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# HOW GEOSCIENCE CAN SUPPORT THE **EUROPEAN GREEN DEAL**

An informative document for  
policymakers and geoscientists

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The **European Green Deal** is a roadmap for turning climate and environmental challenges into opportunities to make the EU's economy environmentally sustainable. The Green Deal sets ambitious targets, including reaching **climate neutrality** in Europe by 2050; preserving and protecting biodiversity; and adopting a zero pollution action plan for air, water, and soils.

This document focuses on two of the Green Deal's main policy areas: biodiversity and pollution. It highlights key aspects that the geoscience community, through its research and expertise, can support within these policy areas and provides examples of recent scientific breakthroughs that may assist in meeting the Green Deal's ambitious targets.

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## WHAT IS THE EGU?

The **European Geosciences Union (EGU)** is the leading organisation for Earth, planetary, and space science research in Europe. With our partner organisations worldwide, we foster fundamental geoscience research, alongside applied research that addresses key societal and environmental challenges. Our vision is to realise a sustainable and just future for humanity and for the planet. The expertise of our 20,000 members spans many key scientific disciplines relevant to the Green Deal, including soil science, hydrology, biogeoscience, climate change, natural hazards, and energy resources.





# BIODIVERSITY LOSS

Biodiversity encompasses the variety of living organisms on Earth, including their habitats and their interactions. Biodiversity supports our food system, increases community resilience, and underpins more than half of global GDP<sup>1</sup>. Yet despite biodiversity's importance, preserving and restoring it remains a complicated task due to the numerous natural and human factors that influence and affect species richness.

The five key drivers of biodiversity loss are: changes in land and sea use; overexploitation; climate change; pollution; and invasive species<sup>2</sup>. The EU Commission's [EU Biodiversity Strategy for 2030](#) aims to put European biodiversity "on the path to recovery" by addressing these drivers through regulation combined with action by citizens, businesses, and the scientific community<sup>3</sup>.

The [EU Biodiversity Strategy for 2030](#) outlines two clear steps to put biodiversity on the path to recovery:

## 1. Widening the Network of Protected Areas

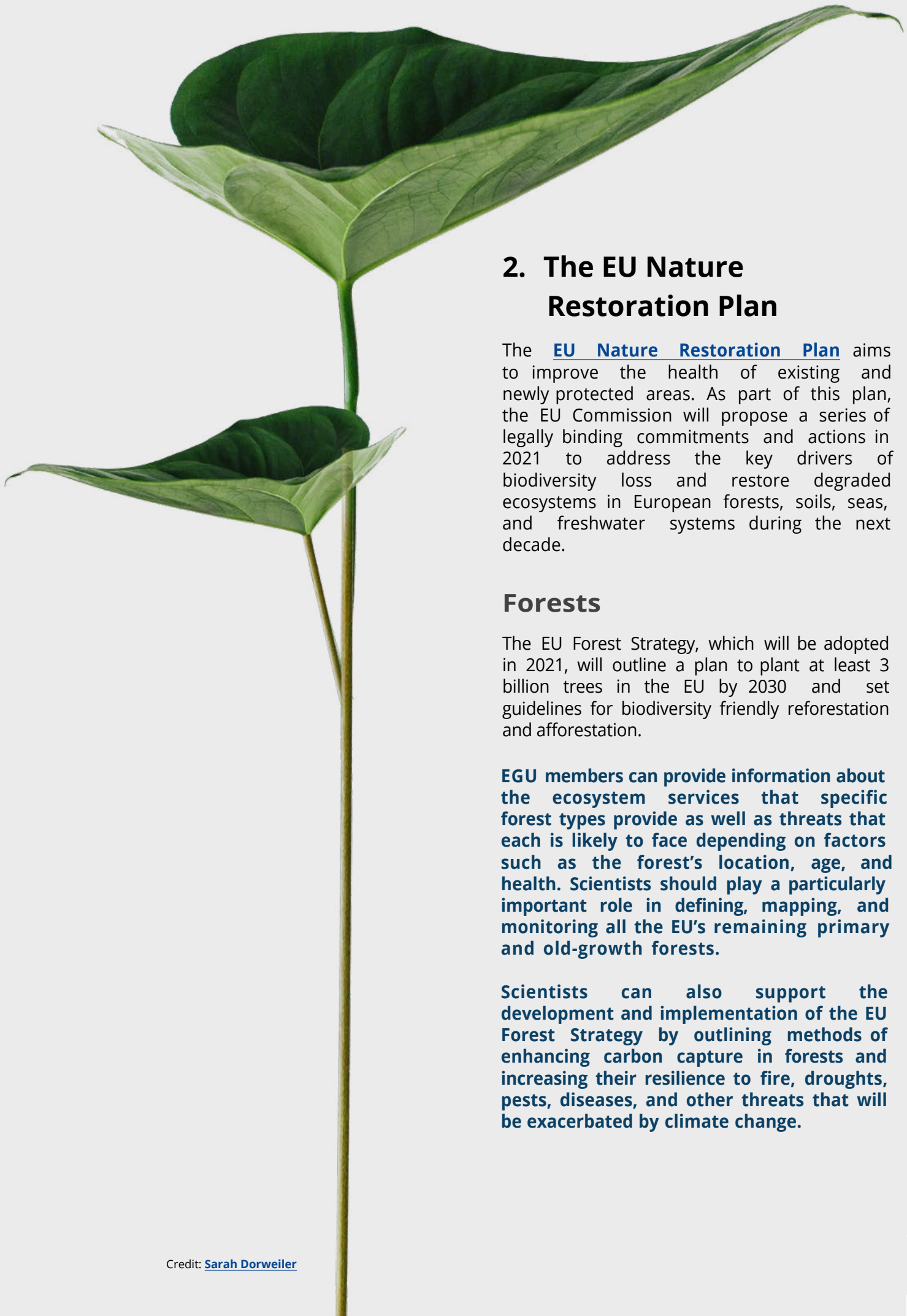
The [Natura 2000 network](#) is the largest coordinated network of protected areas in the world, covering 18% of EU land and 8% of its coastal waters. Following guidance from the [latest scientific](#) studies, the EU Biodiversity Strategy for 2030 aims to increase the EU-wide network of protected areas to 30% for both land and sea, with 10% of each being strictly protected. The strategy also acknowledges the need to establish ecological corridors to prevent genetic isolation.

**In addition to providing advice about which areas of land and sea should be protected, scientists can define the range of benefits that particular ecosystems provide, including the carbon storage capacity of different ecosystems. Peatlands, for example, are crucial because globally they sequester 0.37 gigatons of carbon dioxide per year, more than all other terrestrial vegetation types combined<sup>4</sup>.**

**Experts from [EGU's Division on Biogeosciences](#) can provide information about the relative importance of particular habitats and steps that could be taken to protect or restore them, as well as outline potential threats that individual protected areas face.**

**Once individual Member States have designated areas to be protected, scientists can also help highlight steps that can be taken to ensure their conservation and assist with comprehensive ecosystem monitoring to confirm that progress towards their stated goal is being made.**

**Incorporating innovative ecosystem monitoring strategies, such as [new year-round sensor technologies](#), could reduce the cost of this monitoring and improve its overall effectiveness.**



## 2. The EU Nature Restoration Plan

The [EU Nature Restoration Plan](#) aims to improve the health of existing and newly protected areas. As part of this plan, the EU Commission will propose a series of legally binding commitments and actions in 2021 to address the key drivers of biodiversity loss and restore degraded ecosystems in European forests, soils, seas, and freshwater systems during the next decade.

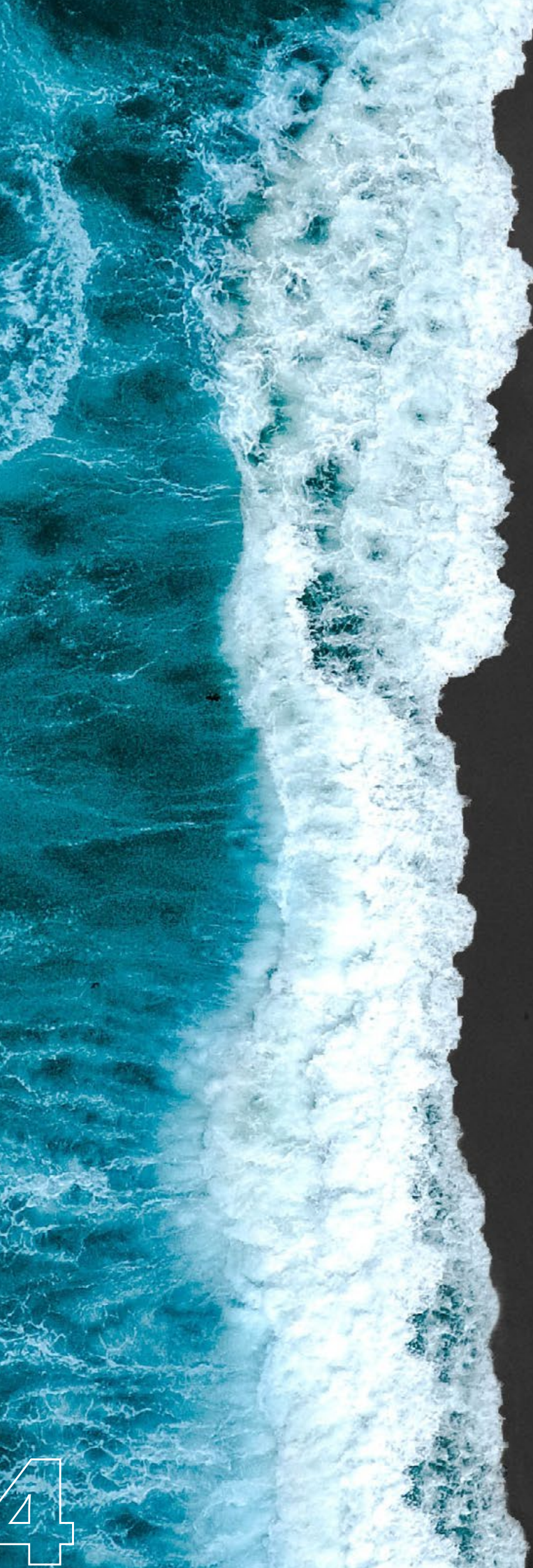
### Forests

The EU Forest Strategy, which will be adopted in 2021, will outline a plan to plant at least 3 billion trees in the EU by 2030 and set guidelines for biodiversity friendly reforestation and afforestation.

**EGU members can provide information about the ecosystem services that specific forest types provide as well as threats that each is likely to face depending on factors such as the forest's location, age, and health. Scientists should play a particularly important role in defining, mapping, and monitoring all the EU's remaining primary and old-growth forests.**

**Scientists can also support the development and implementation of the EU Forest Strategy by outlining methods of enhancing carbon capture in forests and increasing their resilience to fire, droughts, pests, diseases, and other threats that will be exacerbated by climate change.**





## Oceans

The EU Biodiversity Strategy for 2030 highlights the socioeconomic benefits of healthy marine ecosystems for coastal communities and the EU as a whole. It also acknowledges the growing need for action to protect these areas due to the effects of climate change exacerbating marine and coastal ecosystem biodiversity loss. As part of this strategy, Member States have been asked to deliver **national maritime spatial plans** by 2021. These should cover all maritime sectors and activities, as well as local conservation-management measures.

Research from **ocean scientists** can supplement the technical support that the EU Commission is currently providing to Member States. This information can help highlight unexpected threats to biodiversity such as the North Sea's **increasing turbidity**, which appears to already be impacting this ecosystem's **primary production**, as well as its **decreasing dissolved oxygen levels** that have been primarily attributed to global warming and increased nutrient input. Ocean scientists can also contribute to other crucial aspects of ocean biodiversity, such as the **degree and impact of ocean acidification**.

## Soils

A large proportion of terrestrial biodiversity is hidden underground. Soil biodiversity enhances the entry and storage of water, raises resistance to soil erosion, and improves nutrient cycling and retention, and is therefore essential for maintaining healthy soils and the ecosystems they support<sup>5</sup>.

Soil biodiversity is threatened by the five key drivers of biodiversity loss as well as urbanisation (which typically increases **soil sealing**), poor or unsustainable farming practices, and industrial activities<sup>6</sup>. The Green Deal aims to increase and restore soil biodiversity through the implementation of the EU Biodiversity Strategy for 2030, the **Farm to Fork Strategy**, and the new Common Agricultural Policy. These strategies aim to improve farming techniques, protect soil fertility, reduce soil erosion, boost soil organic matter, limit the use of pesticides, and increase the EU's organically farmed agricultural land to 25% by 2030.



Geoscience research techniques can help accomplish these aims. **Soil system scientists** can provide information about soil biodiversity and propose agro-ecological approaches that can optimise carbon sequestration and crop yields<sup>7</sup> and minimise soil degradation caused by contamination, compaction, erosion, and desertification. Research in these areas has the potential to enhance the upcoming revision of the European Commission's **Thematic Strategy for Soil Protection** by providing best-practice assessments and detailing innovative techniques for understanding, improving, monitoring, and modelling soil quality and health. Utilising **satellite data for irrigation and soil management**, for example, can improve farming efficiency while reducing its impacts on soil health and biodiversity.

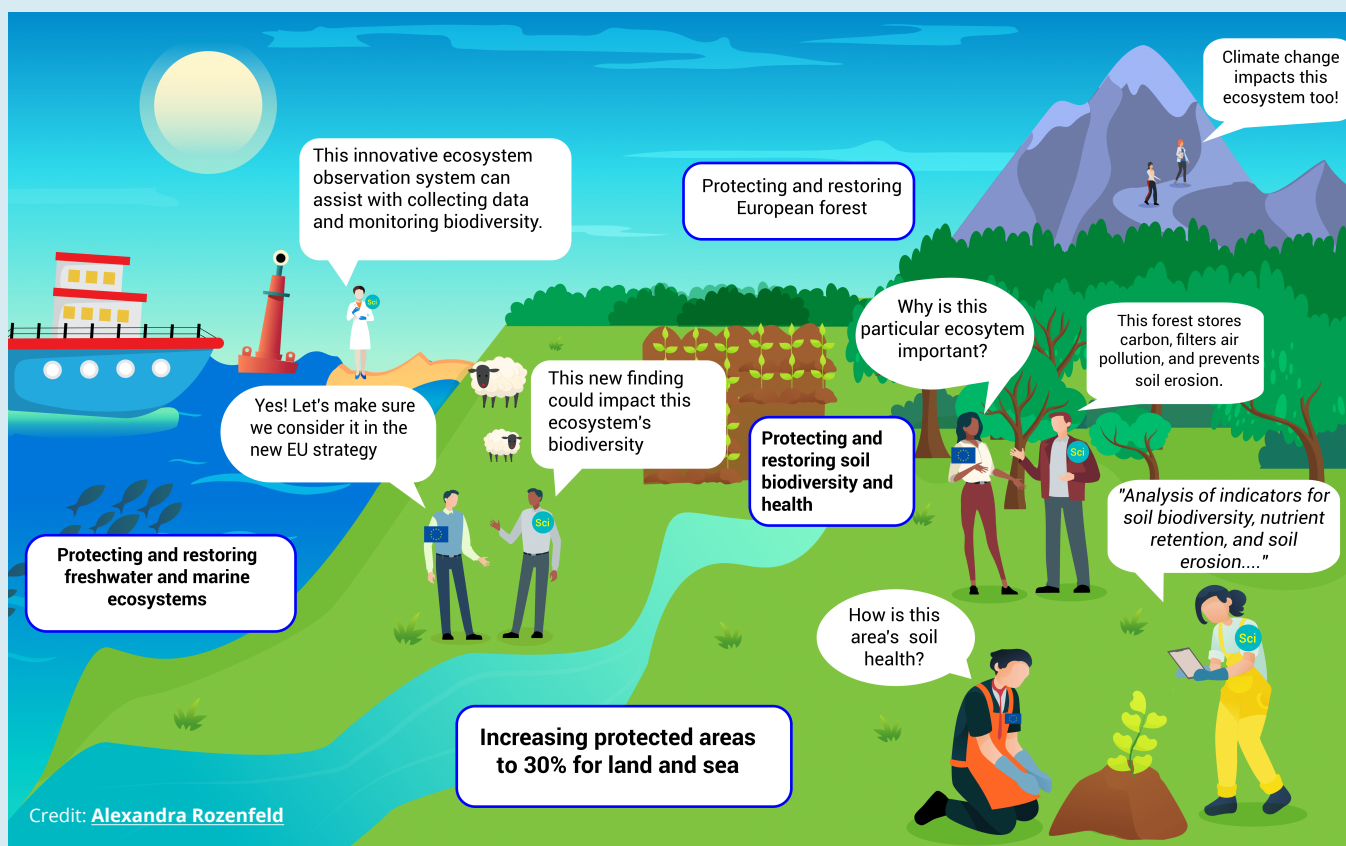
## Freshwater systems

To restore fresh water ecosystems and accomplish the objectives outlined in the **EU Water Framework Directive**, the EU Biodiversity Strategy for 2030 also sets a

target of restoring at least 25,000 km of rivers, floodplains and wetlands by 2030.

**Hydrological sciences** can directly support these goals by providing information regarding the sustainable management of water resources, assisting with river-basin management, and monitoring fresh-water ecosystems.

Hydrologists can, for instance, quantify water fluxes, evaluate the impacts of climate and land-use change on freshwater ecosystems and outline how the structure of river networks and fluvial processes affect biodiversity and enhance conservation strategies<sup>8</sup>. One example comes from a **recently published study** that outlined how a future shift in extreme flows in Switzerland's Alpine region could have negative economic, social, and ecological effects throughout that area. By understanding these changing hydrologic patterns and their impacts on ecosystems, such research can facilitate more effective and integrated water-resource planning and management.



How geoscience can support the EU's biodiversity targets. See [Appendix 1](#) for a conceptual mind map.



# ZERO POLLUTION AMBITION FOR AIR, WATER, AND SOIL

The [Green Deal's Zero Pollution Action Plan for Air, Water and Soil](#), to be adopted in 2021, will address the serious problem of pollution, which can be hazardous to wildlife, human health, and the environment. The Zero Pollution Action Plan aims to both prevent the generation of pollution and to implement measures to remedy it. The following section highlights how geoscientists can help identify and address some of the key challenges outlined in this plan.

## Air

It is well established that air pollution harms human health and the environment and affects climate by scattering or absorbing sunlight and impacting cloud formation<sup>9</sup>. To minimise the impacts of air pollution, the EU's 2013 [Clean Air Policy Package](#) and [Ambient Air Quality Directives](#) have defined air-quality standards as part of a broader strategy to improve air quality across Europe. Although these policies have been partially effective, they have not resulted in sufficient action to meet the air-quality standards in many regions<sup>10</sup>. Furthermore, the [2019 Fitness Check](#) indicates that Europe's current air-quality standards should be updated to include additional pollutants not covered by the current directives, such as ultrafine particles and black carbon.

**[Atmospheric Sciences](#) researchers can provide expertise to define more ambitious standards that will bring Europe closer to the air-quality guidelines established by the [World Health Organisation](#).**

EGU members are experts in issues such as emissions of primary pollution, formation and transport of [secondary pollutants](#), and the effects of individual pollutants such as [black carbon](#), which can also be harmful to human and ecosystem health. Innovative atmospheric science research can improve [environmental-sensing methods](#) and modelling and also help to minimise the economic, social and environmental [impacts caused by airborne pollutants](#).

The presence of pollutants in European waters not only threatens freshwater ecosystem biodiversity but also raises concerns for public health. In 2015, 53% of waterbodies in the EU showed a good/high ecological status<sup>11</sup>. In 2019, a [Fitness Check of the EU's current Water Framework Directive](#) found that although the directive is flexible enough to accommodate emerging challenges such as climate change and microplastics, legislation regarding chemical pollution requires improvement.

A [Chemicals Strategy for Sustainability](#) is subsequently being supported as part of the Green Deal Action Plan. This strategy aims to better protect people and the environment from hazardous chemicals, encourage the development of safe and sustainable alternatives, and facilitate more efficient trading of safe chemicals within the EU.





EGU experts in [hydrological](#) and [biogeosciences](#) can provide in-depth insights on particular sources of aquatic pollution, such as organic or nutrient pollution from farming, wastewater treatment facilities, or fertilised lands in urban areas. Recent studies also address key topics and techniques relevant to ensuring the Water Framework Directive's success and reducing surface and groundwater pollution, including [a novel approach for real-time monitoring of nitrate in soils](#), [the potential for using Earth observations to track pollution and flood propagation](#), and techniques for [non-point source pollution measurements](#).

## Ocean and coastal waters

Marine pollution is difficult to manage due to its wide variety of direct and diffuse sources and its dispersal via ocean currents. A 2020 report on the first implementation cycle of the [Marine Strategy Framework Directive](#) outlined the need for more action to combat plastic litter, excess nutrients, and underwater noise. By incorporating the best-available science, the Green Deal's upcoming 2021 Action Plan to conserve fisheries resources and protect marine ecosystems has the potential to support the Marine Strategy, enabling Europe to achieve a [good environment status](#) and maintain healthy fish stocks.

A [recent review of the environmental threats and gaps in European coastal monitoring programmes](#) highlighted the need for increased monitoring efforts, better monitoring design, and stronger linkages with research and new technologies. EGU's Ocean Sciences Division can help define new guidelines, suggest improved monitoring programmes, and help policymakers consider the cumulative effects of the many pollution sources and human pressures that are degrading Europe's marine ecosystems. Recent research can also help define the causes and impacts of specific ocean pollution, which may assist in the design of more integrated pollution management strategies. For example, scientists [can track how plastic travels through ocean currents](#) and explain the [effects of ship emissions on air quality](#) in specific regions.



## Soil

Soil contamination impacts soil, ecosystem, and human health and continues to be a concern throughout Europe as evidenced by the approximately 2.5 million<sup>12</sup> sites where potentially polluting activities have occurred. The sources of contamination vary by region but are most frequently associated with agriculture, industry, inadequate waste disposal, and mining. There is some evidence of slow progress in the remediation of contaminated sites, and this success should be further supported by upcoming EU initiatives, including the [Chemical Strategy for Sustainability](#), 2022 Integrated Nutrient Management Action Plan, and 2021 Soil Thematic Strategy.

**Soil system scientists can bolster the EU's upcoming strategies by improving methods to reduce contamination and helping to implement innovative monitoring and remediation techniques. In particular, soil system research can help farmers reduce nutrient leakage as well as trace sources of contamination whose presence even in low concentrations can adversely affect microorganisms crucial for maintaining soil health. EGU experts can also provide research on novel agricultural techniques that minimise nutrient leakage as well as insights into lesser-known causes of contamination and their impacts such as [the prevalence and impacts that microplastics and microglass can have on soil microorganisms](#).**



**How geoscience can assist in the EU's zero pollution targets.** See [Appendix 2](#) for a conceptual mind map.

## CONTINUED SUPPORT

The EGU fully supports the European Green Deal's ambitious targets for climate neutrality, preserving and protecting biodiversity, and zero pollution. As Europe's largest geoscience society, the EGU is uniquely positioned to facilitate the transfer of knowledge from research into practice and to connect policymakers to the most relevant geoscience experts. The EGU is also available to serve as a scientific translator by holding meetings and writing fact sheets, white papers, and other summary documents to help policymakers understand the legislative relevance of ground-breaking geoscience research.





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For more information about the EGU and how to access our members' expertise, please contact [policy@egu.eu](mailto:policy@egu.eu).

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