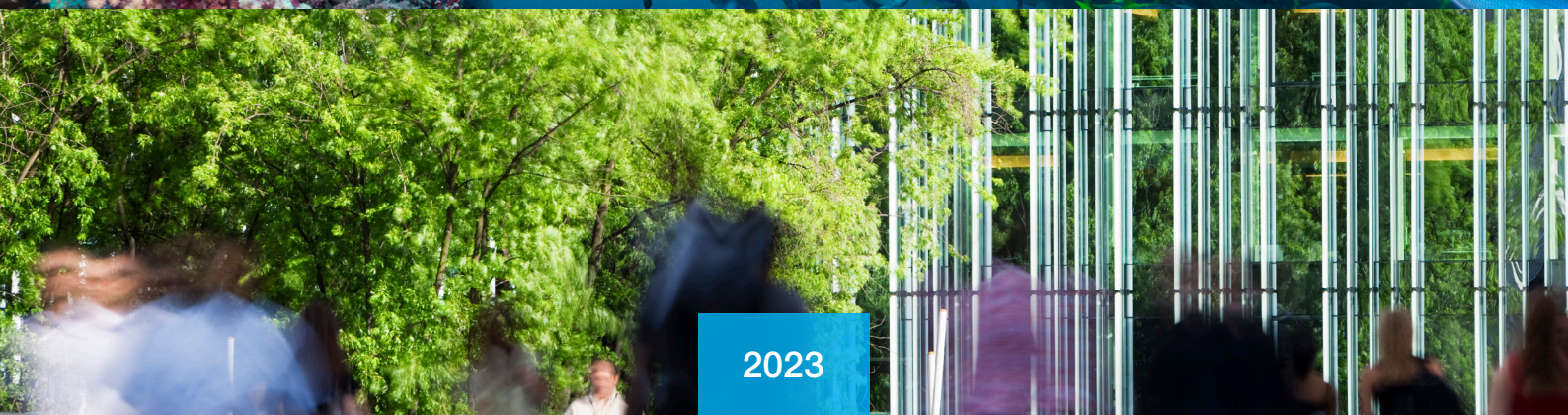
European Research Council
Established by the European Commission

European Commission

Mapping ERC Frontier Research
Biodiversity



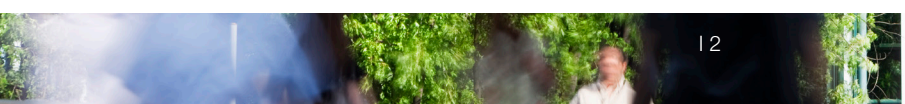
2023

Mapping ERC Frontier Research Biodiversity

Under the Horizon Europe Framework Programme, the European Commission has delegated a new task to the ERC Executive Agency (ERCEA) to identify, analyse and communicate policy relevant research results to Commission services. The ERCEA has developed a Feedback to Policy (F2P) framework for ERCEA to guide these activities, adapted to the specificities of the ERC as a bottom-up funding programme.

This report is part of a series aiming to demonstrate the relevance of ERC-funded frontier science, for addressing societal, economic, and environmental challenges and thus its contributions towards key EU policy goals. This F2P series does not offer any policy recommendations.

More information: https://erc.europa.eu/projects-statistics/mapping-erc-frontier-research



Introduction

The European Research Council (ERC) is the premier European funding organisation for excellent frontier research. It has been a key component of the EU's funding programmes for research and innovation since it was set up in 2007. It gives its grantees the freedom to develop ambitious research projects that can lead to advances at the frontiers of knowledge and set a clear and inspirational target for frontier research across Europe.

The ERC funds a rich and diverse portfolio of projects in all fields of science, selected without any predefined academic or policy priorities. These projects can have an impact well beyond science and provide frontier knowledge and innovation to help solve societal challenges and inform EU policy objectives.

This report gives an overview of curiosity-driven research on biodiversity funded by the ERC and highlights connections with EU policies for the protection and restoration of biodiversity and ecosystems.

Biodiversity and nature provide food, clean air and water as well as energy and raw materials. They can regulate climate, bring social and health benefits, and can drive economies. In the EU, human activities have transformed and impacted nature for centuries and biodiversity is now declining at an alarming rate. Despite some progress, more than 80% of habitats are considered in poor condition[1] and most protected habitats and species are rated with a poor or bad conservation status.

When selecting projects for this report, the following political background was especially considered.

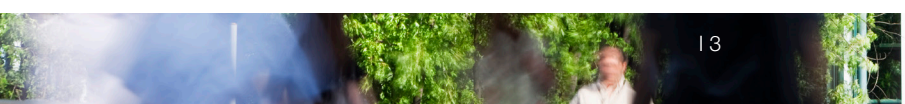
Adopted in May 2020 by the European Commission, the EU Biodiversity Strategy for 2030[2] "Bringing nature back into our lives" addresses the loss of biodiversity and the degradation of ecosystems, which have an impact on wellbeing and prosperity across the world. The long-term plan is an essential part of the European Green Deal and is in line with the objectives of the Paris Agreement on Climate Change. It proposes four main objectives, or pillars, to protect nature, restore ecosystems, to introduce measures to enable transformative change, and to tackle the challenge of biodiversity loss at the global level (EU as a global leader). More than 100 specific actions are listed under these four pillars that also contribute to advancing a number of Sustainable Development Goals (SDGs).

More recently, the European Commission proposed the EU's Nature Restoration Law[3], a continent-wide, comprehensive law and a key element of the EU Biodiversity Strategy for 2030. It aims to restore ecosystems in the EU to "(1) enable the long-term and sustained recovery of biodiverse and resilient nature, (2) contribute to achieving the EU's climate mitigation and climate adaptation objectives and (3) meet international commitments." The proposal also proposes targets for specific ecosystems.

At international level, in December 2022, representatives from governments worldwide and international organisations negotiated an agreement aimed at protecting and restoring nature: the Kunming-Montreal Global Biodiversity Framework[4]. The agreement seeks to preserve the diversity of plant and animal species while promoting the sustainable use of natural resources over the coming decades. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) gathered scientific evidence, in the form of assessment reports[5], that supported the framework.

This report is structured in four chapters:

1. **Chapter one** gives an overview of the more than 230 ERC projects relevant to biodiversity policy and the methodology used to identify them.
2. **Chapter two** presents a series of ERC projects that have wielded considerable influence on policy making at international level: their publications were cited as scientific evidence in three of the latest IPBES assessment reports.
3. **Chapter three** describes how ERC projects contribute to the four pillars of the EU Biodiversity Strategy for 2030 and gives examples of this research.
4. **Chapter four** provides an overview by ecosystem as well as examples of projects that study these ecosystems or have delivered results that offer solutions for their monitoring or restoration.



1. ERC Frontier research on biodiversity: Overview

The projects featured in this report were selected based on their potential to generate knowledge and inform biodiversity policy. Additionally, some projects were included due to the impact of their outcomes on biodiversity policy. Overall, **more than 230 projects**, which were selected for funding without any predefined priorities, were identified as relevant to biodiversity.

Funded since 2007 by the EU's Seventh Framework Programme for Research and Innovation (FP7 from 2007-2013) or its follower Horizon 2020 (H2020, from 2014-2020), these projects were hosted in 19 EU and associated countries. ERC projects funded by Horizon Europe Framework Programme (2021-2027) were not included in the statistics presented in this report.

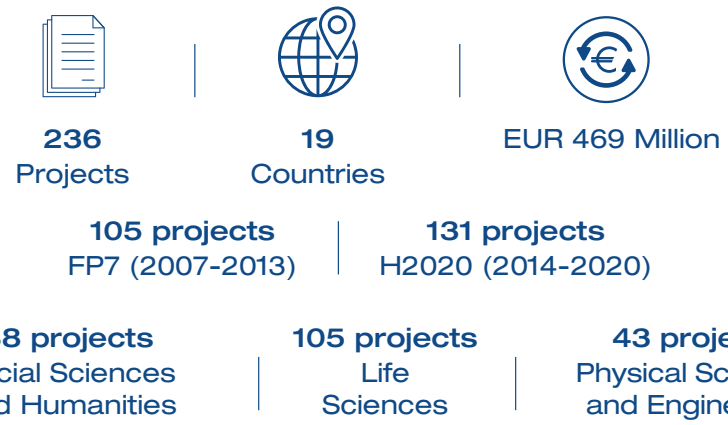


Figure 1: ERC Biodiversity portfolio in numbers

While these projects are funded across all scientific domains[6], most of them are coming from the life sciences, with a majority funded in the fields of environmental biology, ecology and evolution. In physical sciences, earth systems is the most represented area. In the social sciences and humanities, projects in political science, human geography, sociology are more numerous.

Methodology

This portfolio was built on two studies, conducted by the ERC and the European Commission's Directorate General for Research & Innovation. The resulting datasets were further complemented through additional research to include other relevant projects.

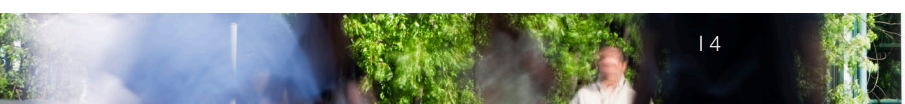
A first set of projects was identified through the ERC internal classification exercise **Mapping Frontier Research (MFR)[7].** The analysis looked at the 6,707 projects funded under H2020 and identified those relevant to the European Green Deal. These projects were presented in the factsheet ERC frontier research contribution to the European Green Deal. Within the subset of projects deemed relevant to biodiversity, 93 were included in this portfolio.

Secondly, **the bibliometric analysis[8] of academic references** cited in three reports of the latest IPBES assessment cycle. This analysis singled out publications acknowledging ERC funding, which came from 90 different ERC projects funded under FP7 and H2020, some of which were already in the MFR data set. 81 projects were added to the portfolio.

The list of projects was completed using an in-house **semantic search**, specifically targeting projects that align, based on their abstracts, with those identified in the MFR analysis. This search led to the identification of 56 projects funded by FP7 and H2020 that were added to the portfolio.

The resulting portfolio of projects was quality checked manually by ERCEA colleagues and against data from the European Commission's **Joint Research Centre (JRC) technical report "Mapping interlinkages between EU-funded research projects and EU policy priorities**, Application of the TIM open access tool to case studies in the context of the EU Biodiversity Strategy for 2030"[9]. Consequently, six projects were added to the portfolio.

Data presented in this report correspond to latest update as of October 2023.



2. Contribution to IPBES assessment reports

One key contribution of the ERC to advancing our understanding of biodiversity is exemplified by a set of ERC projects that have exerted influence on policy making at international level. This influence is substantiated by the recognition of their academic **publications as scientific evidence in assessment reports of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)**[10].

The IPBES has provided critical scientific evidence for the Kunming-Montreal Global Biodiversity Framework[11] in the form of assessment reports, which present a consensus based on carefully reviewed available scientific and indigenous knowledge.

A recently published technical report[12] of the European Commission examined the scientific publications cited in three of these reports and identified those that acknowledged support from EU Framework Programmes for Research and Innovation. The report considered the references of:

- IPBES Global Assessment Report on Biodiversity and Ecosystem Services[13] (2019),
- IPBES Thematic Assessment Report on the Sustainable Use of Wild Species[14] (2022)
- IPBES Methodological Assessment Report on the Diverse Values and Valuation of Nature[15] (2022).

The analysis shows that 20% of EU funded research cited in the report has received support through ERC grants. This corresponds to more than 180 academic publications linked to ERC grantees' results. Some of these publications have been cited multiple times in one or several reports. They came from 90 projects funded by the FP7 (67.5%) and H2020 (32.5%) Framework Programmes.

Repartition of publications cited by report and scientific domain

Most publications were cited in the report published in 2019, the Global assessment report. These publications came from projects funded by the ERC across scientific domains[16] .

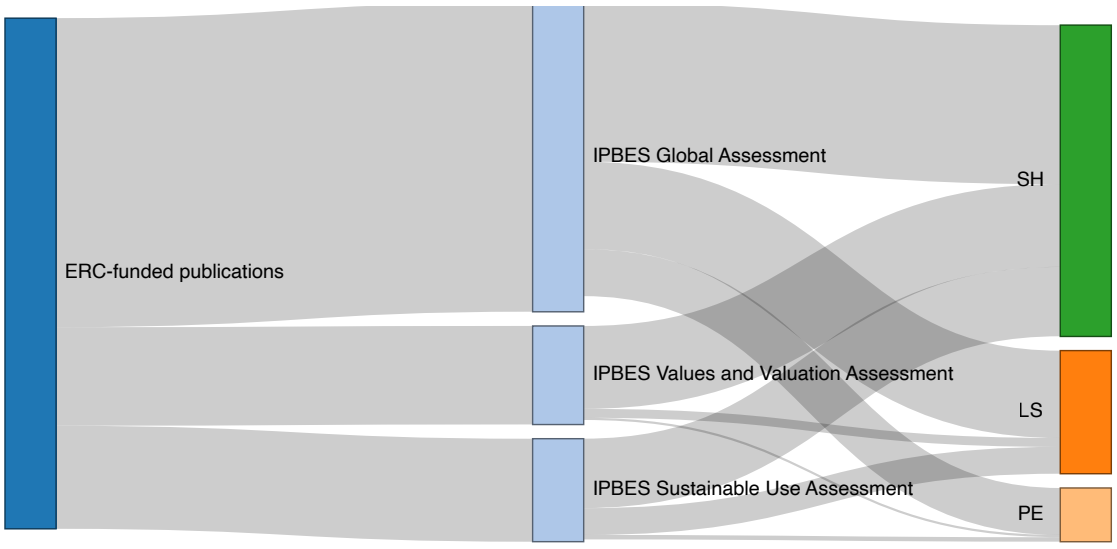


Figure 2: Repartition of ERC-funded publications cited by IPBES assessment reports. Source: Linking research to global biodiversity policies – How did the EU research funding contribute to recent IPBES reports?
Dataset: https://doi.org/10.5281/zenodo.8184041.

Overall, more than half of the projects with results cited in IPBES reports were granted funding by ERC panels in the social sciences and humanities (53%). Additionally, environmental biology, ecology and evolution and earth system sciences stand out as the two other areas of research in these projects.

Highlighted below and throughout the report are projects that serve as illustrative examples. These projects not only provided evidence to contextualise the IPBES reports but also contributed models, atlases, knowledge, and scientific results that were cited in the reports.

- The LUISE project focused on **land use intensification**. On a national and European level, the project identified patterns of intensification spanning two centuries showing that the intensive land use at local level (due to increases in agricultural yields and in input-output efficiency of livestock systems) were accompanied by a polarisation into intensively used areas and more extensively used or abandoned agricultural land. At larger spatial scales, these trends led to a stabilization or recovery of many systems level-intensity indicators. Another important result of the project was the development of a novel modelling environment which consider systematic assessments of trade-offs between land cover change and land use intensification. The model emphasised the crucial role of human diets in determining the scope for future development of land systems to meet sustainability targets. Read more.

- **Aquatic biodiversity:** Focusing on aquatic ecosystems, the BIOTIME project looked into the evolution of species within changing ecosystems. The project pioneered a new way of looking at biodiversity change in rivers of Trinidad, the Mamirauá Reserve in the Brazilian Amazon and the seas of Scotland. One of their results showed that while the richness in biodiversity remains quite constant, communities are rearranged faster than ecological theory would have predicted, with ecosystems evolving so that the same species are becoming more widespread. A long-term impact of the project is an **open-source biodiversity** database, that could help researchers and conservation managers find solutions to protect wildlife. It provides a collection of assemblage time-series in which the abundances of the species that comprise ecological communities have been monitored over a number of years. Read more.

- The EnvJustice project developed a theory of "ecological distribution conflicts" and a new scientific approach to **environmental justice**. The team collected and analysed cases of conflicts worldwide, related among others to biodiversity, land use, water, to the extraction of minerals, metals, fossil fuels or other commodities, to nuclear energy or tourism. These cases are catalogued in the EJAtlas, together with cultural expressions of these conflicts, e.g., banners or iconography, that allowed the team to analyse the vocabulary of the movement for environmental justice and its evolution since the 1980's. Finally, the project looked into elements for a possible alliance between global environmental justice movements and the degrowth movement in Europe and the US. The atlas is open to researchers and environmental justice organisations. Read more or visit the project website.

More examples can be found in the following chapters. They are marked with the IPBES visual in the margin of the report.

Figure 3: Main words and phrases appearing in the titles of ERC publications that were cited in IPBES reports.

3. Linking ERC funded projects with the EU Biodiversity Strategy for 2030

This chapter highlights **projects that offer knowledge directly relevant to the EU Biodiversity Strategy for 2030**. All projects were individually linked to the different objectives of the Strategy, namely to its four pillars aiming to protect nature, restore ecosystems, introduce measures to enable transformative change, and to tackle the challenge of biodiversity loss at the global level (EU as a global leader). Projects that could not be linked to a pillar were listed under the category "other."

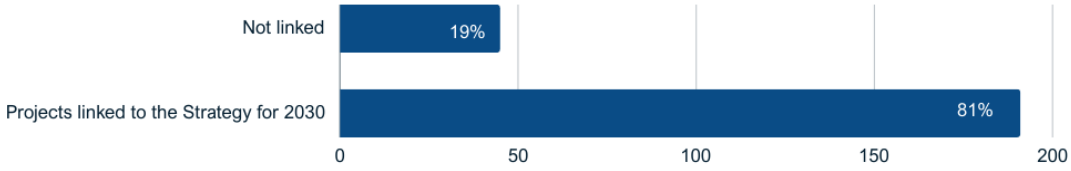


Figure 4: ERC Biodiversity projects links with the EU Biodiversity Strategy for 2030

Out of the 236 projects in the ERC portfolio, 191 are relevant to the pillars of the EU Biodiversity Strategy for 2030. It's worth noting a single project could be pertinent to more than one pillar. Although 45 projects may not directly align with the Strategy pillars, their results hold potential to inform or be applied to biodiversity policies, both in Europe and globally. The concluding section of this chapter presents some of these projects and the diverse areas they cover.

Repartition of projects relevant to the EU Biodiversity Strategy for 2030 by pillar

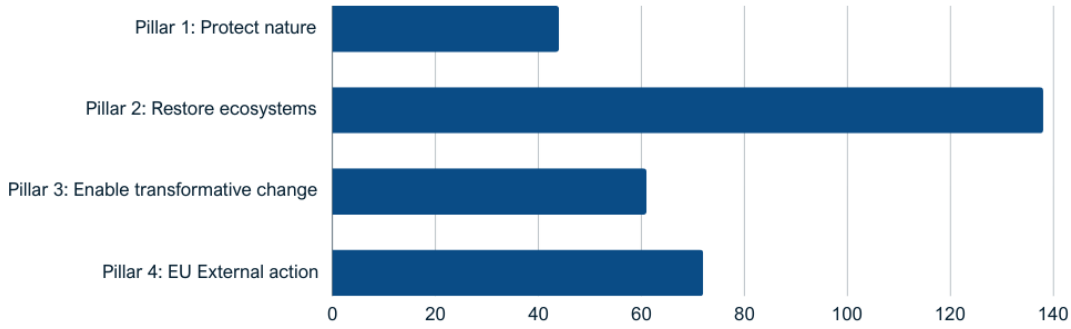


Figure 5: Repartition of ERC projects by EU Biodiversity Strategy for 2030 pillars

Protect nature

The objective of the first pillar of the strategy, "a Coherent network of protected area", is to **protect nature by establishing an EU-wide network of protected Natura 2000 areas**, encompassing 30% of the land and 30% of the sea in Europe.

ERC projects linked to this pillar mainly come from the life sciences domain, particularly in environmental biology, ecology, and evolution. These projects investigate biodiversity conservation and yield findings that could inform conservation policies, as well as contribute to the identification, designation, management and monitoring of protected areas. A lesser but notable number of projects come from the social sciences, offering perspectives from disciplines such as anthropology, economics, human geography, and political sciences.

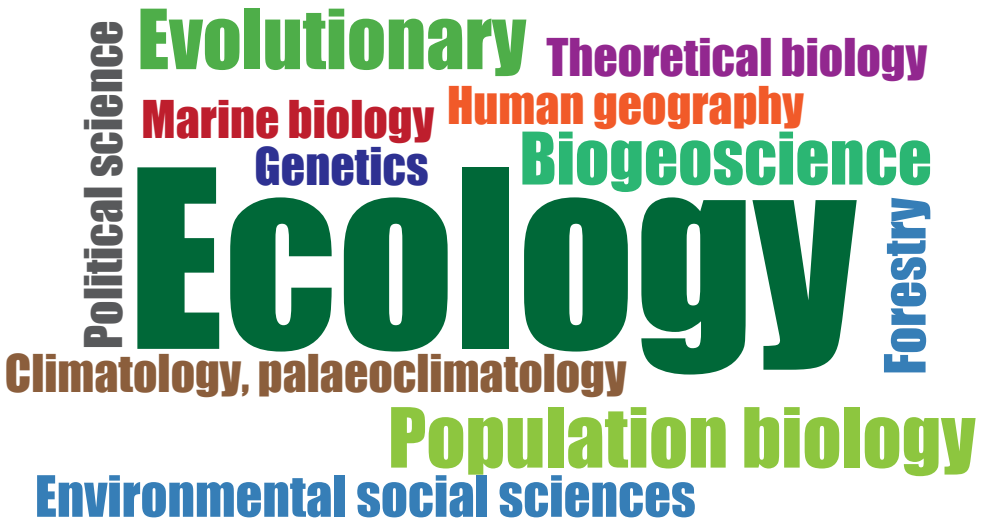


Figure 6: Word cloud of the main disciplines represented in the ERC projects linked to the EU Biodiversity Strategy for 2030 pillar 1. Source: ERC Mapping Frontier Research (MFR), an internal classification system that captures the scientific disciplines, topics, and methods of ERC projects.

Pillar one has the fewest ERC projects associated with its objectives. Overall, 44 projects have been identified, selected either for the relevance of their research or because of their results' potential to support policies related to the establishment and monitoring of EU protected areas. A selected few of these projects are highlighted below.

- The EU aims to enlarge the network of protected areas that have a high biodiversity or climate value. But how can we ensure this status helps meet biodiversity conservation targets? The FIDELIO project investigates the **social impacts of biodiversity conservation** policies across Europe. They focus on 20 protected areas to understand why some of them are more efficient than others. The team looks at the social impacts of protected areas, how they are described and how they are perceived by local communities. The project has already developed a social capital and impact assessment tool as well as a new theoretical framework that could help policymakers understand and predict public acceptance and support for protected areas. Read more on the project website.

- The SPREC project worked on a new approach to predict how wildlife populations respond to environment changes, which is important for conservation but could also be relevant to monitor invasive species or exploitable ones. Combining fitness-related trait information of populations (e.g., body size) with demographic ones, the team proposed a method to assess demographic growth and identify **early warning signals** of population collapse. Read more on the team's website.

IPBES

- The GEDA project, funded under FP7, focused on **land use planning** and resource allocation in conservation biology. It aimed to develop decisions methods and analyses that can support conservation decisions, regionally and globally. The team developed a series of methods and software products for this purpose, including Zonation, a software that can be used to identify priority areas for conservation and land use planning. Among other results published by the project, their analyses on trade-offs between renewable energy and biodiversity and trophy hunting were cited by IPBES reports.

- Synergy project SEACHANGE brings four principal investigators together to study the history of marine biodiversity and ecosystems functioning. The team focuses on two periods: long-term changes in prehistoric times in North-western Europe as well as biodiversity loss and changes during the last 2000 years as a result of fishing and marine habitat loss, in the North Sea and around Iceland, eastern Australia and Antarctica. The aim is to reconstruct the **baselines of marine ecosystems** and estimate the impact of human activities. The project results could inform marine conservation efforts. Read more on the project website.

Restore ecosystems

The projects presented below have addressed issues relevant to the second pillar of the Strategy "**EU Nature Restoration Plan"** that aims to restore degraded ecosystems across Europe.

This broad pillar includes objectives for the restoration of various ecosystems such as agroecosystems, forests, freshwater, urban and marine ecosystems, as well as objectives relevant across ecosystems such as pollution reduction or addressing invasive alien species. The broad scope of this pillar may explain why it is the largest pillar in terms of the number of relevant ERC projects (close to 140 projects).

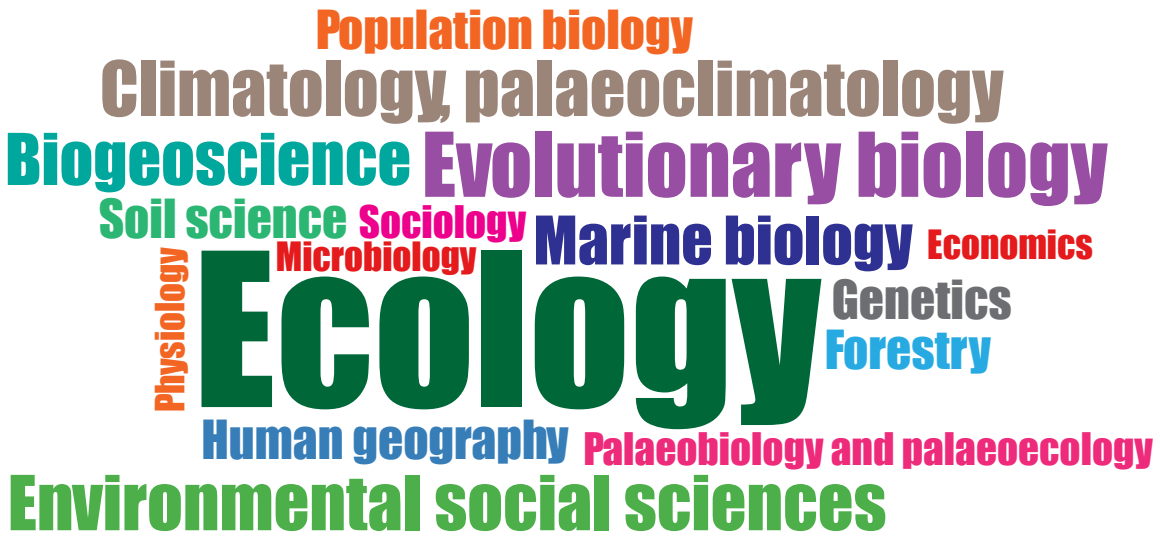


Figure 7: Word cloud of the main MFR disciplines represented in the ERC projects linked to the Strategy pillar 2

- Does the design of **nature governance rules** affect people's decisions to comply with law? How can we design them to **maximise compliance** and environmental outcomes? The LEGALARCHITECTURES project ran an interdisciplinary study of the relationships between the legal architecture of EU biodiversity policy and compliance decisions in three Member States: Ireland, France and the Netherlands. The team proposed a new way to measure the evolution of EU environmental governance laws over time as well as indicators enabling to measure their effectiveness. Finally, the project engaged in a unique behaviour analysis of the effectiveness of EU nature laws, taking into account the opinion of environmental NGOs, farmers but also individual citizens. Their findings are summarised in a Policymakers' Handbook available on the project website.

- The EcoSpace project developed new approaches for **mapping and accounting for ecosystem services** at large scale, at the level of a province for example. The aim of the project was to provide models that would help manage ecosystems and maintain their ecosystem services in the context of climate change. The team tested their models on three sites, looking at flood protection in the Netherlands, impacts of climate change in Norway, and optimising land use including production of biofuels stock in Indonesia. The project's work contributed to an ecosystem accounting approach integrating ecology, geography, and economics and to our understanding of ecosystem services and natural capital. Several results were cited in the IPBES assessment report on Diverse Values and Valuation of Nature. Read more.

- **Monitoring insect pollinators and alien species:** Using laser physics, the Bug-Flash project works towards improving solutions for insect monitoring. The team aims to develop and test a new LIDAR technology that can capture light flashes from insects' wings outdoors. The team has already identified important differences in light scattering for a variety of winged insects. They have developed LIDAR instruments which they have begun testing in the field. Their aim is to detect, quantify and track free-flying insect species including agricultural pests, pollinators or insects acting as disease vectors.

- **Fires and ecosystems**: The EU Biodiversity Strategy aims to build our societies' resilience to future threats, including forest fires. The ECOFLAM project studied fires to better understand their impact on ecosystems and the longer-term functioning of our planet. The team looked at **how plants adapted to natural fires** in the past and the present day. They established an experimental fire testing laboratory, the Wildfire lab, and developed techniques that can be used to estimate and understand the impacts of fire behaviour on ecosystems in the Earth's past but also today and in the future. The project results also led to a Proof of Concept aiming to develop a tool for **forensic fire investigations**.

- **Soil health:** A challenge for sustainable food production is to find solutions to increase crop yield while reducing the use of fertiliser that can be harmful to the environment and restoring soil biodiversity. The SENSOILS project looked into the **dynamics of crop roots and soil microbes** in the rhizosphere, the layer of soil around plant roots. Rather than creating new fertilizers, their focus was on developing better, healthier soils. They developed artificial soils and imaging techniques to track microbial interactions and their impact on crop roots and observe changes in the soil chemical composition. The team's findings on bacteria behaviours in the soil's pores could lead to solutions that maintain population of beneficial microbes along plant roots and make crops less dependent on fertilisers. Read more.

IPBES

- **Environmental impact of biofuels**: The SIZE project aimed to improve methods to evaluate the ecological footprint of biofuels, integrating biodiversity in calculations. The team assessed the large-scale implementation of second-generation biofuels produced from bioenergy with carbon capture and storage (BECCS), looking into their benefits for climate mitigation as well as the related risks for biodiversity loss following land use change. Based on their findings, the researchers propose that early and limited deployment of BECCS is the most promising strategy. The team have now started to work on the modelling of other renewable energy sources. Read more in CORDIS article and the project website.

IPBES

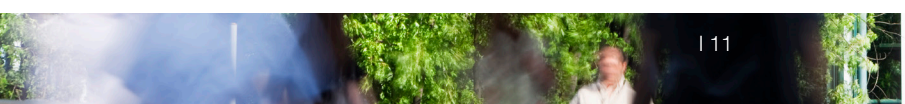
- **Nutrients, soil, and climate dynamics:** Nutrients such as nitrogen and phosphorus have a key role for plant growth, soil dynamics and feedbacks between biospheric processes and climate. The QUINCY project aimed at clarifying the role of the interacting nitrogen and phosphorus cycles and their effects on carbon and water fluxes. The team developed a terrestrial biosphere model tracking the flows of carbon and nutrients for pre-defined terrestrial ecosystem types as well as mesocosm greenhouse experiments that allowed the team to measure carbon and nitrogen fluxes. The project results were cited by the IPBES Global assessment report. Read more on the researcher's website.

IPBES

- **Urban green infrastructures** such as parks, gardens, or waterfronts can improve citizens' quality of life but also improve ecosystems services and cities' resilience to e.g., climate warming or floods. The GREENLULUS project studied 40 cities going through green transformation in Europe and Northern America. Their results, some of which are cited in IPBES assessment report on Diverse Values and Valuation of Nature, highlighted the potential for social inequality arising from these changes. They can for instance bring up real estate value and cost of living and lead to the displacement of lower-income and minority residents. With the Proof of Concept grant ClimateJusticeReady, the team will further develop their tools to help municipalities predict and **prevent green gentrification** and ensure green transitions do not leave anyone behind. Read more in the researcher's website.

IPBES

- **Marine ecosystem management**: As climate change impacts fish populations and the fisheries sector, the CLOCK project has proposed a climate adaptation framework that integrates **fisheries** management science in the context of socio-ecological systems. Tested under various setting, the framework aims to explore the best **adaptation options for both ecosystems and the people** who depend on them, to assure long-term sustainability of the resources and livelihoods. The project took a global perspective but also focused on three specific fisheries social-ecological systems: the Basque industrial tropical tuna fishery, Galician artisanal fishery, and the Nayarit artisanal fishery in Mexico. Read more on the project website.



Enable transformative change

Pillar three of the Strategy aims at **enabling transformative change**. Actions include unlocking funding for biodiversity (including for advancing knowledge), and setting in motion a new, strengthened governance framework. Some 60 projects were linked to this pillar, with the large majority coming from the social sciences and humanities. The main scientific disciplines represented in this group of projects is represented below.

Figure 8: Word cloud of the main MFR disciplines represented in the ERC projects linked to the EU Biodiversity Strategy pillar 3

IPBES

- From 2008 to 2012, the ReDirect project studied the theory and practice of approaches to conservation using **payments for ecosystem services (PES)**. The team successfully designed, established, and monitored a PES system where communities in a montane rainforest in southwest Rwanda were offered cash transfers, contingent on their performance in relation to a set of conservation indicators. This allowed the researchers to look at the effectiveness, efficiency, and equity of payments for ecosystem services schemes. The team also aimed to better understand ways of reconciling **biodiversity conservation and poverty alleviation**. Read more.

IPBES

- The BENELEX project conducted the first systematic evaluation of how **international law** can support the use of benefit-sharing as a tool for equitable change. Their results clarified how the international legal concept of **fair and equitable benefit-sharing** should be understood within the framework of international human rights law and as a common approach for cooperation in areas like biodiversity conservation, climate change, ocean governance, and bio-based research. The team also produced training modules for advocates and lawyers of Indigenous peoples and local communities, which provide guidance on benefit-sharing and concluding benefit-sharing agreements. The research team has advised various international organisations, civil societies, and governments. Read more.

IPBES

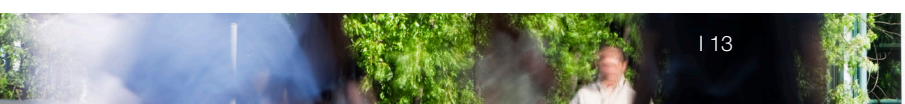
- People and nature are intertwined and interdependent in what are referred to as **social-ecological systems** (SES). The SES-LINK project aimed to improve our understanding of these close interactions and how they affect the resilience of SES and our capacity to govern them in a sustainable way. The team developed simulation models of these complex dynamics based on cases from the Baltic Sea fishery, small-scale fisheries in Mexico, lake restoration in Sweden, and poverty traps in agricultural landscapes. Read more.

IPBES

- The LEK project is one of the ERC projects highly referenced in the IPBES reports. It aimed to test the hypothesis that cultural knowledge might enhance **human adaptive strategy**. The team collected empirical data related to medicinal plants, hunting or agricultural knowledge in three Indigenous societies on three continents. Their findings provide understandings of previously neglected **knowledge systems in Indigenous societies** and of the impacts of local cultures, environmental knowledge and human adaptation on biological diversity, with implications for conservation. Read more. A second project, LICCI, aimed to bring insights from local knowledge systems into climate research and, with a Proof of Concept grant, the team developed an observation network to strengthen the participation of Indigenous peoples and local communities in policy making processes around climate change.

IPBES

- Using a range of health data sets and statistical modelling, the PhyBEHI project investigated the role of various physical, social and economic factors in influencing inequalities in health. This provided new insights into e.g., the connections between **green space, health and wellbeing** and how environmental exposure in early life matters for health outcomes in old age. One of their publications was cited in national and international policy documents, including those of IPBES. The project also considered factors such as air pollution, migration and mobility, levels of social investment, regional disparities in socioeconomic factors, and the density of tobacco retailers.



EU External action and global biodiversity agenda

In the fourth pillar, "EU external action and an ambitious global biodiversity agenda," the Biodiversity Strategy for 2030 aims to tackle **the global biodiversity challenge** and position the EU as a global leader. This pillar includes actions related to international ocean governance, trade, deforestation, wildlife trafficking and illegal trade. More than 70 projects have been linked to this pillar.

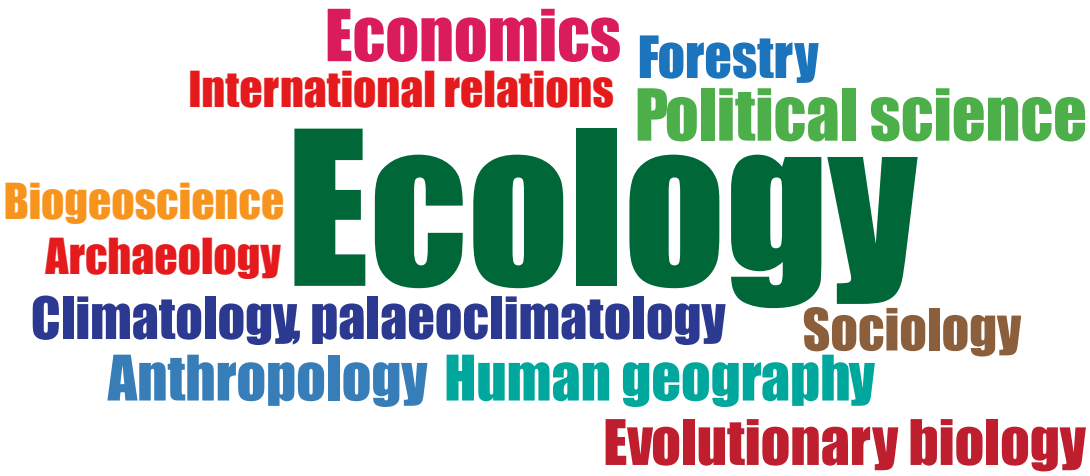


Figure 9: Word cloud of the main MFR disciplines represented in the ERC projects linked to the EU Biodiversity Strategy for 2030 pillar 4

- Maritime economic activity is increasing. Traditional sectors such as oil and gas and fisheries are expanding; new activities are emerging from wind farms to deep-sea mining. The SUSTAINABLEOCEAN project focused on the interplay between the law of the sea, climate change law and energy law and has developed a theory of interest and regime interaction in **ocean governance**. The project results shed light on how the law can strike a balance between competing interests at sea while also contributing to the protection and sustainable use of our oceans, and developed legal tools to help decision makers create a more sustainable ocean policy. Read more.

IPBES

- Focusing on **tropical forests** across four continents, the T-FORCES project aimed to improve our understanding of their role in the global carbon cycle and climate change. The project's results showed subtle but important changes in forest behaviour that could also impact their roles as a global carbon sink. The project also provided evidence that the functional composition of tree species in the Amazon is shifting. In collaboration with other projects, they developed a **unique database of tree measurements** with contributors from across the world who follow standardised protocols and methodologies. ForestPlots.net is still available online and provides information on tropical forests in the Amazon, Africa, Asia, and Australia. Read more.

- The EARLYLIFE project studied the early life of 15 species of marine predators, seabirds and seals, in the southern oceans. This is for them a critical period when they need to learn to survive without their parents, and high mortality occurs. Combining animal behaviour and demography, the research investigated potential effects of global changes on young animals and could lead to a shift in focus for **conservation** efforts: after their first two months of independence at sea rather than during the first two months. In parallel, tracking devices developed for the project found an unexpected application. A new type of logger attached to albatrosses have made it possible to **detect illegal fishing activity** and collect information for authorities and organisations involved in protecting the ocean and threatened marine species. This was developed with follow-up Proof of Concept project OCEAN SENTINEL that won the Horizon Impact Award 2020. Read more.

- Started in January 2022, the FORAGING project aims to develop a conceptual understanding of foraging as a basic economic strategy and a form of socio-environmental entanglement. Foraging has gained momentum globally as a means of subsistence and sometimes the only avenue to upward social mobility. At the same time, growing concerns about the rapid loss of biodiversity underscore the urgency for environmental conservation. The project aims to understand evolving frictions at this interface and the **environmental implications of age-old foraging** practices today.

ERC Projects beyond the Biodiversity Strategy pillars

While advancing our understanding of biodiversity and strategies for its preservation, a subset of projects could not be directly aligned with the pillars of the Strategy (19%). These projects study diverse realms, such as the evolution and diversification of species, species interactions, co-evolution, and symbiosis. Others explore the link between biodiversity and the health of both humans and animals. In the field of earth system science, research themes include climate change impact and adaptation, climate, ocean, atmosphere, and ice sheet dynamics. Projects within the social sciences and humanities adopt historical or archaeological perspectives, examining aspects like past climate changes, ecosystems collapse, the domestication of animals, among other research themes.

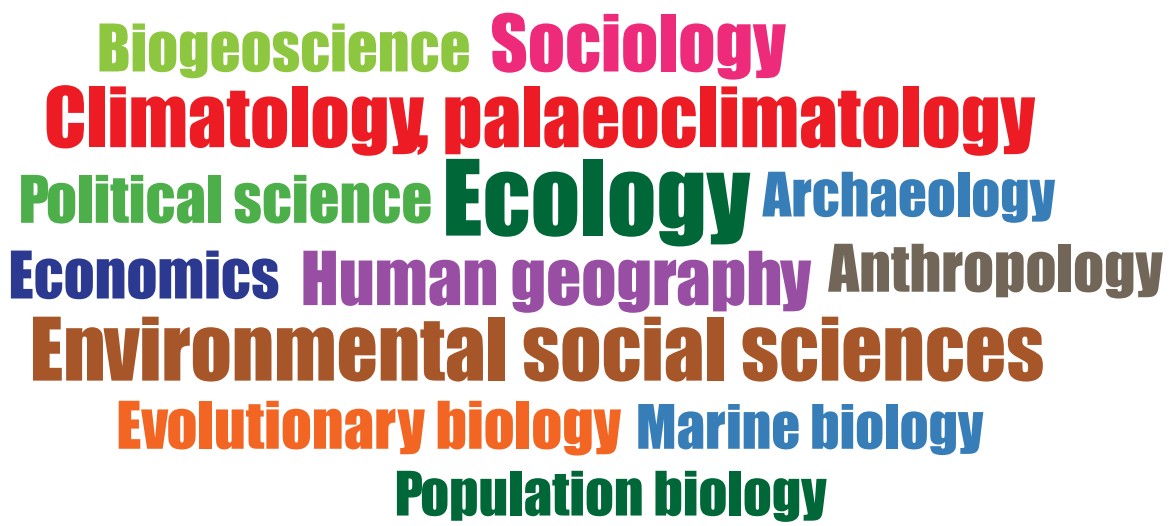
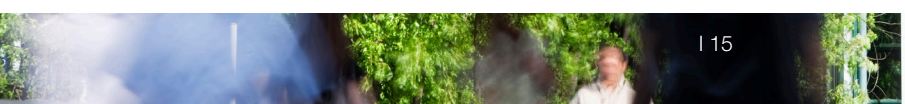


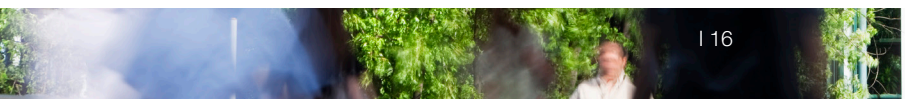
Figure 10: Word cloud of the main MFR disciplines of ERC projects that were not linked to the objectives of the EU Biodiversity Strategy for 2030




- To better understand biodiversity as we see it today, the PANDA project looked at its dynamics over millions of years of **evolution**. The team focused on the ecological and evolutionary processes that could help understand how species richness is distributed on earth and in the tree of life. The team proposed novel approaches, models and tools that allowed a shift in focus from descriptive to a more process-based understanding of species diversification in evolution. New methods were made available to the scientific community and the team used them to answer biological questions. Read more.

- Plants can host microorganisms, fungus or bacteria, and their beneficial **interactions** within the plant's cells has been essential for the evolution of terrestrial ecosystems. The ORIGINS project studies several land plant species and several types of symbioses using gene manipulation techniques. The team aims to discover the genes and the molecular mechanisms responsible for the origin of these symbioses millions of years ago and understand how they diversified and evolved to be observed in today's plants. This research could be the basis of new **symbioses** mechanisms that could support sustainable agriculture.

- Looking at our history, some societies appear to have been able to prevent or cope with disasters, while some were more vulnerable. The COORDINATINGforLIFE project analysed historical records of rural Western European societies spanning a period of 500 years to understand what determines resilience. Their interdisciplinary and institutional approach (looking into institutional arrangements, coordination systems, political equality, and economic distribution) allowed them to identify characteristics that made societies more successful in dealing with disasters, whether natural or man-made. In particular, the project has shown that societal factors related to power distribution and income inequality affect the success of communities in dealing with disasters. Their publication on inequality in nature and society was cited in two IPBES assessment reports. Read more.



4. ERC Biodiversity projects by ecosystems

The EU Biodiversity Strategy for 2030, alongside the Nature Restoration Law, aims to restore ecosystems throughout Europe. This chapter provides an overview of **the ecosystems studied or relevant to the ERC projects** in this portfolio.

These projects are presented based on the ecosystems classification used by the Joint Research Centre (JRC) for mapping and assessing EU ecosystems and their services, commonly referred to as the "MAES" classification[17]. Ecosystems are categorised into seven groups: urban areas; agroecosystems; forests; heathlands and shrubs (combined with sparsely vegetated lands); wetlands; freshwater (rivers and lakes) and marine ecosystems.

ERC projects have been associated to the ecosystems they study or are relevant to. These links were manually established, based on the information available in the projects abstracts, proposals and results.

While certain projects are explicitly designed to study a particular ecosystem, others may use case studies spanning several ecosystems. Research results, even when projects do not explicitly focus on the conservation of a specific ecosystem, may have relevance for the monitoring or restoration of one or more ecosystems. Consequently, projects can address and be linked to several ecosystems.

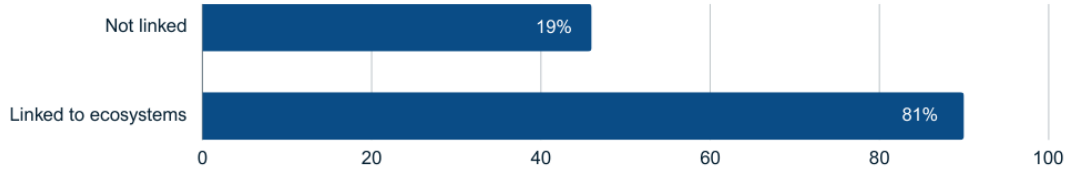


Figure 11: ERC Projects links with ecosystems

Out of the 236 projects, 190 were associated with one or more ecosystems. However, 46 projects, although contributing to biodiversity, were not considered specifically relevant to a particular ecosystem. These included studies involving model species in controlled lab environments and more theoretical projects whose results could have broader applicability across diverse ecosystems.

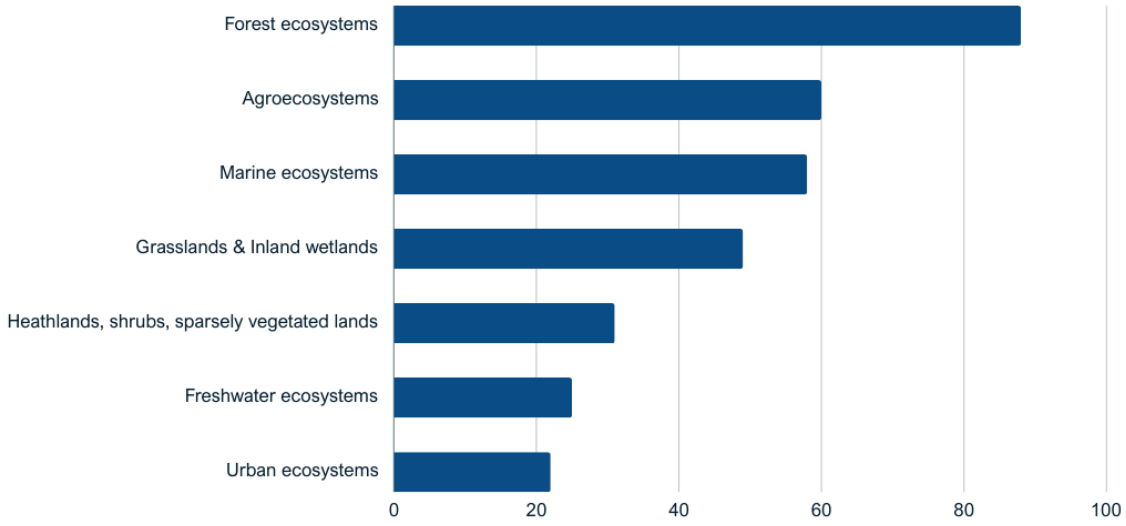


Figure 12: Repartition of ERC projects by ecosystem

The following sections provide examples of ERC projects for each of these ecosystems.

Woodland and forests

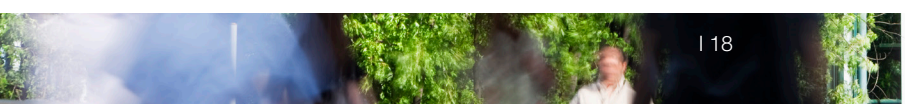
Forests are the largest terrestrial ecosystem in the EU, hosting a large part of Europe's terrestrial biodiversity. Forests also contribute significantly to climate change mitigation. Europeans have modified forests by clearing them for e.g., agriculture and using its wood products[18].

ERC projects mostly study forest ecosystems and woodlands, with a particular emphasis on general forest ecosystems or those in specific regions, including tropical forests, notably the Amazon. A substantial number of these projects explore issues related to land use and examine the link between forests and climate change. Finally, several projects have contributed models or monitoring tools for forest ecosystems management, such as the T-FORCES project described in chapter three.

- The Longwood project looked into human influence on **woodland vegetation in Central Europe**, with a focus on the contribution of historical **knowledge** to today's nature conservation. Combining history, palaeoecology, archaeology and ecology, this interdisciplinary project aimed to recover the evolution of forest composition and management in Moravia, Czech Republic, over the last 7500 years. The researchers combined archive documents, fossil pollen, current vegetation, and archaeological data. The project results, database and models are of relevance to forest management and woodland conservation. Read the ERC grantee's interview and visit their website.

- The SmartForests project studies how new **digital technologies** influence **forest management** and the socio-political impacts they may have. Smart forests technologies can help manage forests by targeting their carbon uptake or biodiversity. On the other hand, these new technologies may pose risks of socio-political inequalities and undemocratic governance, studying these is at the centre of the project. Through five case studies, the team examines how forest technologies are changing the methods of observing, mitigating, participating in, and regulating environmental change. The team set up a Smart Forests Atlas a research platform to explore how digital technologies are transforming forests and reimagine knowledges and technologies. Read more.

- The **forest understorey**, the vegetation layer on the forest floor, is home to the most diverse collection of vascular plants and plays a vital role in providing ecosystem services. How herb layers are influenced by global environmental changes was studied in the PASTFORWARD project. It particularly aimed at understanding the **combined effects of land use change, atmospheric deposition, and climate warming** on forest herb layer communities, taking into account that legacies of past land use can have long-lasting effects. The project results can support forest managers and policy makers to balance resource extraction with biodiversity conservation in an era of environmental change. The researchers also developed an online tool to accurately **track biodiversity loss** in the understorey. This was funded with Proof of Concept project UnderSCORE. Read more about the project and its online tool.



Agroecosystems

Agroecosystems, accounting for approximately 47% of the EU's land area, represent communities of plants and animals interacting with their environments, shaped by human intervention to produce food, fibre, fuel and other products for human consumption and processing. These systems can be composed of both cropland and grassland.

ERC projects studying croplands and agroecosystems cover a wide range of themes including soil science, land use and species interactions.

- Droughts and heatwaves impact croplands, land processes, soil moisture and vegetation. They also affect climate. Using data from satellites and ground observations, the DROUGHT-HEAT project analysed these **extreme weather events** to develop more precise climate models and better understand land-climate dynamics in the context of climate change. One of the findings was that, in dryer years, there was much more CO_2 in the air. This suggests that carbon sinks on land are much less efficient when an extensive fraction of the land area is affected by droughts. A follow-up Proof of Concept project led to the development of an open-source earth-system model that predicts climate extremes from emissions and land use. Read more.

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- The Synergy Grant IMBALANCE-P studied the **impact of nutrient imbalance** on climate change and biodiversity. They focused on **phosphorus**, a finite resource as opposed to carbon and nitrogen which have increasing availability. The project team integrated the nutrient imbalance dimension in biodiversity models and climate modelling. The project further investigated how to distribute phosphorus globally in order to ensure food security, limit global warming and preserve biodiversity. Read more.

- Between 15,000 and 10,000 years ago, humans formed bonds with plants and animals, transforming their genetics and behaviour and paving the way for early urban societies. The UNDEAD project used emerging DNA sequencing technologies to characterise the nuclear genomes of ancient animals: chickens, dogs and pigs spanning 30,000 years. The research contributed to a deeper understanding of **animal domestication** and evolving relationship with humans. Read more.

Several ERC projects at the **interface of food security and biodiversity concerns** were presented in the ERC report on Mapping Frontier Research: Sustainable food production and consumption.[19] These projects explore and seek to address, for instance conflicts between food security and biodiversity conservation. Additionally, some propose theories explaining the specific properties of social-ecological systems that benefit both biodiversity conservation and food security.

Marine and coastal ecosystems

This section focuses on marine waters and ecosystems including marine inlets and transitional waters, coastal waters, shelf waters and open ocean[20]. A large pool of projects studies the oceans, the biology of species including plankton, corals and fish and marine animals and their evolution, the physical, chemical, and biological processes taking place in ecosystems. A subset of projects specifically looks at fisheries management, while other projects study various aspects of ocean governance in the context of climate change.

- The OCEAN DEOXYFISH studies the **effect of global warming and ocean deoxygenation on the ocean's top predators** such as sharks and tunas and how this can in turn impact fishing activities. The team tracks sharks in the Atlantic Ocean to understand how the expansion of permanent oxygen minimum zones affects them and their habitats. Some fishes indeed tend to concentrate further in surface water where oxygen is more abundant, making them more vulnerable to fisheries. Researchers also mapped hotspots where the risk of collision between marine traffic and the world's largest fish, the whale shark is high and combined them with recordings providing evidence for sinking, probably dead, whale sharks. This finding, which will inform the UN Convention on Migratory Species, could explain why whale shark populations continues to decline despite international protection and low fishing-induced mortality. Read more.

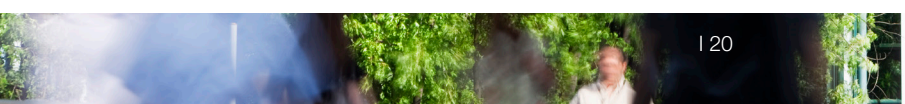
IPBES

- **Diatoms** are large, diverse group of algae found in the ocean around the world. The DIATOMITE project explored their genetics, physiology, metabolism and evolution to better **understand their success in contemporary marine ecosystems**. The team could identify genes that drove physiological and metabolic innovations in diatoms during their evolution. Among other results, they found that photosynthesis in diatoms is configured differently to other organisms, resulting in a more efficient photosynthesis. The team also created the first epigenome for a stramenopile organism and sequenced the genomes of ten distinct ecotypes of the experimental model diatom Phaeodactylum tricornutum revealing pervasive allele-specific gene expression and identifying multiple genes subject to positive selection, a significant departure from findings in other organisms studied so far.

- **Coral reefs** that provide services such as food, tourism revenue, and shoreline protection are also highly sensitive to rising seawater temperatures. While corals are able to adapt to changes, it is unclear if they can adapt sufficiently fast. Some corals are more heat tolerant than others and the CORALASSIST set out to understand if this trait could be harnessed for conservation. The team analysed the feasibility of several **methods to conserve coral reefs** in real-world scenarios. They have developed a new method for outplanting corals produced by IVF, increasing their survivorship. Read more.

IPBES

- The **deep seafloor**, which accounts for around 70% of Earth's surface, is one of the least explored regions on our planet. Bacteria dominate deep-sea life in terms of abundance and biomass. They play a crucial role in the Earth's carbon and nutrient cycles. The ABYSS project focused on the Arctic Ocean and studied the response of **microbial deep-sea communities** to changing environmental conditions. The team investigated the diversity and function of these bacterial communities. Thousands of bacterial types were discovered per gram of deep-sea sediment, but only a few are known or isolated for laboratory studies. The project discovered a small number of bacterial groups that are abundant worldwide, among them JTB255 bacteria which play a significant role in deep-sea ecosystems. Read more.



Grassland & inland wetlands

Wetlands include a wide variety of inland habitats such as marshes, wet grasslands and peatlands, floodplains, rivers, and lakes, as well as coastal areas such as saltmarshes, mangroves, intertidal mudflats, and seagrass beds.[21] Some 50 projects were identified as studying or being relevant to these ecosystems.

- The ALIENIMPACTS project, which started in 2021, analyses the **impact of alien plants on floristic diversity**. The project uses temperate grasslands as a model system and will draw on theoretical and empirical approaches to quantify the effects of alien species on biodiversity. The team aims to forecast the effects of newly introduced alien species and better understand how to conserve the biodiversity of plants under global environmental change. Read more.

- **Tropical peatlands** are wetlands that store the equivalent of 10 years of global anthropogenic CO_2 emissions; they are the most carbon-dense ecosystems in the world. The TroPeaCC project, which started in 2021, looks at the geographical distribution of peatlands in tropical regions, the size of their carbon sink and their methane flux. Furthermore, they plan to estimate the overall carbon balance of tropical peatlands and how it will change in the future. With an interdisciplinary approach, the project will integrate tropical peatlands further into earth system models and provide insights on how to optimise provision of ecosystem services. Read more.

- The HAZE project aimed to better understand and ultimately help **fight smouldering fires** of porous natural fuels such as peat. These fires destroy those ecosystems and are also responsible for greenhouse gas emission. The project used field and laboratory experiments, along with numerical modelling, to study how smouldering combustion ignites, spreads, and extinguish. The team also studied the haze and smoke emissions from these fires. They developed new methods to prevent, detect and monitor smouldering fires through, for instance, their chemical signatures. The main objective was to better understand and ultimately help fight smouldering fires of porous natural fuels, such as peat fires. Read more on the project website.

Heathlands, shrubs, and sparsely vegetated lands

Heathlands and shrubs areas are dominated by small woody plants often in combination with herbs, and sometimes with a large contingent of mosses, liverworts, and lichens. Sparsely vegetated lands include bare or sparsely vegetated rock, lava, ice and snow of cliffs, screes, caves, volcanoes, glaciers and snowfields, dunes, beaches, and sand plains. Both ecosystems are present across Europe and can be associated or interlinked, for instance in some mountain or coastal areas.[22]

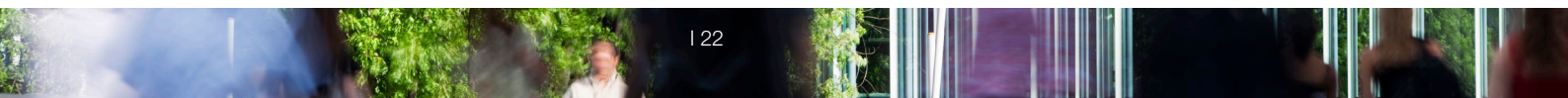
ERC projects address these ecosystems across the world, with perspectives across scientific domains and varied themes. They look at the evolution of wild populations, soil health, the role of water in these environments, they take cues from environmental history or propose solutions to better manage and effectively protect biodiversity in these areas.

- **Drylands** cover about 40% of the world's land surface, hosting many endemic plant and animal species and supporting 38% of human population. Due to their reliance on rainfall and soil fertility, they are particularly susceptible to climate change and desertification. The BIOCOM project investigated the **role of biodiversity** in enhancing the ability of drylands to maintain essential functions. The team also examined how the attributes of drylands biotic communities will affect ecosystem responses to global environmental change. The researchers studied drylands across all continents but Antarctica and found that plant species' diversity is crucial to maintain the drylands ecosystem functioning, including their soil health and fertility. The project was followed by another one, BIODESERT, that studied **desertification drivers and processes in dryland ecosystems**. Among other results, the team built a first **global atlas of soil bacteria** and fungi and identified ecosystem **thresholds** beyond which systemic and abrupt ecological changes can occur. Read more and visit the team's website.

IPBES

- The PALAEODESERTS project studied **how climate change influenced human occupation and migration** in the Arabian Peninsula over the last 500,000 years. The researchers speculated that Arabia's landscapes underwent transformations over time and that it could have served as a significant migration route, but little was known prior to the project. The project started by employing computer simulations and satellite imagery to identify **habitable areas and ancient water bodies** in the region. The surveys and subsequent excavations of hydrology maps have yielded significant discoveries, leading to the identification of multiple exceptionally preserved archaeological and paleontological sites dating back 500,000 years. New sites with fossils and stone tools were discovered along ancient lakeshores and rivers, revealing lush landscapes with freshwater lakes, grasslands, and trees in the past. Animals and early humans migrated across Arabia during wet periods and no animal or human presence was observed during arid periods, indicating population decline or migration due to harsh conditions. Read more and visit the project website.

- Coastal dunes fulfil several environmental functions that include absorbing storm wave energy, removing pollutants, capturing carbon, purifying water, and supporting various socio-economic activities. They are now protected environments, but this was not the case in the past. In the 18th century in many regions, fences were built, and trees planted to trap coastal dunes and reduce the volume of sand being taken inland, silting rivers, and destroying villages. The DUNES project looks at the **environmental history of dunes** to better understand how to best rehabilitate these ecosystems. Combining knowledge from natural and social sciences and physics and engineering, the researchers have gathered historical information on dunes in many parts of the globe into a database that will offer a comprehensive view on the interactions of humans and dunes during the last three centuries. Read more on the project's website.



Freshwater ecosystems

Freshwater ecosystems include rivers and lakes and more generally the networks of running and standing waters that link land to the sea.[23] ERC projects cover for instance the monitoring of aquatic biodiversity in the BIOTIME project, to social-ecological linkages as in the SES-LINK project (both described earlier). Projects also study the impact of habitat fragmentation on biodiversity or vegetation effects on water flow and mixing. Finally, some projects investigate the management of fishing activities, flood prevention or more generally water management.

- LeDNA aims to develop a new method for monitoring biodiversity on large spatial scales, using environmental DNA (eDNA) caught up in lakes. eDNA is an effective method to provide information about fish communities in large lakes, the team explores, thanks to modelling and field expeditions, how to **use eDNA to measure distributions of animal and plant species**. They are testing whether lakes accumulate eDNA transported by rivers. If so, sampling eDNA in lakes would become a more cost effective and quicker way to survey biodiversity. Read more.

IPBES

- The RINEC project focused on river basins and how **river networks** and water resource management affect **biodiversity**. It also studied the impact of river systems on populations via **water-borne diseases** such as cholera and to what extent mathematical models could describe these diseases. The team found that their mathematical models were not only capable of forecasting the trajectory of future epidemics but also mapping ongoing outbreaks. The team also studied a mussel invasion in the Mississippi-Missouri river system. The models they created have shed light on the importance of river systems in global species movement and overall biodiversity. Read more.

Urban ecosystems

Urban ecosystems are cities and the surrounding social-ecological systems where most people live.[24] These environments are growing with urbanisation and have an impact on the health and wellbeing of their human inhabitants. Urban environments are mostly artificial but can include all other ecosystem types with their biodiversity in various proportions in the cities or the city fringes.

While urban ecosystems are those less addressed by ERC projects, more than 20 projects were identified as relevant. More than half of them come from social sciences, such as GREENLULUS project (described above under pillar 2), NicheNBS and RUN presented below. Some projects also study species in an urban context such as the ECOLIGHT project.

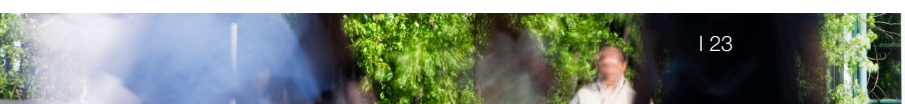
- **Nature-based Solutions** (NbS) are seen as promising solutions to design greener, more sustainable, and resilient cities. Inspired and supported by nature[25], they can bring both environmental and social benefits with healthier, happier residents. The Niche4NbS project aims to develop and test a new, interdisciplinary approach to foster the deployment of NbS and understand trade-offs and synergies between social and ecological outcomes. It could help urban planners **optimise co-benefits** and find a balance between biodiversity conservation, economic development, and social wellbeing. Read more on the team's website.

IPBES

- **Artificial night-time lighting** has increased due to human activity, particularly over the last 50 years and in urban regions. The ECOLIGHT project studied how this has affected the behaviour of a wide range of animals, such as moths, turtles and seabirds. The natural cycle of light and darkness is indeed crucial to animals' lunar clock and celestial compass. It affects foraging, predation, and migration behaviours, among others. The project found that night-time lighting changes the abundance of plants, herbivores, and predators. It further aimed to find ways of **balancing the human need for light and its effects on nature**. Read more.

IPBES

- The RUN (Rethinking Urban Nature) project aimed to challenge our understanding of urban nature and provide a new approach to urban ecology including insights into the cultural, political and epidemiological dimensions of urban space. In six cities world-wide, London, Berlin, Gothenburg, Tallinn, Lahore, and Chennai, the team studied **spontaneous, unplanned forms of urban nature** such as wastelands and marginal spaces rather than designed urban nature such as parks. The project found that cities often exhibit high levels of biodiversity due to different biotopes and connectivity to other cities; cities are also bound up with broader processes of global environmental change. Read more on the project website and watch their *Natura Urbana* documentary telling the post-war history of Berlin through its plants.



In a nutshell

This report presents the contribution of curiosity-driven research funded by the ERC to EU policies that aim to protect and restore biodiversity and ecosystems. More than 230 projects, selected for funding without predetermined priorities, address a wide range of research questions related to biodiversity, advance knowledge, and deliver solutions for the scientific community and policy makers. Funded without predetermined priorities, these projects were identified for their potential to inform biodiversity policies or because they had already demonstrated tangible impact through their results.

More than 80% of these projects were linked to the **pillars and actions of the EU Biodiversity Strategy for 2030**. Most projects were related to pillar two for restoring ecosystems with close to 140 projects. The pillar that was less addressed by ERC research is pillar one, focusing on EU protected areas. Nonetheless, more than 40 projects were linked to its actions and objectives.

Forests are the **ecosystem** that is most covered by the ERC biodiversity portfolio. Projects look at forests across the world as well as their relationship with climate change. Agroecosystems and marine ecosystems follow, and the least addressed ecosystem is urban ecosystem, which is covered by over 20 projects.

The report **highlights examples** of ongoing projects as well as results of finished projects with relevant results. These projects outcomes include new models, databases, methods, tools, scientific results, and policy recommendations available to researchers and policy makers. A subset of projects has also provided evidence that was cited in three reports of the last IPBES assessment cycle.

Finally, while this analysis focuses on projects funded under the EU's FP7 and H2020 Framework Programmes, several **Horizon Europe projects** have also been identified as contributing to climate, environment, and biodiversity policies and an analysis if those will follow in the future. For example, Horizon Europe projects aim at understanding the decline of biodiversity on islands, study how assisted migration of species can be used to design functional ecosystem of the future or look at how animals rebound from wildfires and what we can learn from their recovery techniques.

Acknowledgements

We would like to thank ERCEA colleagues Carmen Garcia Fernandez and Mike Mugabushaka for their guidance and support, and Michel Chaduteau for designing a tool that helped complement the portfolio of projects for this analysis, which was led by Noélie Auvergne and Jannik Sielmann. We are grateful to the ERCEA Feedback to Policy (F2P) network and Scientific Officers for their valuable contributions. We would also like to thank colleagues from the European Commission DG Research and Innovation, Unit B3 Climate & Planetary Boundaries of Directorate B Healthy Planet, as well as from the Joint Research Centre's Knowledge Centre for Biodiversity for the close collaboration and valuable input.

Further reading

This report was built on two ERC datasets that were represented in the following publication:

Using the ERC internal classification of projects “Mapping Frontier Research (MFR), the first one led to a factsheet ERC research contribution to the EU Green Deal:

- European Research Council Executive Agency, ERC frontier research contribution to the European Green Deal, 2022,

Using the same dataset, the ERCEA recently published a report focusing on ERC research on sustainable food production of consumption, with several projects bringing insights at the intersection of the food and biodiversity research:

- European Commission, European Research Council Executive Agency, Mapping ERC frontier research sustainable food production and consumption, Publications Office of the European Union, 2023,

The second dataset was the basis for the bibliometric analysis of the European Commission DG Research and innovation:

- European Commission, Directorate-General for Research and Innovation, Mugabushaka, A., Linking research to global biodiversity policies – How did the EU research funding contribute to recent IPBES reports?, Publications Office of the European Union, 2023,

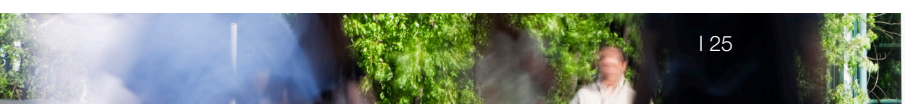
Other efforts that offer a mapping of research and innovation actions relevant to the EU Biodiversity Strategy for 2030 include the European Commission’s Joint Research Centre (JRC) report that presents the results of an analysis of EU-funded research projects contributing biodiversity policy, based on keyword searches in the projects titles, and abstracts using text mining tools.

- European Commission, Joint Research Centre, Parracciani, C., Ganisheva, K., Ventocilla Jaramillo, J. et al., Mapping interlinkages between EU-funded research projects and EU policy priorities – Application of the TIM open access tool to case studies in the context of the EU Biodiversity Strategy for 2030, Publications Office of the European Union, 2022,

More publications and more information on this work can be found on the EU research project-policy link explorer of the European Commission’s Knowledge Centre for biodiversity (KCBD).

More information can be found on the European Commission’s web pages on the EU support to biodiversity research and innovation and to Nature-based solutions, including with ERC grants.

List of Figures



Endnotes

1 https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-law_en
2 https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en
3 https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-law_en
4 https://www.cbd.int/gbf/
5 https://www.ipbes.net/assessing-knowledge
6 The evaluation of applications to ERC grants is conducted by peer review panels organised in three domains: Life Sciences (LS), Physical sciences and engineering (PE) and Social sciences and humanities (SH) described in ERC panel structure: https://erc.europa.eu/sites/default/files/2023-03/ERC_panel_structure_2024_calls.pdf
7 Mapping Frontier Research (MFR) https://erc.europa.eu/projects-statistics/mapping-erc-frontier-research-overview
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9 https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en
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13 https://www.ipbes.net/global-assessment
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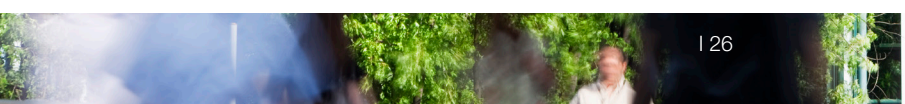
21 Ibid.
22 Ibid.
23 Ibid.
24 Ibid.
25 The European Commission defines nature-based solutions as “Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions.” Nature-based solutions must therefore benefit biodiversity and support the delivery of a range of ecosystem services. https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en The United Nations Environment Programme also defines NbS here (UNEP/EA.5/Res.5).



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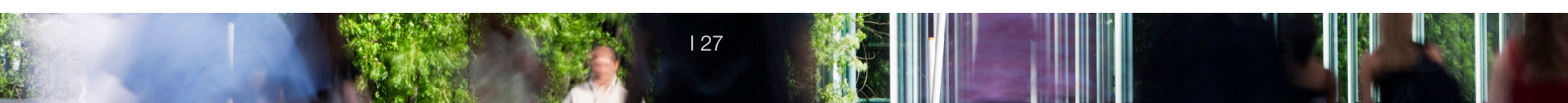

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