



Green Deal Projects Support Office

Restoring ecosystems under the
Green Deal Call: **Recovering
biodiversity and connecting
to nature**

*Independent
Expert
Report*



*Research and
Innovation*

Restoring ecosystems under the Green Deal Call: recovering biodiversity and connecting to nature

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Restoring ecosystems under
the Green Deal Call:
**recovering biodiversity
and connecting to nature**

Green Deal Projects Support Office

Ellie O'Hare, Beatriz Mayor

The Green Deal Projects Support Office is operated for the European Commission
– DG RTD by [Ecorys](#) and [Ricardo](#)

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About the Green Deal Projects Support Office

The Green Deal Projects Support Office has been developed to facilitate coordination between projects funded under the Horizon 2020 Green Deal Call (GDC) and maximise their positive impact in the longer term. The Green Deal Projects Support Office will operate until November 2026 and the key activities will include supporting Green Deal projects in effective collaboration,

provide networking and knowledge exchange opportunities to develop synergies, and help projects boost communication efforts of their results. The Green Deal Projects Support Office will support networking, knowledge exchange and common capacity building activities through 5 working groups:



For more information on the Green Deal Projects Support Office,
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1

Introduction

Biodiversity in Europe is in crisis, with one fifth of all species threatened with extinction¹. The main driver of this loss is ecosystem degradation and destruction, fuelled by human activity. Habitat loss through land-use change (particularly agriculture and urbanisation), over-exploitation of natural resources, climate change, and pollution, are amongst the primary impacts that we have upon nature. Biodiversity and ecosystem health are contingent upon each other and as well as being of intrinsic value, their proper functioning is fundamental to human prosperity.

People are not separate to nature and the impacts of biodiversity loss and decline in ecosystem quality and quantity spill over into our economy, our mental and physical health and our food security, to name a few. The benefits that we receive from nature, known as ecosystem services, are diminishing². There is a vast array of ecosystem services that we receive from nature, and they are divided into four categories: **provisioning**, **regulating**, **cultural**, and **supporting services**².

Provisioning services encompass the products that we harvest from nature, such as food, ingredients for medicine, water, fuel and other materials.

Regulating services are the natural ecosystem processes in place that we benefit from, such as storage of carbon, flood management, pollination, human disease regulation and climate regulation.

Cultural services are the non-material benefits that can be gained from nature, such as recreation, sports, mental health support, aesthetic appeal, spirituality, tourism and education. Whilst not material, these often contribute generously to the local economy and general human well-being. As these services are less tangible, their value varies geographically and depends on local perceptions and culture.

Supporting[†] services provide the foundation for all other ecosystem services and include activities such as nutrient cycling, production of atmospheric oxygen, soil formation and water cycling. These services occur over a long timeframe and their disruption carries over to all other services.

Due to the complex nature of ecosystems and relationships between different species, biodiversity is essential to the proper functioning of ecosystem services and therefore a decline in biodiversity threatens human life and wellbeing.

Ecosystem restoration is the act of human intervention to aid the recovery of degraded or destroyed ecosystems to return to an improved state³. It can also include the preservation of restored or at-risk ecosystems. The ultimate goal is to allow biodiversity to regenerate and to resume the proper functioning of ecosystem services. At present, there is no universal methodology for ecosystem restoration, although there are shared principles that should underlie all initiatives that have been adopted

¹ Axel Hochkirch et al., "A Multi-Taxon Analysis of European Red Lists Reveals Major Threats to Biodiversity", PLOS ONE, volume 18, issue 11, 2023

² Millennium Ecosystem Assessment, "Ecosystems and Human Well-Being – A Framework for Assessment", 2003

³ European Council, "Nature Restoration", November 2023

[†] Under some frameworks (e.g. CICES), supporting services are not considered a standalone service and are instead recognised as foundational processes behind the other three ecosystem services.

by the [UN Decade on Ecosystem Restoration](#)⁴. For example, restoration should be site-specific and take into account local ecological, cultural and scientific needs, and have considerable engagement with local communities and other stakeholders. For restoration to be successful and long-term, ecological needs should be balanced with the needs of those close to it. Due to the vast diversity of ecosystems and

ecosystem conditions across Europe, even those of the same category (terrestrial, freshwater, coastal or marine) may have different needs and sensitivities. However, research and demonstration of how existing successful solutions can be scaled up to cover a larger area and how best practices can be integrated into the governance and policy landscape will help Europe's restoration needs to be met.



Figure 1: Principles of ecosystem restoration adapted from the UN Decade of Restoration⁴

⁴ FAO, "Principles for ecosystem restoration to guide the United Nations Decade 2021-2030", 2021

Ninety-six percent of Europeans believe it is our responsibility to look after nature and this is reflected in the EU's dedication to restoring ecosystems and reversing biodiversity loss through policy implementation and the provision of funding⁵. Over the past few decades, the EU has introduced legislation that has increasingly focused on the protection and restoration of nature, culminating in the [Nature Restoration Law](#), which was agreed by the European Parliament in February 2024 and adopted by the European Council in June 2024. On top of this, the EU Horizon 2020 funding programme has funded the European Green Deal Call, and through this has invested in research and innovation projects

that are driving transformative change towards a sustainable future.

Four projects that focus on restoring biodiversity and ecosystem services have been awarded a total of EUR 82.1 million⁶. These Green Deal Call-funded projects will develop and demonstrate methodologies for large-scale restoration of European ecosystems and their biodiversity and contribute towards establishing a more secure future for Europe. The four projects started in the autumn of 2021 and will run until either the end of 2025 or the end of 2026 (depending on the project duration), when key results and outcomes will be readily available, for uptake and further upscaling of restoration efforts.



MERLIN (Mainstreaming Ecological Restoration of freshwater-related ecosystems in a Landscape context: INnovation, upscaling and transformation) focuses on

restoring freshwater ecosystems such as wetlands, streams and transboundary rivers. Methodologies will be produced to extend the reach of the project, transforming industries with close ties to freshwater by encouraging them to integrate restoration into their normal activities.



REST-COAST (Large scale RESToration of COASTal ecosystems through rivers to sea connectivity) targets

the restoration of coastal areas, covering the connection between rivers and the sea. Through their active restoration of sites and development of financial models, they will demonstrate how European coasts can be restored to maximise the benefits of carbon storage, disaster-risk mitigation and biodiversity.



SUPERB (Systemic solutions for upscaling of urgent ecosystem restoration for forest related biodiversity and ecosystem services) aims to restore forest ecosystems and will

be exemplary in how this can be achieved at their demonstration sites. Through the development of a strong network of stakeholders, their vision for transformative restoration can be upscaled across European forests and further afield.



WaterLANDS (Water-based solutions for carbon storage, people and wilderness) aims to restore wetland sites across

Europe and lay the foundations for scalable protection across much wider areas. The project is co-creating more effective restoration which captures ecological, social, governance and financial aspects, to connect habitats and communities across Europe, ensuring both thrive for generations to come.

⁵ European Union, "Attitudes of Europeans towards Biodiversity", May 2019

⁶ European Commission, "A deep dive into the European Green Deal Research and Innovation Call", October 2021

Together, the four Green Deal Call-funded projects form a cluster, where they closely collaborate on joint work related to biodiversity restoration. They have recently hosted a webinar on the topic of “[Ecosystem Restoration on a landscape level: how can it work in practice?](#)” and in August 2024 they will host a joint session at the 14th European Conference on Ecological Restoration,

in Tartu Estonia, on the topic of “[Strategies for restoring at landscape scale](#)”. The cluster is liaising with national and regional authorities and other EU-funded projects, particularly at the projects’ demonstration sites, some of which are shared. They are also working in collaboration with other EU funding programmes such as [LIFE](#) and [INTERREG](#).

KEY TERMS	
Biodiversity	The variety of living species within a defined area
Ecosystem	The dynamic relationship of species of plant, animal, fungi and other types of organism, their communities and their non-living geographical environment, interacting as a functional unit ⁷
Habitat	An area in which organisms live, defined by its physical features and by the type of species present ⁸
Ecosystem services	The benefits that ecosystems can impart to human well-being, in terms of provisioning services, regulating services and cultural services
Ecosystem restoration	Human intervention to aid the recovery of degraded or destroyed ecosystems to an improved state

Table 1: Key terms for ecosystem restoration

⁷ Adapted from Convention on Biological Diversity, “Article 2. Use of Terms”, February 2006

⁸ Adapted from European Environment Agency, “European Nature Information System (EUNIS)”, April 2019

2

Policy landscape

Since the 1970s, the EU has been legislating for the protection of nature. The [Birds Directive](#) (BD) was first established in 1979 (and updated in 2009) with the aim of preserving, maintaining or re-establishing populations of selected wild bird species and their habitats. Member States were directed to identify Special Protection Areas (SPAs) and implement measures to ensure their protection. Thirteen years later in 1992, the complementary [Habitats Directive](#) (HD) was put in place, outlining similar protections for wild flora and fauna and their habitats. Comparable to SPAs, Special Areas of Conservation (SACs) were drawn up and together, an ecological network of over 27 800 sites called [Natura 2000](#) was formed. As an ongoing process, sites continue to be created and expanded upon. These two

Directives are known collectively as the Nature Directives and since their adoption, several further directives have been mandated that involve the protection of European biodiversity and ecosystems (see Figure 2).

These important directives laid the groundwork for the EU's commitment to protecting its biodiversity, however, their objective of conserving European biodiversity at an acceptable level has not yet been achieved. As of 2020, 81% of habitats and 63% of species covered by the HD are in an unfavourable (poor or bad) condition⁹. Whilst the HD directs Member States to take steps to maintain a "favourable conservation status" (see Table 2) for included habitats and species, there were no defined targets or timelines.

FAVOURABLE CONSERVATION STATUS AS PER THE HABITATS DIRECTIVE

HABITAT	SPECIES
<p>For a habitat to be of a favourable conservation status it should:</p> <ul style="list-style-type: none"> • Be stable or increasing in its natural range. • Contain the structures and functions necessary for the habitat to be maintained long-term, with the likelihood they will remain into the foreseeable future. • Maintain the conservation status of its typical species as "favourable". 	<p>For a species to be of a favourable conservation status it should:</p> <ul style="list-style-type: none"> • Be able to maintain itself as a viable component of its natural habitat, on a long-term basis, as measured by population-dynamics data. • Not be experiencing a reduction in its natural range, nor is this likely to occur in the foreseeable future. • Have a sufficiently large habitat to maintain its population on a long-term basis.

Table 2: Favourable Conservation Status definition as per the Habitats Directive

⁹ European Environment Agency, "State of Nature in the EU – Results from reporting under the nature directives 2013-2018", October 2020

Common Fisheries Policy

1970

A set of rules for sustainably managing European fishing fleets and conserving fish stocks



European Green Deal

2019

The plan to sustainably transform the EU's economy and society with the overall goal of being climate-neutral by 2050, including through preserving and restoring ecosystems and biodiversity. It highlights the importance of halting biodiversity loss and outlines how current and future policy will contribute to this



Common Agricultural Policy

1962

A partnership between EU agriculture and society to ensure a stable supply of affordable food, safeguard income for farmers and keep rural areas vibrant



A Farm to Fork Strategy

2020

An initiative towards a sustainable transition that makes food systems fair, healthy and environmentally-friendly



Biodiversity Strategy for 2030

2020

A comprehensive, ambitious and long-term plan to protect nature and reverse the degradation of ecosystems



New Forest Strategy for 2030

2021

A vision and concrete actions to improve the quantity and quality of EU forests and strengthen their protection, restoration and resilience



Nature Restoration Law

2024

Binding targets to restore degraded ecosystems, in particular those with the most potential to capture and store carbon and to prevent and reduce the impact of natural disasters



Invasive Alien Species Regulation

2014

Restrictions on keeping, importing, selling, breeding and growing invasive species and/or releasing them into the environment



Habitats Directive

1992

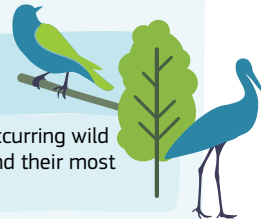
Protections for over a thousand species, including mammals, reptiles, amphibians, fish invertebrates, and plants, and 230 characteristic habitat types



Birds Directive

1976

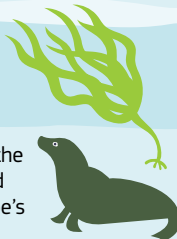
The protection of all naturally occurring wild bird species present in the EU and their most important habitats



Water Framework Directive

2000

Rules to halt deterioration in the status of EU water bodies and achieve good status for Europe's rivers, lakes and groundwater



Marine Strategy Framework Directive

2008

The protection of the marine ecosystem and biodiversity upon which our health and marine-related economic and social activities depend

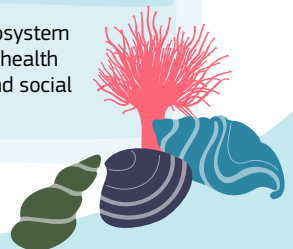


Figure 2: An overview of the main EU policy and regulatory framework involving the protection or restoration of biodiversity

Under the BD, 49% of species have a poor or bad conservation status. Whilst slightly less severe than the condition of species protected under the HD, it is still not sufficient and as is the case with the HD, no explicit targets or timelines were set.

To tackle the urgent problem of ecosystem degradation and biodiversity loss, the EU published its vision for protecting nature and restoring damaged habitats in the [Biodiversity Strategy 2030](#) (BDS 2030) under the umbrella of the [European Green Deal](#). The BDS 2030 builds upon and surpasses the ambitions of the Nature Directives, with an emphasis on restoration as the solution to bring European ecosystems into a healthy state.

The BDS 2030 lays out the EU's ambitions for restoring nature within its borders and how this should be underway by 2030. It presents a robust case for ensuring ecosystems are recovered to a healthy status, highlighting the benefits that would be brought to society in terms of climate change resilience, natural disaster resilience, food security and disease prevention. The scope of the BDS 2030 is far-reaching, but there is an emphasis on how the following approaches will be pivotal to achieving its goals:

- Expanding and strengthening protected areas in Europe, particularly the Natura 2000 network, by protecting at least 30% of land and sea by 2030.
- Introducing a Nature Restoration Law, which will legally commit Member States to binding targets to restore degraded ecosystems, in particular those with the most potential to capture and store carbon and to prevent and reduce the impact of natural disasters.
- Improving the overall governance that surrounds biodiversity protection and restoration, including its monitoring, financing, and understanding through research and education.

- Reaching beyond the borders of the EU by encouraging a global agenda to confront the on-going ecological crisis.

In terms of nature protection and restoration, the BDS 2030 identifies five focus areas in which it is crucial to target restoration: agriculture; soils; forest ecosystems, particularly primary and old-growth; marine and freshwater ecosystems; and urban areas. It sets defined targets, such as planting three billion new trees and restoring 25 000 km of Europe's rivers to being free-flowing by 2030. Overall, the BDS 2030 aims to set the recovery of Europe's ecosystems in motion, which will benefit people, the planet, the climate, and the economy.

However, the BDS 2030 is not legally binding and needs strong legislation to support its goals if they are to become a reality. A headline target of the strategy is the EU Nature Restoration Law. The European Commission adopted the proposal for the [Nature Restoration Law](#) (NRL) in June 2022 and the European Parliament [adopted its position](#) on the proposed regulation in February 2024, after over one year of deliberation. In June 2024, the Regulation was approved by the Council of the European Union. The text will enter into force 20 days after its publication in the EU Official Journal.

The primary aim of the NRL is to bring Europe's degraded ecosystems into a biodiverse and resilient state, through the obligatory implementation of restoration measures. At least 20% of land and sea ecosystems in need of restoration must be covered by restoration measures by 2030, which is expanded to cover all degraded or vulnerable ecosystems by 2050. Member States will prepare a National Restoration Plan, which will comprehensively detail their planned restoration measures. The Plans will be a road map for a Member State's ecosystem restoration actions until 2050 and should be backed by contemporary scientific knowledge.

The NRL includes an inventory of habitat types that are found in Europe's terrestrial, coastal, freshwater and marine ecosystems (see Table 3). The Regulation calls on Member States to assess the condition of these habitat types. For habitat types found in terrestrial, coastal and freshwater ecosystems, the current condition of 90% of the total area that the habitat types cover must be assessed by 2030, with 100% completion by 2040. For habitat types that are not in a good condition, restoration measures must be put in place that will facilitate their recovery to a good condition within a specified timeline, with enhanced connectivity between fragmented habitats and the needs of species protected by the HD and BD being met. Once in a good condition, this condition must be maintained.

For terrestrial, coastal and freshwater ecosystems, the following extent of the restoration measures and their timelines apply:

- Restoration measures in place on 30% of the total area of all habitat types that are not in a good condition by 2030;

- Restoration measures in place on 60% of the total area of each group[†] of habitat types that is not in good condition by 2040.
- Restoration measures in place on 90% of the total area of each group[†] of habitat types that is not in good condition by 2050.

Priority is given to the restoration of Natura 2000 sites until 2030, but the overall requirements outlined in the NRL apply to the total area of habitat types that are not in a good condition. Habitat types that fall within marine ecosystems are subject to similar regulatory requirements and timelines within the NRL, though with slightly extended deadlines to complete habitat type condition assessments and, for some habitat types (those in Annex II, Group 7), longer deadlines to comply with restoration measure requirements.

Moreover, the NRL goes beyond the restoration of degraded habitats by requiring the re-establishment of habitat type area that has been completely eradicated, so that the surface area of each habitat type is of a favourable size.

EXAMPLE HABITAT TYPES AS PER THE NATURE RESTORATION LAW

TERRESTRIAL	FRESHWATER	COASTAL	MARINE
Mountain hay meadows	Blanket Bog	Estuaries	Seagrass beds on Atlantic littoral sand
Eastern white oak woods	Fennoscandian natural rivers	Coastal lagoons	Bivalve reefs in the Atlantic littoral zone
Alpine and Boreal heaths	Mediterranean temporary ponds	Embryonic shifting dunes	Black Sea littoral mud*

Table 3: Example of habitat types as per Annex I and Annex II of the Nature Restoration Law (* - Annex II, Group 7 marine habitat with alternative targets and timelines)

[†] Individual habitat types are classified into related groups in Annexes I and II of the NRL

As well as area-defined goals related to habitat types, the NRL makes use of indicators to monitor and evaluate progress of compliance with the law. For example, in forest ecosystems, restoration indicators include forest connectivity, tree species diversity and the share of forests dominated by native tree species. In agricultural areas, the indicators used are the Grassland Butterfly Index,[†] the stock of organic carbon in the soil, and the share of agricultural land with high-diversity landscape features. For measurable indicators such as these, the NRL mandates that an improving trend must be seen. Other coverage-based indicators are also used, for example, drained peatlands should have measures in place that will promote their rewetting (returning water levels to their natural near-surface state), culminating in at least 50% coverage by 2050.

The NRL goes beyond previous legislation with its strong focus on the restoration of nature, rather than its conservation, which reflects the urgent need to actively revive European ecosystems. It links the co-benefits of restoring resilient ecosystems to other EU goals of climate change mitigation and adaptation and preventing land quality degradation. There are also protective objectives for urban green spaces, goals to reverse the decline in pollinator species and a general encouragement of increased connection between agriculture and nature. It also legally adopts some of the targets that were set out in the BDS 2030, such as the commitment to re-establishing 25 000 km of free-flowing rivers. With clear goals to be achieved by the end of each decade up to 2050 and its breadth of coverage, the adoption of this law sets Europe on the path to be a world-leader in confronting the impact of human activity on biodiversity and ecosystems.

[†] *The Grassland Butterfly Index monitors annual changes in the population abundance of 15 grassland butterfly species at EU level as an indicator of overall ecosystem health.*

3

How Green Deal Call-funded projects contribute to the targets of the Nature Restoration Law

Policy support

The Biodiversity Strategy 2030 (BDS 2030) and the Nature Restoration Law (NRL) have a strong focus on restoration as a key principle to confront Europe's nature crisis. The four Green Deal Call-funded (GDC) projects working on these topics (MERLIN, REST-COAST, SUPERB and WaterLANDS) have provided expert insight and support to the development and implementation of the NRL, including through the preparation of policy briefs relevant to their focus ecosystems. The briefs make the case for the restoration of their target ecosystems, explaining key terms and methodologies, and presenting ways in which best practice restoration can be achieved. For example, in a [policy brief](#) produced by WaterLANDS, peatland rewetting and the related restoration goals set in the NRL were explored. It argues why restoration of Europe's peatland is essential in the fight against climate change and makes the case for increasing the scope of peatland

restoration targets in the NRL. SUPERB released a [policy brief](#) that made four recommendations to the design of the NRL, in the context of large-scale forest restoration. REST-COAST joined forces with projects external to the GDC to publish a [policy brief](#) related to increasing the resilience of European coastal areas, including through coastal restoration.

The four GDC-funded projects also collaborated on a [joint policy brief](#) (published November 2022) to provide overall commentary and advice related to specific articles of the NRL. This joint policy brief suggested amendments and additions that could be made to the NRL to strengthen its ability to legislate on successful ecosystem restoration. For example, the projects proposed that Nature-based Solutions (NbS) should receive more emphasis in the NRL due to the additional benefits of NbS for society, alongside the restoration of nature.

Nature-based Solutions (NbS) are solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions.¹⁰

¹⁰ European Commission, "Nature-based solutions"

It is important to ensure that the legislation captures these benefits and that the messaging of the NRL reflects their potential. The policy brief also touched upon increasing the ambitions of targets related to specific ecosystems and expanding the range of indicators to make them more applicable to the landscape as a whole. For example, in terms of targets, it states that the target of restoring 25 000 km of rivers to being free flowing by 2030 is insufficient as this covers only 2% of EU rivers. Regarding forest ecosystem indicators, the tree species diversity indicator should focus more on functional diversity and the ability of species to contribute to ecosystem services.

With regards to the NRL as a whole, the coordinators of the four GDC-funded projects additionally contributed to a policy forum article that was published in the *Science* journal¹¹. The article reviewed the NRL and its potential to achieve its own goals, within the context of previous directives related to ecosystem and biodiversity conservation. The authors highlight the advantage of the NRL being an EU regulation, as opposed to previous nature-focused legislations, which were EU directives. Regulations do not require transposition into the law of each EU Member State, as must be done for directives, and come into force shortly after being passed. This allows for faster action, which is imperative for rescuing Europe's ecosystems given the urgency of the task. The potential of the NRL to reinforce the implementation of previous directives is also discussed, due to complementary and overlapping policies and target areas. The authors support the integration of time-defined and quantifiable restoration obligations into the law, which were not well-established in previous directives. The use of

measurable restoration indicators, such as the [Grassland Butterfly Index](#), will make it easier to monitor the progress of the law and therefore increases its enforceability. Using established indicators has the additional benefit of avoiding time spent on developing novel indicators.

Nonetheless, despite its ambitions and legislative power, there are hurdles that must be recognised, and effort is needed to overcome them. The authors underline that funding has historically been a significant barrier to policy success. It has been estimated that restoring 30% of Habitat Directive habitats by 2030 will cost approximately EUR 8.2 billion annually¹². Whilst the NRL does commit to providing dedicated EU funding to help implement the regulation, financing gaps remain that will need to be filled by other sources of private and public investment. The authors of the policy forum note that these income streams will need to be assembled both at a Member State and EU level, and that funding from other EU initiatives could potentially be streamlined to reach the NRL goals.

Research and demonstration of large-scale restoration

Many of Europe's ecosystems are in a degraded state, or even declining further, and large-scale restoration is essential to reverse the damage of the past and present and to improve biodiversity. The Green Deal Call (GDC) is providing funding for four projects in Europe that explore and demonstrate large-scale restorative solutions: MERLIN; WaterLANDS; SUPERB;



¹¹ Daniel Hering et al., "Securing success for the Nature Restoration Law", *Science*, volume 382, issue 6676, December 2023

¹² Institute for European Environmental Policy, "How much will the implementation of the Nature Restoration Law cost and how much funding is available?", December 2022

and REST-COAST. The projects target a variety of different ecosystems, habitat types and species, whilst sharing common restoration themes and activities.

The EU provides financial support to a large number of projects focused on ecosystem restoration via various means. For example, the GDC is funded through the Horizon 2020 research and innovation funding programme, and other programmes exist such as the LIFE programme. However, a gap remains, and external public and private investment is essential for ecosystem restoration to succeed. The activities of the four GDC-funded projects include the development of models and advice for the sustainable financing of restoration in their focus ecosystems. Restoration provides a great opportunity for investment and the projects work to emphasise and promote the financial returns that can be made from investing in contemporary nature and restoration markets. For every EUR 1 invested in nature, EUR 4-38 can be returned in terms of benefits to society and the economy, and both public and private actors can have a stake in its good condition¹³.

As previously mentioned, Nature-based Solutions (NbS) can play a pivotal role in ecosystem restoration and are a theme within the Nature Restoration Law. The GDC-funded projects explore NbS at their demonstration sites, tailored to each environment and considering local needs and challenges.

In all four projects, engagement with local communities and other stakeholders is placed at the centre of restoration. Alongside scientific knowledge and design, restoration requires collaboration on many levels to be successful. From on the ground support and approval from local communities, to financial and legal support from local authorities, private organisations and

NGOs, restoration needs to bring different values and viewpoints together. The projects form links between various actors and involve them in decision-making, co-design, planning and action to forge connections to nature and biodiversity, highlighting its importance and giving restoration the best chance of success.

Finally, the vision for restoration does not stop with the action undertaken by the projects. Upscaling restoration and expanding their reach outside the boundaries of the projects is important. The aims and goals of the projects have future planning woven into their design. Methodologies and practical examples are being developed by the projects and will be available as best-practice models for large-scale restoration. Degraded ecosystems across Europe can have restoration implemented in a similar way and incorporate lessons that have been learnt throughout the GDC project process.

The ambitions and individual targets of the projects are explored in more detail in the following sections.

MERLIN - Mainstreaming Ecological Restoration of freshwater-related ecosystems in a Landscape context: INnovation, upscaling and transformation

Europe's freshwaters are suffering, with 60% of surface waters not having a good ecological status¹⁴. The MERLIN project proposes innovative NbS that can be used to restore Europe's freshwater ecosystems. For NbS to be successful, different stakeholders need to work together. MERLIN unites research institutions, businesses, nature conservation organisations and governments under the common goal of restoring freshwater ecosystems, with society and local communities at the heart of actions. Across 18 demonstration sites, MERLIN is actively

¹³ European Commission, "Nature restoration law"

¹⁴ A. Bérczi-Siket et. al., "Deliverable D4.1: Mainstreaming aquatic restoration using Nature-based Solutions", 2023



© MERLIN

demonstrating the potential of NbS to transform freshwater ecosystems towards a sustainable future, highlighting the benefits to the economy and society.

MERLIN's goals for NbS implementation extend outside the demonstration sites. The project team strives to make implementing NbS the norm in six key sectors that rely on freshwater: agriculture; hydropower; insurance; navigation; peat extraction; and water supply. Through collaboration and engagement, MERLIN promotes how these sectors can invest in NbS to incorporate them into their business strategies, bringing NbS into the mainstream. Specific benefits vary across each sector, but are based on the overall notion that nature can be restored and integrated to work with the economic activities of stakeholders, providing ecosystem services that lead to growth that is in harmony with nature.

REST-COAST - Large scale RESToration of COASTal ecosystems through rivers to sea connectivity

European coastal regions are extensive and diverse, from the North Sea to the Baltic. Carrying a rich cultural and historical significance to the people that inhabit them, they have sustained human populations for centuries as a vital source of ecosystem services. They host a wide range of habitats and wildlife, forming complex ecosystems such as coastal marshland, seabed meadows and coastal dunes. In a modern world dealing with the climate crisis, coastal ecosystems are sensitive to its effects, which along with other anthropogenic pressures, leads to their degradation. REST-COAST

aims to solve the challenges faced by coastal ecosystems through targeted restoration in nine demonstration sites. Restoration requires co-operation and collaboration with local inhabitants, and wider groups of citizens, policymakers and businesses. REST-COAST's strategies include engagement with these stakeholders to maximise success. The project will design a coastal restoration approach that is transferable and scalable. In creating a blueprint that can support future governance and policymaking, REST-COAST sets Europe's coastal ecosystems on a pathway to a healthier future. Through the work demonstrated by REST-COAST, coastal ecosystem services will be restored, leading to a gain in biodiversity and increasing their ability to store carbon, mitigate against flood risk and erosion, and provide food to communities.

SUPERB - Systemic solutions for upscaling of urgent ecosystem restoration for forest related biodiversity and ecosystem services

Forests are emblematic of European nature and are found all across the continent. They are of huge cultural importance, having been a source of food, shelter and traditional folk tales throughout the course of history. These are just a few of the ecosystem services provided to us by forests. In a more critical context, forests store carbon in their vegetation and soil, mitigating the impact of climate change. However, with changes in land use and the increasing impacts of climate change, there is a need for silvicultural interventions to prevent Europe's forests from falling into a poor state. The biodiversity loss seen in European forests is also a significant indicator of low ecosystem health. SUPERB aims to change the trajectory of European forests through demonstrating best practices for forest restoration at 12 demonstration sites. Bringing together knowledge from previous restoration activities with experts in the field, and channelling input from local communities and landowners, SUPERB

is setting an example of long-term restorative change. SUPERB also sets its sights beyond its demonstration sites and aims to upscale restoration. Throughout its lifetime, the project is uniting stakeholders that are close to forest

Silviculture is a form of holistic management where forests and woodlands as a whole are composed and nurtured to meet specific needs and values.

landscapes across Europe to form a network of actors that have the tools to influence forestry restoration and decision-making into the future.

WaterLANDS - Water-based solutions for carbon storage, people and wilderness

Wetlands are an integral part of the European landscape providing many essential ecosystem services. They are a natural store of carbon (which supports climate change mitigation); they provide clean drinking water; and they buffer the impact of floods and storms, to name but a few. However,



Figure 3: Map created by the GDC ecosystem restoration cluster, displaying demonstration sites only.

when wetlands are degraded, these essential ecosystem services are lost. Human activity has put wetlands in Europe under threat and their degradation comes at a great cost to society and the economy. WaterLANDS aims to tackle this issue through restoring freshwater and coastal wetland sites and developing a framework for best practice to facilitate the upscaling of wetland restoration. Returning wetlands to their former state reverses the damage caused and allows them to function naturally once more. WaterLANDS' work includes the identification of 15 "knowledge sites", which are examples of successful restoration, be this in terms of public engagement, supportive governance mechanisms, successful financial incentivisation, or physical restoration of habitats

and ecosystem services. Lessons learned from the knowledge sites are applied at six "action sites", where hands-on restoration is being conducted. The knowledge sites act as sources of inspiration, strategy and learning for similar action sites, which in turn will function as best practice examples for upscaling restoration beyond the project. WaterLANDS ensures that communities local to the wetlands are connected to the restoration projects through citizen science and co-design. This ensures that local needs are met and that the restoration has a higher chance of success with long-term community engagement.

The four projects have worked to [create a map](#) that displays the location of all of their demonstration sites and of their partner institutions (see Figure 3).

4

Demonstration site spotlight cases

Overview

The four Green Deal Call-funded (GDC) projects target a variety of ecosystems. Not only do they demonstrate the potential of large-scale ecosystem restoration, they also research and develop best practice methodologies, so that restoration can be upscaled in Europe and beyond. Together, these projects conduct hands-on restoration in 23 European countries at their demonstration sites. To give context to the large-scale restoration work that is being conducted by the GDC-funded projects, a spotlight case is presented in this report on one demonstration site from each project.

MERLIN

Demonstration site spotlight case – Beaver re-introduction, Sweden

Beavers are semiaquatic rodents that inhabit waterways and wetlands. With their strong front teeth that have evolved to cut through wood and thick vegetation, they shape the water landscape by creating dams. Dams are built along rivers and streams to impede the natural flow of water, which in turn creates ponds and wetlands in the local area. Beavers use vegetation, rocks and mud in this way to provide themselves with shelter and food. Not only does their environmental engineering benefit themselves, but they also create habitats for bountiful species. In terms of ecosystem services to humans, the wetlands they create can help with flood risk mitigation,

water purification and can act as a carbon store to reduce the effects of climate change. They also provide cultural ecosystem services such as tourism and recreation opportunities. However, as with all ecosystems there are complex relationships to consider and a poorly placed beaver dam can cause harm to other ecosystem services. In certain areas, dams cause flooding which can damage soil, agricultural land and forest plants, all of which carry financial and ecological implications. Therefore, beaver populations and their activities are often managed, limiting the damages but also the potential benefits.

In Sweden, the native beaver was forced into extinction due to human activities over a century ago. Through a concerted reintroduction effort, population levels have increased to approximately 200 000. MERLIN aims to demonstrate the effects of beaver re-introduction at demonstration sites in the Vindelälven catchment in northern Sweden and the Grannebyån catchment in southern Sweden. The purpose of this specific reintroduction is to take advantage of the beavers' natural engineering behaviour to restore the degraded wetlands to their pre-industrial condition,



Figure 4: Eurasian beaver (*Castor fiber*).¹⁵

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¹⁵ MERLIN, "Fact sheet #3", June 2022

returning ecosystem services to local human populations and rebuilding biodiversity in the area. The demonstration is one piece of a puzzle in the overall goal of restoring Sweden's wetlands and buffer zones to a healthy and functional state by 2050, in keeping with the European Green Deal and Nature Restoration Law. Since the re-introduction of beavers to Sweden, landowners typically remove beaver dams that appear on their property, as permitted by law. In MERLIN's demonstration, the beavers will be given free rein to engineer without human dam management, making this demonstration a truly Nature-based Solution. Whilst this carries a risk of potential negative impacts on some ecosystem services, there are multiple potential benefits to be reaped, including enhancing the knowledge base of the impact of beaver engineered environments, which is currently under-researched. Through studying the impacts of beaver engineering at the demonstration sites and the trade-offs between different ecosystem services, MERLIN will provide evidence for informed decision-making by landowners. Whilst beavers themselves are no longer endangered in Sweden, their restoration of the native land is expected to increase biodiversity, with a particular emphasis on endangered bird species.

Actions and impacts achieved

MERLIN is investigating and answering important questions related to the effects of beaver reintroduction and unmanaged engineering on river and wetland landscapes:

- What effect does beaver engineering have on freshwater ecosystems?
- What potential downsides should land-owners be aware of and how can these be mitigated?
- Does the beaver-transformed landscape contribute to increased biodiversity, flood protection or drought mitigation?
- Are any other European Green Deal goals (under [transforming the EU's economy for a sustainable future](#)) supported by this passive way of restoring freshwater ecosystems through beaver engineering?

As part of its investigations, MERLIN is building and removing its own artificial beaver dams to further study the effect that beaver dams have on the surrounding ecosystem in interrupting river continuity. These are different to traditional dams made by humans because beaver dams allow for much more water to pass through and do not completely stop the flow of water.

Involvement of local stakeholders is of utmost importance. Therefore, MERLIN has co-ordinated campaigns to reach out to stakeholders and local land-owners, to provide information about the beaver activities and the potential benefits their activity brings for nature and society.

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Figure 5: Beaver dam at the demonstration site in Sweden



Figure 6: Cantabrian brown bear
(*Ursus arctos arctos*)

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There is an urgent need to restore the bear's habitat to a healthy condition, to give the Cantabrian brown bear the best chance at survival. SUPERB aims to restore forests to protect the bear at its demonstration site in Castille and Leon, northwestern Spain, in an area of over 250 000 hectares of forest land.

The project has developed a restoration plan that includes measures

to improve the habitat of the brown bear, such as planting selected native species that are suitable as food for the bear, for example those that produce acorns, and the creation of mixed-species forests. Forestry activities, known as silviculture, will also be carried out to reduce forest fuel (comprised of organic matter) and decrease the risk of fires.

For restoration to be best practice, a holistic approach will be taken that includes benefits to local communities. Chestnut plantations will be created in nearby rural communities to optimise the income stream of the local economy and encourage a connection to the forest.

Actions and impacts achieved

In order to assess and monitor the state of biodiversity at the Castille and Leon demonstration site, several techniques are being implemented. Soil sampling, sampling of flying arthropods, forest inventory (which can include species type and number, along with metrics of individual trees), remote sensing (using non-contact data collection technologies such as satellites or drones), and bioacoustic monitoring of bats and bird species

SUPERB

Demonstration site spotlight case – Brown bear habitat restoration, Spain

Spain is home to a population of Eurasian brown bear (*Ursus arctos arctos*, which is a subspecies of brown bear), known as the Cantabrian brown bear. Whilst the subspecies in general is not at risk due to its high numbers in Eastern Europe, the Cantabrian brown bear population is considered to be endangered due to its isolation from other populations of Eurasian brown bear¹⁶. The brown bear species (*Ursus arctos*) is included in the Habitats Directive as an animal of community interest whose conservation requires the designation of Special Areas of Conservation (SAC). Within Spain, the Cantabrian brown bear's natural habitat area is fragmented and partly degraded. Forest fires are the primary threat to the bears, with motorway construction, lack of forest management, and climate change having also contributed to habitat loss. Lack of good quality habitat leaves the Cantabrian brown bear population in a vulnerable position as the bears require a large area to live and a network of connecting corridors between habitats for breeding to guarantee a sufficient genetic diversity.

¹⁶ Agencia Estatal Boletín Oficial del Estado, "Real Decreto 139/2011, de 4 de febrero, para el desarrollo del Listado de Especies Silvestres en Régimen de Protección Especial y del Catálogo Español de Especies Amenazadas", 2011



Figure 7: Planned area for chestnut plantation

© SUPERB

are all being used. The data that is collected is analysed by SUPERB to better understand and monitor the site's condition.

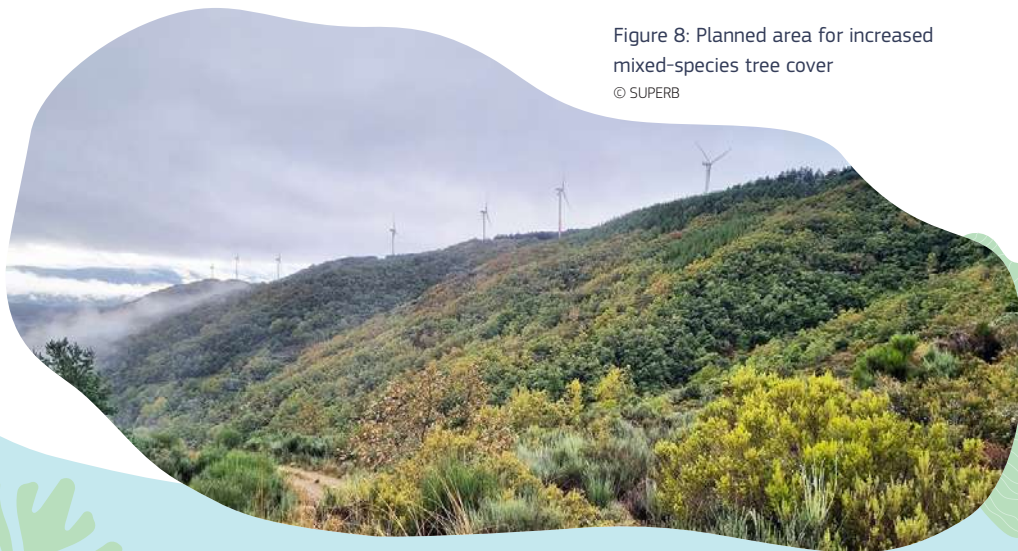
An assessment of how local stakeholders use the forest and their perception of the benefits of ecosystem services was undertaken to ensure that restoration is designed with the preferences of local communities in mind. This work will be continued in 2024, with surveying of societal demands regarding forests and forest restoration in three locations close to the demonstration site. Similarly, as a means to involve stakeholders in the restoration activities, two stakeholder engagement workshops have also been carried out. These workshops help to incorporate local stakeholders' views into the restoration actions and the upscaling plan.

In February 2024, the restoration plan for an area of 138 hectares within the Castille and Leon demonstration site was sent to tender. The plan contains the following actions to be carried out:

- Creation of chestnut plantations to revitalise rural areas.
- Addition of selected native plants species as a suitable food source for the Cantabrian bear.
- Planting of tree species to increase cover, which will improve natural ecological corridors between habitats and act as a shelter for the bears.
- Clearing of plant litter from the forest floor, to reduce the risk and limit the spread of forest fires by reducing the fuel available.
- Silvicultural treatments to reduce tree density and enhance acorn production for bear feeding.

Figure 8: Planned area for increased mixed-species tree cover

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REST-COAST

Demonstration site spotlight case – Enhancing coastal resilience to a changing climate, Wadden Sea, the Netherlands/Germany

The Wadden Sea is an intertidal zone off the shared coastline of the Netherlands, Germany and Denmark (see Figure 9). It is a UNESCO World Heritage site, which reflects its rich cultural and ecological value. Between its waters and the land, there are a multitude of habitat types to be found, including the largest unbroken system of intertidal sand and mud flats in the world. Thanks to the wildlife that is sustained by these habitats, the Wadden Sea is a global hotspot for biodiversity. Up to 12 million migratory birds visit each year and it is home to other species, such as the grey seal, oystercatchers and various endangered fish species. Many natural processes continue to take place in the area, such as sand dune formation and migration, salt marsh formation and sediment dynamics. However, anthropogenic activities and the associated impacts of climate change are disrupting the area's natural balance. Extreme weather events and rising sea levels create unfavourable conditions for plant species and force animals to move to alternative sites. Loss of sediment through erosion is one of the factors behind this. Industrial and agricultural (or aquacultural) activity lead to land and sea use change, reducing habitat area for local species. Plastic, oil, and other contaminant pollution creates a hostile environment for life.

REST-COAST has taken on the challenge of tackling some of these environmental issues at their demonstration site in the Eems-Dollard estuary, an intertidal marsh located in the Dutch-German territory of the Wadden Sea. This site is also shared with its sister GDC-funded project, WaterLANDS, which is conducting its own demonstration in the area. REST-COAST is implementing Nature-based Solutions for coastal protection, which complement the ecosystem's natural state and processes. REST-COAST is restoring seagrass coverage, which increases the area's natural ability to store carbon from the atmosphere and protects against coastal erosion and flooding. The project team is also managing some of the geographic features of the ecosystem. The ability of existing sediment to support the rich diversity of species is being enhanced through mixing in specially selected sediment with specific characteristics, to enhance its overall quality. The resulting coastal landscape is more resistant to extreme weather events, which in turn protects the ability of local species to survive.



Figure 9: View of the Eems Dollard estuary from the Netherlands

© Henk Osinga Photography/Shutterstock.com

Actions and impacts achieved

Members of the REST-COAST project have published a study in the *Ocean Dynamics* journal on the topic of seagrass as an NbS in the Wadden Sea area¹⁷. The results of this study show that increasing seagrass coverage improves the area's resistance to extreme weather by dampening the velocity and height of waves. The dampening effect on wave action reduces weather-damage because less sediment is displaced from the coastal area.



© REST-COAST

The reduced impact from the waves reduces coastal erosion and helps sediment accumulate as energy is diverted from the seabed, and it reduces the risk of flooding.

WaterLANDS

Spotlight case – Holistic approaches to wetland restoration, Dragoman Marsh, Bulgaria

Dragoman Marsh is a wetland and designated Natura 2000 site located in western Bulgaria. After decades of conversion to arable land, by the 1990s, the marsh was almost entirely drained. When wetlands are drained, important ecosystem services such as carbon storage, flood management and water purification are impeded, and native biodiversity is severely impacted. The drainage pumps fell into disuse across the 1990s and 2000s and the site has gradually returned to wetland. Bird species have started to return to the area, and rare and endemic flora and fauna, particularly rare amphibian species, can be found once again. However, Dragoman Marsh is still under threat from untreated wastewater pollution and intensified agricultural activities nearby. High nutrient levels from agricultural activity mean that regular management is needed to control excess plant growth and to allow restoration to continue in a manner that provides ecosystem services that benefit both local people and the wider population. WaterLANDS aims to conduct further restoration



© WaterLANDS

at its Dragoman Marsh demonstration site, focusing on finding the best solutions for biodiversity restoration and maintenance, long-term carbon storage and the encouragement of eco-tourism. Building relationships with local communities and landowners, and encouraging their involvement, will be integral to restoration activities and extending the reach and impact of the work. For example, whilst agricultural activities have had a detrimental impact on the health of the wetlands in the past, they are also essential to the local economy as a means of income and food provision. Instead of excluding agriculture, holistic approaches to farming can be practiced that benefit nature, local people and the economy. Paludiculture is one such farming method, where marketable products can be grown in wetland settings, maximising their value as both a

¹⁷ B. Jacob et al., "Evaluation of seagrass as a nature-based solution for coastal protection in the German Wadden Sea", October 2023



Figures 10 & 11: Photographs from the Dragoman Marsh demonstration site from BALKANI Wildlife Society¹⁸

© BALKANI Wildlife Society



resource for the local economy and biodiversity. WaterLANDS aims to nurture paludiculture in the area and to promote agri-environmental support programmes which will contribute to the livelihoods of local farmers and underpin the future sustainability of the restoration.

Actions and impacts achieved

WaterLANDS is carrying out active on-the-ground restoration activities which include:

- Removing excess plant matter (such as reeds) and organic debris, and investigating its use as biomass fuel and organic fertiliser.
- Establishing buffer zones on the margins of the wetland to create a new habitat for wading birds and to reduce the effect of excess nutrients being imported from the surrounding agricultural land.
- Baseline monitoring of habitats and vegetation.

WaterLANDS has emphasised the importance of stakeholder engagement, with inclusion of landowners, environmental agencies, community and civil society actors, scientists and wetland users. The following restoration activities have taken place with stakeholder involvement:

- Regular monitoring of wintering bird populations in the wetlands.
- Annual bird ringing camps organised between August and October.
- Ongoing restoration of boardwalks and paths in the Dragoman Marsh to support access for recreation and education.
- A youth educational camp held in November 2022 which involved the co-creation of information boards for the Dragoman Marsh.

¹⁸ Balkani Wildlife Society

On top of this, to support governance, WaterLANDS is petitioning for Dragoman Marsh to be re-designated as a water body under the Water Framework Directive. If successful, it will provide an example of good governance that can be replicated for similar wetlands in Bulgaria.

The project has launched an Artistic Engagement Residency at each of its six action sites. In Bulgaria, contemporary artist Maria Nalbantova is engaging with partners and local communities to provide new perspectives on the ongoing restoration. This connection is strengthening the relationship between the public and Dragoman Marsh, giving greater insight into the value it holds.

Maria recently displayed her work inspired by the Dragoman Marsh in her exhibition "Paradise Marsh"



See more from all WaterLANDS' artists-in-residence

© Maria Nalbantova,
"Paradise Marsh", 2023

at the National Gallery in Sofia. The exhibition explored the connection between biodiversity at the marsh and human perception of the wetlands. The artwork displayed was a variety of forms, including sculptures made of reeds from the Dragoman Marsh (see Figure 12), videography and photography.



Figure 12: Three sculptural objects in the Paradise Marsh exhibition, Bulgaria.
Artwork by Maria Nalbantova

© Maria Nalbantova, "Paradise Marsh", 2023

5

Conclusion

Biodiversity is a function of ecosystem health and after centuries of intensive and industrial human activity in Europe, it is in a concerning state. The impacts of climate change are set to exacerbate the problems experienced by our ecosystems. Degraded ecosystems cannot function to their fullest extent and the essential ecosystem services that they provide decline or are even completely arrested. Immediate and urgent action needs to be taken to ensure the health and prosperity of current and future European generations, who are tied to nature and its wellbeing.

The EU is prioritising the recovery of biodiversity through ecosystem restoration, having set out its ambitions and targets in the Biodiversity Strategy for 2030. As part of this strategy, the groundbreaking Nature Restoration Law will introduce defined restoration targets for EU Member States. Policymaking plays a vital role in realising transformative change and the EU is showing its commitment to large-scale nature restoration by proposing legally binding objectives.

However, legislation is not enough, and large-scale restoration methodologies need to be developed and demonstrated to support EU policy implementation. The EU encourages innovation and upscaling of nature restoration through funding programmes, including through the Horizon 2020 Green Deal Call. Four Green Deal Call-funded projects – REST-COAST, SUPERB, MERLIN and WATERLANDS – are laying the foundations for sustainable and transformative change in coastal, forest, fluvial and wetland ecosystems. These projects bring together multidisciplinary tools for restoring biodiversity and ecosystem services, to maximise the potential of large-scale restoration work, both in their demonstration sites and beyond. Science-backed solutions are being designed across the lifetimes of these projects and can be upscaled across Europe to transform the landscape of European ecosystems into a state where nature, society and the economy are resilient and in harmony.

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Large-scale ecosystem restoration is an urgent necessity in Europe to achieve the goal of recovering nature to a biodiverse and resilient state, whilst simultaneously mitigating against climate change. This report examines the current condition of European ecosystems and the landscape of European biodiversity and ecosystem restoration policy, with a particular focus on the groundbreaking, recently adopted Nature Restoration Law. Work is underway to upscale ecosystem restoration in Europe through the Horizon 2020 Green Deal Call. Four projects (MERLIN, REST-COAST, SUPERB, and WaterLANDS) have been granted funding to develop and demonstrate methodologies for large-scale ecosystem restoration in terrestrial, freshwater, coastal and marine ecosystems. Their work is essential for a transformative change towards a sustainable, resilient, and just future for Europe.

Studies and reports

