack of availability of high-quality, detailed data on collections of native seeds and the wild populations they derive from. In practise, restoration practitioners can struggle to find seed sources, especially sources of high-quality, genetically diverse, native seeds. Compounding these issues, means for knowledge exchange between researchers and restoration practitioners and native seed custodians is often fragmented.
To help address these issues, SeedPOD is a publicly available digitial platform to support seed-based restoration, conservation, and research communities launching this September. SeedPOD will unlock detailed field, processing, seed quantity and availability data on wild plant species throughout their global distribution range and will link related seed collections stored at multiple locations for easy identification and comparison. SeedPOD will also share germination test data, to assist the process of transforming native seed back into thriving plant communities. SeedPOD will link to complimentary resources and information sources. Significantly SeedPOD will include a point of request for seed samples from participating native seed custodians.
Native seed custodians will have in SeedPOD a user-friendly, reliable platform to disseminate their organisation details and seed list easily and for free, while researchers and restoration practitioners will be able to access high-quality data, and to identify appropriate seed sources available for use.

P98.Sea Ranger Service: A new workforce for ocean restoration

Wietse Van De Werf. Sea Ranger Service – Netherlands

The Sea Ranger Service is a mission-driven enterprise restoring marine ecosystems by deploying young professionals at sea aboard zero-emission sailing vessels and in coastal field work teams. Since 2018, 200+ Sea Rangers have been trained and deployed to deliver 35+ government and commercial contracts across six countries in Europe. In this plenary, founder Wietse van der Werf will share how the Sea Ranger Service integrates maritime operations, youth activation, ecological restoration and biodiversity financing into one working commercial model - with the ability to pay the living wage to next generation conservationists as professional restoration practitioners.

P99."Beyond Expected Utility: Integrating Ecological Perspectives into Civil Engineering Practices -Lessons from the Ground."

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Civil infrastructure is undergoing a profound transformation in the context of global environmental change, biodiversity loss, and increasing social-ecological uncertainties. Within this context, these infrastructures are increasingly recognized as components of complex social-ecological systems, where maintaining ecosystem functioning and biodiversity is essential for long-term adaptive capacity. This latter is crucial for building resilience of coupled social ecological systems across spatial, temporal, and institutional scales. While emerging paradigms (including ecosystem-based management, bioengineering, ecological engineering and nature-based solutions), seek to embed infrastructure development within ecological processes, their operationalization within the rigid constraints of the built environment remains a significant challenge. To address how this gap is being bridged, this study undertakes a qualitative meta-synthesis of infrastructure case studies to examine the empirically grounded mechanisms and dimensions underpinning the integration of ecological processes, and to assess the extent of ecological outcomes, with a specific focus on the contribution of ecological restoration principles to civil infrastructure planning and management. The findings identify three interdependent levels structuring the integration of ecological processes into civil engineering. At the conceptual level, they reveal evolving framings of biodiversity within engineering paradigms. At the operational level, they highlight required transformations in design and management practices. Finally, at the systemic level, they emphasize the role of governance, participation, and adaptive learning in enabling or constraining long-term change. Advocating such a perspective to frame civil engineering interventions and design may have long-term benefits to build resilient social ecological systems.

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