



Federal Ministry
for the Environment, Nature Conservation,
Nuclear Safety and Consumer Protection

Federal Action Plan on Nature-based Solutions for Climate and Biodiversity

Draft

Draft: Federal Action Plan on Nature-based Solutions for Climate and Biodiversity

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Preface



Heat, drought, forest fires – this summer has shown once again that the climate crisis has arrived in Germany. It is high time for us to respond, taking precautionary action with the help of nature. We need, for example, more natural forests, greener cities and more water in our landscapes.

With the launch of the participatory process for the Federal Action Plan on Nature-based Solutions for Climate and Biodiversity, we are driving a key element of the German government's climate policy further forward. The goal is to strengthen, restore and preserve ecosystems so they can mitigate climate change and serve as valuable habitats for plants and animals. This will enable us to leverage synergies and tackle global heating and biodiversity loss together.

The Action Plan does not stand alone, but is closely linked to other programmes of the German government. For example, it includes concrete measures for implementing the Immediate Climate Action Programme for the LULUCF sector. With the National Water Strategy, it shares the goal of ensuring a near-natural water balance.

The Action Plan will mainly be funded by the new Climate and Transformation Fund. Four billion euros are available until 2026, which will make important investments possible in Nature-based Solutions for climate and biodiversity.

Another key to success is broad participation in order to benefit from the greatest possible expertise and to gain as many supporters as possible. Many suggestions and ideas from other stakeholders and ministries have already been incorporated into this first draft, making it a good example of constructive collaboration within the German government. I would like to express my gratitude for this.

We are now opening up the discussion to suggestions from the Länder, associations and the public. We will evaluate their comments and fine-tune the draft, after which final approval will take place within the German government. The cabinet decision is expected in early 2023 so full implementation can begin right away. I look forward to all ideas and input.

A handwritten signature in blue ink that reads "Steffi Lemke". The signature is fluid and cursive.

Steffi Lemke

Federal Minister for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

Nature-based Climate Action¹ – preserving ecosystems and tackling the climate crisis

Two existential crises are threatening the natural foundations of our lives: the biodiversity crisis and the climate crisis. The biodiversity of our planet's ecosystems has declined dramatically in recent decades. At the same time, the average temperature has already risen by 1.2 °C from pre-industrial levels, with devastating consequences for nature and people. Both crises are the direct result of human activities such as burning fossil fuels and the consumption of natural resources. As the landscape changes due to our intensive economic activities, habitats are becoming more susceptible to the impacts of the climate crisis, and biodiversity loss is increasing in practically every ecosystem. Enormous efforts are needed to stop species extinction and limit global warming to 1.5 °C.

There is no doubt that the biodiversity crisis and climate crisis are closely linked: global warming is changing living conditions so fast that ecosystems cannot keep up and are becoming increasingly fragile. Plant and animal species cannot adapt to these changed conditions and are dying out in many places. And degrading ecosystems are releasing the carbon that has been sequestered in them for thousands of years at an extremely rapid rate – making the climate crisis self-perpetuating.

To tackle this dual crisis, nature conservation and climate action must be more closely aligned, giving rise to synergies that can be leveraged. The central pillars are the preservation, renaturation and restoration of natural ecosystems. Natural and near-natural habitats will be preserved and new habitats created on managed areas by transitioning to sustainable and near-natural forms of use. These areas will provide habitats for an abundant and diverse range of flora and fauna. At the same time, when ecosystems are durable, they can serve as carbon reservoirs and sinks, as they can remove carbon dioxide from the atmosphere and sequester carbon over the long term. In residential areas, sufficient green spaces, building practices that minimise land use and a reduction in land sealing can significantly contribute to preserving the ecological functions of the soil and mitigating the impacts of climate change. In addition, near-natural, diverse ecosystems can generally cope better with changes caused by the climate crisis because they are more resilient. In particular, their capacity for water storage enables them to cushion the effects of extreme weather events, especially heavy rainfall and drought.

¹ Throughout this document, the German term “Natürlicher Klimaschutz” will be translated as either “Nature-based Climate Action” or “Nature-based Solutions [for climate and biodiversity]”, according to the respective context. Thereby, “Nature-based Climate Action” refers to the policy level while “Nature-based Solutions [for climate and biodiversity]” refers to the actual measures taken. I.e., Nature-based Climate Action is the policy of implementing Nature-based Solutions for climate and biodiversity.

The Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) emphasises the urgent need for immediate action, as we are on the verge of reaching critical global tipping points. Beyond these tipping points, impacts become unstoppable, and ecosystems are irretrievably lost. We must change course as quickly as possible – and transition to a sustainable way of life that preserves near-natural ecosystems as an indispensable foundation of life and contributes to achieving the 1.5 °C target. Nature-based Climate Action plays a key role in these efforts.

What is Nature-based Climate Action?

Nature-based Climate Action begins where biodiversity conservation and climate action intersect. Nature-based Climate Action does not look at individual measures in isolation, but deliberately seeks to create synergies between climate action and nature conservation to generate win-win outcomes. For this, it employs Nature-based Solutions for climate and biodiversity (NbS) in both natural environments and settlement areas.

NbS directly protect, strengthen and restore natural ecosystems. It is important to take an integrated approach: measures that have a direct impact on net greenhouse gas emissions are just one of several components. It is equally important to strengthen the resilience of ecosystems to the impacts of the climate crisis. Moreover, NbS establish the conditions needed for such measures through actions ranging from assessing ecosystem status and determining the causes of degradation to developing suitable countermeasures.

NbS often also help adapt to the impacts of the climate crisis. A near-natural water balance that keeps water in the landscape, for example, is needed to rewet peatlands and other wetlands. At the same time, these solutions prevent droughts and create retention areas to protect against local flooding after heavy rainfall events, which will occur in future with greater intensity and frequency.

Goals of the Action Plan

The German government's Federal Action Plan on Nature-based Solutions for Climate and Biodiversity aims to lay the groundwork for significantly improving the general condition of ecosystems in Germany and their climate mitigation performance. Under the Action Plan natural terrestrial and marine environments will become more resilient, more structurally rich and more natural. Agriculture and forestry will become more sustainable and allow space for a more diverse range of flora and fauna on managed areas. Sustainability also means involving local communities as partners and participants, because the people who manage

land and those responsible in municipalities and cities know what is most urgently needed. The measures in the Action Plan therefore focus on support and incentives.

Only healthy and stable ecosystems can make a long-term contribution to climate change mitigation. In 2021, the amendment to the Federal Climate Change Act set for the first time specific targets for terrestrial ecosystems, which are captured in the total net emissions of the land use, land use change and forestry (LULUCF) sector. The target for average net emissions in this sector for the period 2027-2030 is minus 25 million tonnes of CO₂ equivalents per year. This means that every year the LULUCF sector must remove and permanently store as biomass 25 million tonnes more CO₂ equivalents than it emits, e.g. from drained peatlands. The targeted net emissions for the period 2037-2040 is minus 35 million tonnes of CO₂ equivalents and for the period 2042-2045 minus 40 million tonnes of CO₂ equivalents. A comparable target for 2030 is currently on the table for the sector at EU level.

The Action Plan on Nature-based Solutions for Climate and Biodiversity is the German government's primary instrument for reaching these targets. To this end, the emissions attributable to the LULUCF sector have to be reduced as quickly as possible, and existing sinks that remove greenhouse gases from the atmosphere need to be stabilised and expanded.

A particular focus here is on drained peatlands and on forests. Drained peatlands are the largest source of greenhouse gas emissions in the LULUCF sector and need to be rewetted at a much faster pace. The National Peatland Protection Strategy calls for annual emissions in this sector to be reduced by five million tonnes of CO₂ equivalents by the year 2030. Forests, on the other hand, are the largest land-based greenhouse gas sink in Germany: they can permanently remove CO₂ from the atmosphere. However, the function of these sinks is in jeopardy due to the increasing frequency of droughts caused by the climate crisis and to the often one-sided management of forests geared solely towards timber production. This is why one aim is for forests to be restructured to become more species-rich and resilient. And 10,000 hectares of new forest will be created every year between 2023 and 2030.

The more natural and biodiverse ecosystems are, the greater their resilience, i.e. the more resistant they are to external influences, which will continue to intensify as the climate crisis progresses. The measures in this Action Plan are designed to strengthen the resilience of ecosystems to increasingly complex challenges. If we want to preserve nature in Germany in the long term, we must give it the opportunity now to recover and become healthy for the future.

Financing

In the coalition agreement, the coalition parties agreed to develop the Action Plan on Nature-based Solutions for Climate and Biodiversity and to provide sufficient funding from the Energy and Climate Fund (to be called the Climate and Transformation Fund in future). On this basis, budgetary heading 686 31 (Nature-based Solutions for Climate and Biodiversity) was created in the 2022 budget of the Energy and Climate Fund/Climate and Transformation Fund and allocated a total of 4 billion euros in the financial planning period through 2026.

The budgetary heading is earmarked for a wide range of NbS and will make a significant contribution to achieving the German government's Nature-based Climate Action goals. It will also be the most important financing source for measures launched under the Federal Action Plan on Nature-based Solutions for Climate and Biodiversity.

The Action Plan will also include existing measures and measures that do not require any financing or that are financed from other sources. However, a key focus of the Action Plan is defining new measures to be funded through the Energy and Climate Fund budgetary heading.

Links to other strategies and programmes

The Action Plan covers a wide range of content. It addresses a variety of different ecosystems with the aim of strengthening natural environments in Germany on a broad scale. For this reason, the Action Plan is linked to many other programmes and strategies of the German government. Thanks to their synergies, Nature-based Solutions can contribute to various goals and programmes of the German government at the same time. This Action Plan specifically incorporates existing NbS.

In particular, some NbS will comprise part of the Immediate Climate Action Programme for the LULUCF sector. This applies to measures that have a particular impact on the net emissions of the land use sector. Under the Action Plan these measures will be fleshed out in more detail and implemented.

The Action Plan measures will also be aligned in particular with the Immediate Action Programme for Climate Adaptation, the new version of the National Strategy on Biological Diversity (NBS), the German Sustainability Strategy for the implementation of the United Nations 2030 Agenda for Sustainable Development, the National Water Strategy, the National Peatland Protection Strategy and the planned Marine Strategy. It will also be coordinated with current, ongoing and planned federal funding programmes, for example the

Blue Belt Programme, the species support programme, as well as with the already existing Climate Action Plan 2050 and the Strategy for Adaptation to Climate Change.

There are also plans for an initiative to fast-track renaturation projects. This is intended to benefit implementation of the Action Plan and the other strategies and programmes mentioned. The goal is to shape the relevant legal framework in such a way that certain NbS and nature conservation projects can be implemented more quickly. Burdens on existing areas with high value for nature-based Climate Action or nature conservation will be reduced, thereby facilitating their preservation for the long term. Possibilities here could include priority rules in nature conservation, building, water, spatial planning and land consolidation legislation or lowering land-related taxes or obligations.

Close cooperation with the Länder is also important for the implementation of NbS. Especially in nature conservation, the Länder have key responsibilities and, most importantly, many years of experience in planning and implementing projects on the ground. One example of how the federal and state levels can work together efficiently is the Federation-Länder target agreement on climate change mitigation through peat soil conservation concluded in 2021.

There are also many processes, initiatives and agreements where NbS play an important role at EU and international level. These will be described in more detail in field of action 10.

Dialogue and participation

The transformation to sustainable and climate-neutral lifestyles has an impact on every area of life. That is why it needs broad public support. To ensure that the measures of the Action Plan are effective, there must be intensive and in-depth dialogue with all relevant stakeholders in administrations and associations, with farmers and foresters and with land managers, land owners and other affected groups. The experiences of local experts are particularly valuable.

In light of this, the BMUV is putting this draft of the Action Plan up for discussion in a broad participatory process. All affected or interested groups are invited to give their views on the scope and direction of the measures proposed here. This feedback will serve as an important basis for the final version of the Action Plan.

However, participation does not stop once the plan is finalised: many of the measures in the Action Plan include the involvement of local communities as a key element. Particularly where far-reaching changes in current land use are imminent, a sustainable transition towards more Nature-based Climate Action can only succeed if stakeholders work together.

In the case of peatland protection, for example, this is even explicitly enshrined in the coalition agreement.

Fields of action for Nature-based Solutions for climate and biodiversity

1. Protection of intact peatlands and rewetting

Peatlands store large amounts of carbon over long periods of time: the remains of dead plants do not immediately decompose – as in dry places – but slowly turn into peat under the surface of the water where the carbon remains stored. As ecosystems, peatlands provide habitats for unique animal and plant species, which depend on these special living conditions.

In Germany, however, 92% of peatlands have been drained. They are usually used as cropland or pasture land and for peat extraction. On contact with the air, the plant remains, which have accumulated over centuries and millennia, begin to decompose very quickly, releasing the trapped carbon as CO₂ in the process. These emissions amount to around 53 million tonnes of CO₂ equivalents annually, representing roughly 6.7% of total national greenhouse gas emissions. In addition to the considerable emissions when peatlands are drained, native flora and fauna are lost along with the regulating effect on the water balance. Peatlands can keep water in the landscape.

To reduce greenhouse gas emissions from drained peatlands, which are usually used for farming, the water levels have to be raised again and new, sustainable forms of use developed. But also most of the few remaining near-natural and unused peatlands have a poor conservation status. They need protection to ensure that they remain intact and can recover.

Measures

1.1. Implementing the National Peatland Protection Strategy

Ambitious peatland protection is a key component in climate action, biodiversity conservation, climate adaptation and sustainable water management and agriculture. The most pressing need for action in peatland protection is rewetting drained peatland soils used for agriculture and forestry. The implementation of the necessary peatland protection measures represents a major challenge and will require considerable staff and financial resources from the various stakeholders in the coming years. The National Peatland Protection Strategy addresses peatland protection from the perspective of nature, water and soil conservation as well as climate change mitigation and adaptation and looks at the

various options for use. It thus contributes directly to climate action and biodiversity conservation.

The National Peatland Protection Strategy defines the policy framework for all aspects of peatland protection in Germany and combines the various measures. It addresses all aspects that fall under the responsibility of the federal government and integrates the content of the Federation-Länder target agreement on climate change mitigation through peat soil conservation. It serves as the basis for peatland protection measures in the context of Nature-based Solutions and is intended for all relevant stakeholders. Implementing this strategy is a priority for Nature-based Climate Action.

Our actions:

We will implement the National Peatland Protection Strategy rigourously. The German government will work to:

- establish a pre-emptive right of the public sector to purchase peatlands
- develop and implement peatland protection measures on land owned by the federal government
- improve legal and funding policy instruments for peatland protection and peatland soil conservation
- analyse practical experiences of the Länder (spatial planning, peatland protection planning, land consolidation procedures) related to peatland protection and peat conservation

1.2. Implementing the Federation-Länder target agreement on climate change mitigation through peat soil conservation and launching the Programme ‘Climate Action through peatland protection’

In 2021 the Federation-Länder target agreement on climate change mitigation through peat soil conservation was signed and a greenhouse gas reduction target agreed for peatland protection. The agreement centres on measures for the large-scale rewetting of drained peat soils. To this end, cooperative and regionally tailored voluntary solutions will be developed and supported. The aim is for new forms of farming and forestry to be possible and promoted on these areas, even after water levels are raised. The packages of measures will be designed and implemented in close cooperation with the Länder to ensure that an annual emissions saving of 5 million tonnes of CO₂ equivalents is achieved in 2030.

Our actions:

We will establish a permanent Federation-Länder committee to monitor and coordinate implementation of the target agreement and to identify a priority list of measures for implementation.

We will develop programmes and funding instruments that specifically address the issues related to the use of drained peat soils for agriculture and forestry and promote large-scale rewetting and land use conversion (paludiculture).

1.3. Improving the condition of unused and protected peatlands and financing renaturation measures

Ambitious peatland protection is a key component in climate action, biodiversity conservation, climate adaptation and sustainable water management and agriculture. In peatland protection, priorities include rewetting drained peatland soils that are important for nature conservation, especially in protected areas, and improving the conservation status and restoring legally protected peatland biotopes and habitats of threatened species typical of peatlands. Despite various measures, it has not been possible in the past to stop or reverse the negative trend.

In the next few years, considerable improvements will be made through a number of measures and programmes tailored to the needs of nature and biodiversity conservation. Federal measures will complement and support the Länder's existing activities and be used to specifically promote the interests of the Natura 2000 protected area network.

Our actions:

In consultation with the Länder, we will develop programmes and funding that specifically address the needs of nature conservation in peatland protection (renaturation with the aim of restoring ecosystems typical of peatlands). To this end, a set of measures will be drawn up for peatland rewetting, maintenance and connectivity, especially in protected areas, but also outside them. The focus is on long-range initiatives at measure and project level.

1.4. Concluding suitable agreements with the Länder to fast-track the planning and approval process, also for peatland protection

The most pressing need for action in peatland protection is rewetting drained peat soils used for agriculture and forestry. It will be an enormous challenge to implement the necessary peatland protection measures. Implementation is usually hampered by long and complex

planning and approval procedures. The relevant legal regulations at federal and state level have not adequately reflected peatland protection concerns to date.

The National Peatland Protection Strategy has already identified various relevant measures, and there is an extensive need for action. In particular, suitable agreements with the Länder are needed to quickly implement the required rewetting measures. By identifying measures and, if necessary, making adjustments, the procedures can be speeded up and streamlined.

Our actions:

Working with the Länder, we will develop solutions to speed up and streamline procedures for rewetting measures. How peatland protection can be better integrated into spatial planning will also be assessed. We will determine whether designating priority or reserved areas for peatland protection would be useful and could help speed up procedures.

1.5. Creating new value chains for paludiculture and product marketing

To successfully establish alternative forms of agriculture, e.g. paludiculture, on rewetted, previously drained peat soils used for farming, there must be a market for the products. These products compete with other goods and agricultural products on the market.

As formulated in the National Peatland Protection Strategy, different measures are needed, on the one hand, to support the production of these kinds of goods and, on the other, to stimulate demand. For reasons of resource efficiency, the focus will primarily be on material use.

Our actions:

We will take various goal-oriented measures and support private sector initiatives that develop sustainable products beneficial to society as a whole and sell these products on the market. We will use the lessons learned in the BMUV pilot projects and the BMEL model and demonstration projects for the development of new products and make them publicly available.

1.6. Phase-out plan for extraction and use of peat and developing alternatives

Ambitious peatland protection is a key component in climate action, biodiversity conservation, climate adaptation and sustainable water management and agriculture. Peat extraction and peat use, however, are a significant source of greenhouse gas emissions. Germany is a global leader in the area of potting soil and substrate production. A federal

strategy is needed that addresses both the use of peat and peat alternatives and creates a reliable and predictable framework for all stakeholders.

The BMEL's peat reduction strategy aims to set the policy framework for peat use in Germany and pools the various measures at federal level. For a largely smooth transition to peat-free soils, a planning timeline for commercial horticulture is needed for large-scale substitution by 2030. Peat use needs to be phased out of private gardening by 2026. Peat use will be reduced through agreements and voluntary measures.

This will require significant effort to identify and provide suitable peat alternatives. There is still a considerable need for research into alternatives for peat substrates in gardening. The BMEL is continuing to develop a set of measures together with its research institutes to make it possible to phase out peat use in private gardening by 2026 and to largely phase out peat use in commercial horticulture on the basis of voluntary measures by 2030.

Our actions:

We will quickly adopt the peat reduction strategy and implement the measures. In particular, we will continue dialogue with the potting soil industry and launch an information and education campaign on the use of peat alternatives.

2. Near-natural water balance with vibrant rivers, lakes and floodplains

Intact water bodies – rivers and lakes – and their floodplains are hubs of biological diversity. Rivers and their floodplains can play a particularly important role in the biotope network. However, many rivers have been straightened and are practically cut off from their floodplains. Today, a good third of active floodplains are used for arable farming, settlements, transport infrastructure or commercial activities. Only nine percent of floodplains are ecologically intact.

In the protection of water bodies, particular advantage can be taken of the synergies of Nature-based Solutions: restoring water body systems and reconnecting floodplains secures refuges for a range of flora and fauna. Moreover, floodplains filter surface water and keep it in the landscape, thus preventing droughts. They provide flood protection in the form of retention areas.

As the climate crisis progresses, the availability of water is moving increasingly towards extremes: on the one hand, summers are becoming drier and there are more droughts. On the other hand, local heavy rainfall events occur with greater frequency and intensity, which can lead to disastrous flooding as was the case in July 2021. These diverse impacts show that we need to fundamentally realign water management goals.

The aim is to keep more water in the landscape and scale back the rapid drainage of large areas. This not only helps to prevent local floods, droughts and forest fires. A larger and more evenly distributed supply of water also makes the existing ecosystems more resilient. It is often even the basic prerequisite for more extensive renaturation and restoration measures, e.g. rewetting peatlands.

Measures

2.1. Establishing sustainable and near-natural landscape hydrology

Near-natural landscape hydrology (e.g. in water bodies, forests and large wetlands/peatlands) ensures that the soils, wetlands and water bodies contain or supply enough water, even in extended dry periods. To preserve or restore near-natural landscape hydrology, the water management of the entire catchment area must be assessed and adapted in such a way that greenhouse gas emissions are prevented. The functions of the soil, too, must be protected or restored in order to maintain the water balance. Guiding principles for regional, near-natural water balances are of utmost importance for the design and goals of implementation strategies, e.g. for regional water supply plans.

The impacts of the climate crisis and a diminishing water supply will affect agriculture and forestry in particular, to a varying extent from region to region. In dialogue with practitioners from agriculture, forestry, water management and water conservation, recommendations and guidelines for joint models for water-optimised agriculture – with a view to climate adaptation – will be developed with the involvement of existing networks and taking into account the recommendations of the Commission on the Future of Agriculture.

Experts from water management, agriculture, forestry and nature conservation will jointly design training and education programmes for farmers and foresters. The education and training programmes will help reduce the negative impacts of agriculture and forestry on water bodies and raise awareness of the correlations between water-sensitive management and Nature-based Solutions.

Water body maintenance measures can provide targeted support for nature conservation, water conservation and Nature-based Climate Action. Training and education will contribute to environmentally compatible water body maintenance, which reconciles the interests of water management with those of agriculture, forestry and nature conservation.

Environmental education needs to focus more on the subjects of water, water conservation, groundwater and the water cycle. The aim is to create a nationwide network of educational institutions and experiential learning sites dedicated to water issues (similar to the nationwide

working group of state-supported educational institutions in nature conservation and environmental protection) that will advise training providers on the development of educational programmes.

For the design, support and evaluation of the individual measures, a project will be awarded externally to support the work units responsible for the implementation of the individual measures.

Our actions:

We will

- develop guiding principles for a regional, near-natural water balance
- conduct dialogue with practitioners from agriculture, forestry and water management
- develop education and training programmes for agriculture and forestry, vegetable farming and gardening
- enhance the expertise of those responsible for water body maintenance to develop a culture of integrated water body maintenance
- initiate a network of experiential learning sites dedicated to water issues

2.2. Federal programme of climate measures in water management and water body development

Near-natural water body development and a near-natural water balance are essential elements for a wide range of Nature-based Solutions, e.g. for rewetting peatlands or increasing forest cover. In light of this, we need a general improvement in water retention, a significant reduction in land sealing, measures for de-sealing and improving infiltration, decentralised rainwater management, especially in urban areas, a reduction in surface runoff and the integration of water management measures in urban development. These kinds of measures contribute to mitigating the impacts of the climate crisis, particularly the harmful effects of extreme weather events. They also have many potential synergies with the goals of the EU Water Framework Directive and for biodiversity conservation.

Funding will be provided in particular for measures in the Länder and municipalities to restore, renature and develop water bodies over the long term and to ensure a near-natural water balance by improving general water retention, infiltration and groundwater recharge. It is hoped that this will have positive effects on achieving the goal of good water body status as defined in the Water Framework Directive, for enhancing biodiversity (e.g. measures to

improve the passability of rivers) and for creating attractive living environments next to water bodies for local residents.

Our actions:

We will launch a federal programme for climate measures in water management and water body development and will begin implementing the first projects in 2024.

2.3. Renaturing, improving ecological quality and reconnecting of floodplains

Near-natural floodplains regulate run-off when water levels are high or low and can mitigate the impacts of the climate crisis on landscape hydrology.

At present, however, our floodplains, which are among the most species-rich ecosystems in Central Europe, are unable to fulfil their natural ecosystem and connectivity functions adequately. Two thirds of the floodplains throughout the country are cut off from potential inundation by dikes. 80% of the floodplain and water body habitats in Germany are under threat.

The immense potential of near-natural rivers and floodplains to absorb carbon and remove it from the atmosphere will be used for Nature-based Climate Action, climate adaptation and biodiversity conservation. Wherever possible, especially in protected areas, the aim is to preserve or restore rivers and floodplains to their natural state. Nature conservation, climate change mitigation and climate adaptation (flood protection) must always be addressed together and taken into account when measures are implemented. Reclaiming natural retention areas and changes in land use are particularly important in this context.

Our actions:

We will promote the purchase, long-term safeguarding, reconnection and renaturation of floodplain areas.

3. Seas and coasts

Marine ecosystems such as seagrass beds, salt marshes and kelp forests, as well as the sediments on the seafloor, absorb carbon from the atmosphere, thereby functioning as natural carbon sinks. They are also habitats and nurseries for many marine species. Intact marine ecosystems contribute to Nature-based Climate Action.

However, our seas have a poor conservation status. Besides suffering from overuse and pollution, the North and Baltic Seas are also affected by the climate crisis. The seas absorb

CO₂ – making them warmer and more acidic. As a result, the marine flora and fauna are becoming less resilient. The destruction of the marine ecosystems in turn releases additional greenhouse gas emissions, which intensifies the climate crisis.

We need to understand marine areas as the foundation of life and an essential component of the climate system. We can enhance their natural functions by protecting our seas and coasts and ensure that they are used sustainably. To this end, we need to learn more about the complex relationships between ecosystems in the North and Baltic Seas.

Measures

3.1. Restoring salt marshes: creating synergies between nature conservation, extensive grazing land management and coastal protection

Salt marshes naturally remove carbon from the atmosphere in the long term and increase the amount of sediments in their ecosystems, thereby playing an important role in Nature-based Climate Action. At the same time, they provide habitats, especially for many birds and endemic plant species, making them important for biodiversity. As natural salt marsh areas are progressively lost, less CO₂ is captured. Salt marsh drainage ultimately leads to the release of methane and CO₂ into the atmosphere. Moderate grazing can increase soil compaction, which can help to sequester CO₂ better in the salt marsh sediments. Coastal protection is another area where salt marshes can play an important role as Nature-based Solutions. They weaken the force of large waves (e.g. during storm surges) and thus help alleviate the pressure on dikes in coastal areas and protect them from major damage. In addition, increasing flood frequency and the associated transport and deposit of sediments cause salt marshes to grow faster in height, which can compensate for the accelerated sea level rise to a certain extent.

The original function of these carbon sinks can be preserved and restored by increasing protection for existing marshes, renaturing destroyed salt marshes and using them in an ecologically sound manner. Rewetting and adequate grazing can promote the potential of salt marshes as carbon sinks.

Our actions:

We will develop an integrated approach to the protection and restoration of salt marshes that reconciles the interests of coastal protection, agriculture and nature conservation and weighs up different options for action. In this process, we want to bring stakeholders into dialogue with each other to foster mutual understanding

and raise awareness of the role of salt marshes as carbon sinks. We will jointly develop and implement proposals for pilot areas and for reducing stress factors, drawing on current R&D projects.

3.2. Restoring seagrass beds and kelp forests

Marine plants, such as seagrasses or macroalgae, as well as the increased sedimentation they cause, play an important role in the natural long-term sequestration of carbon in the ocean. At the same time, they provide habitats for many marine species and are important for biodiversity. Their destruction can lead to the release of additional CO₂. Newly introduced species, over-fertilisation (eutrophication), pollutants, waste, changes caused by the climate crisis and anthropogenic activities such as dredging and sediment dumping, affect the natural development of seagrass beds and macroalgae communities. To preserve the natural climate functions and ecosystem services, these marine habitats must be effectively protected and renatured. To ensure better growing conditions, we need to improve the ecological status of coastal and marine waters, effectively reduce pollution and disturbances and rebuild populations of marine species.

Our actions:

We will launch a recovery programme for seagrass beds and kelp forests. To this end, a plan must be developed to identify pilot sites, area potential and ways to reduce the currently prevailing pollution and disturbance factors in the North and Baltic Seas. We will support this process by evaluating the national management plans under the EU Water Framework Directive (WFD) and the national action plans under the EU Marine Strategy Framework Directive (MSFD), taking into account the current state of research. These findings will be used to develop specific practical plans for measures and implementation in pilot areas, to identify and mediate conflicting user interests and evaluate the effectiveness of the measures in the long term.

3.3. Evaluating carbon sink function of marine sediments and establishing carbon protection zones

Marine sediments absorb large amounts of carbon and have the capacity to store it for a long period of time. Since about 70% of the Earth's surface is covered by oceans, marine sediments can make a vital contribution to Nature-based Climate Action as blue carbon ecosystems.

The sediment type is an important factor in the carbon inventory. Silty sediments have a higher carbon content than sand. In addition, the sedimentation of materials containing carbon is affected when sediments are mixed, e.g. by wind and wave conditions, tidal movements and anthropogenic uses. The natural carbon storage capacities of marine sediments under the different oceanographic conditions and possible interdependencies have yet to be determined.

Our actions:

We will evaluate the carbon inventories of marine sediments and their ability to sequester carbon and develop a standardised measurement method for marine carbon inventories in European and national seas and oceans. Building on this knowledge, marine areas with carbon-rich sediments will be defined and designated as carbon protection zones.

3.4. Bottom trawling and carbon storage capacity of benthic communities and sediment

Marine sediments make a key contribution to the natural carbon inventory by storing significant amounts of carbon over the long term. Even low-intensity bottom trawling destroys or disrupts this storage function and changes the species composition on the seafloor (benthic communities) because it mixes and suspends the sediment, thus releasing CO₂. Recovery often takes several years. The suspended material can also change ecosystems in other areas due to ocean currents.

The short-term effects of bottom trawling in the North and Baltic Seas on carbon stored in benthic communities and sediment are currently being studied in BMBF-funded research networks as part of a research mission of the German Marine Research Alliance (Deutsche Allianz für Meeresforschung, DAM). The long-term effects on German seas, on the other hand, are not yet known. The comparison with the exclusion zones for bottom trawling in the North and Baltic Seas planned at EU level will also serve as a basis for evaluating these measures in the context of Nature-based Solutions.

Our actions:

We want to develop a long-term monitoring programme on the effects of bottom trawling exclusion zones on carbon-rich marine areas and, if necessary, evaluate and implement measures to reduce carbon emissions and create incentives to limit bottom trawling and switch to other fishing techniques.

3.5. Analysing the carbon captured by offshore marine biotopes and the impacts of the climate crisis on marine biodiversity in the North and Baltic Seas

The potential of offshore marine biotopes to store carbon is not yet sufficiently understood. The composition and distribution of animal and plant communities are changing as a result of the climate crisis (e.g. temperature, pH value). A northerly migration of boreal species and an exodus of shallow-water species to deeper, cooler zones will lead to changes in marine ecosystems and their functions. However, the impacts on the carbon budget are not yet sufficiently known.

Similarly, little research has been conducted to date on the carbon storage capacity of offshore biotopes. This is especially true of biogenic reefs, including those of the European oyster, which has disappeared from German seas although it is native to our marine waters. According to initial findings, these reefs have the ability to sequester carbon over the long term and thus contribute to Nature-based Climate Action. Nevertheless their function as a carbon sink is still a controversial subject in the scientific community. It is a known fact that oyster reefs in particular act as breakwaters that protect coasts from erosion. This is an important function, as storm events are increasing due to climate change. Moreover, the European oyster filters huge volumes of seawater, which can counter the increased occurrence of toxic algal blooms caused by the climate crisis. Oyster reefs also serve as nurseries for different species of plants and animals and develop a typical diversity of species over the years.

In addition to the increased deposits of organic material in the calm currents of biogenic reefs, which have a positive effect on long-term carbon storage, the CO₂ influx into the water column/atmosphere is increased during calcification when shells are formed, and carbon is potentially released at the edges of the reefs through physical turbulence.

Our actions:

We will investigate and map the potential for long-term carbon sequestration of offshore biotopes, including biogenic reefs such as mussel and oyster beds in the North and Baltic Seas, and assess their function as carbon sources or sinks, with a focus on inorganic carbon. We also want to advance the reintroduction of the European oyster. In addition, the impact of the climate crisis on marine biodiversity and changes on carbon storage will be analysed.

4. Wilderness and protected areas

Areas where nature can evolve naturally over the long term are vital for biodiversity conservation and valuable for Nature-based Solutions. The aim is to preserve habitats

through sufficiently large protected areas. In addition, strong connectivity between protected areas is important to ensure the resilience of the entire protected area network. Even smaller wilderness and protected areas could make an essential contribution here.

The EU Biodiversity Strategy calls for ten percent of land and marine areas to be placed under strict protection by 2030. Wilderness areas that are left to develop completely naturally are of particular importance for achieving this target, but habitats that depend on use, such as extensively farmed, species-rich meadows or large pasture landscapes, can also play a role.

Protected habitats have particularly positive effects when they have a favourable conservation status, which many German protected areas do not have. To take more effective action in this area, we will also improve the general conditions for the management and maintenance of wilderness and protected areas.

Measures

4.1. ClimateWilderness programme – preserving small areas with natural dynamic development

The existing Wilderness Fund focuses on large-scale areas to help meet the two-percent wilderness target. The ClimateWilderness (KlimaWildnis) programme focuses on small areas that are not covered by the Wilderness Fund: there is an immense need to create effective climate sinks with high nature conservation quality, but the potential for large-scale wilderness development is limited. The best possible synergies between biodiversity conservation and climate action can be created by securing (through land purchase and land rights) the natural development of sites in different habitats, including in protected areas, and ensuring connectivity of these sites. The programme can generate synergies with other measures, e.g. the protection of old-growth, near-natural beech forests (Measure 5.4) or the creation of ClimateWilderness ambassadors (Measure 4.3).

Our actions:

We will launch a new programme to preserve smaller wilderness areas, e.g. in forests, peatlands, floodplains, mountains, on coasts, on former military training areas and in post-mining landscapes. Funding will be provided to protect areas with natural dynamic development that are smaller than 1,000 hectares in size (less than 500 hectares for alluvial forests, coasts and peatlands) and to secure connecting elements and any necessary buffer areas.

4.2. Limiting legal hurdles and incidental and consequential costs in wilderness areas

A large number of legal regulations are in the way of implementing wilderness targets and in some cases pose major financial obstacles for the owners and managers of larger and smaller wilderness areas. This is especially true in wilderness areas, because resources may not be used for economic or material purposes in wilderness areas. Measures are needed that can encourage more land owners to preserve areas for wilderness or that can ease the efforts of people actively working in wilderness protection and simplify management of National Natural Heritage areas. Examples could be enshrining the concept of the protection of natural processes in the Federal Nature Conservation Act, including the definition of process protection as a follow up use for nature conservation in post-mining landscapes and exempting wilderness areas from property tax.

Our actions:

We will – to the extent possible – limit legal hurdles to wilderness development and incidental and consequential costs for owners of wilderness areas and we will protect wilderness areas as a follow-up use in post-mining landscapes.

4.3. ClimateWilderness ambassadors

In the (further) development of wilderness areas, a strong local presence is necessary that can promote the idea and goals of Nature-based Climate Action, create opportunities for wilderness development, establish contacts, build networks, provide information on funding opportunities and thereby act as multipliers (local “caretakers”). This can create opportunities for land consolidation and inform the public and visitors about wilderness and Nature-based Climate Action. A central office will coordinate the ClimateWilderness ambassador network. This process will explore whether there are synergies with the establishment of agencies for Nature-based Climate Action (Measure 9.6).

Our actions:

We will create a funding option for the establishment and networking of local ClimateWilderness ambassadors.

4.4. Creating and implementing a national restoration plan as part of the EU’s restoration goals

On 22 June 2022, the European Commission tabled a proposal for a legal instrument for nature restoration with binding restoration targets, which had already been announced in the

EU Biodiversity Strategy for 2030 presented in May 2020. In addition to ensuring the good condition of ecosystems, the focus will be on their importance for climate regulation, water regulation, soil health and disaster preparedness and protection. The legal instrument will thus be a significant component of Nature-based Climate Action.

The core element of the legal instrument will be the creation and implementation of a national restoration plan. The plan will combine and coordinate restoration measures in all habitats/landscape areas (including Habitats Directive habitat types, forests, peatlands, rivers/floodplains, agricultural landscapes, urban green spaces, coasts/oceans/seas) and levels (federal, Länder, local) and will involve a multi-sectoral, multi-level approach with a high degree of planning, coordination and communication. It will require a complex process of gathering, collating and analysing data from all sectors. Stakeholders will be effectively involved at an early stage.

Our actions:

In 2023, we will establish a funding programme to support structures and measures for data collection, planning, dialogue processes, consultation, implementation and monitoring at all levels (federal, Länder, local) for the creation and implementation of the national restoration plan.

4.5. Launching an action plan on protected areas: strengthening protected areas for Nature-based Climate Action

Protected areas make an important contribution to Nature-based Climate Action. They encompass large parts of the ecosystems in Germany that play a particularly important role in climate change mitigation. In Germany, for example, a substantial number of forests, peatlands, active floodplains, extensive grassland and marine ecosystems are located in protected areas. These habitats have positive effects, especially when they have a favourable conservation status, which is unfortunately not the case for many of them.

The action plan on protected areas therefore aims to increase the share of ecosystems in protected areas that support climate change mitigation, climate adaptation and biodiversity conservation and improve the quality of these protected areas. It is also important to safeguard these habitats through sufficiently large protected areas, to link them with functional habitat connectivity structures and integrate them into the surrounding landscapes to increase the resilience of the protected areas network. This requires conceptual approaches that are integrated into protected area management planning and designed together with the relevant local stakeholders. Responsibility for these tasks could be

assumed by the climate managers for protected areas. Synergies with the establishment of agencies for Nature-based Climate Action (Measure 9.6) will be explored.

Protected areas are an important cross-cutting issue in the context of Nature-based Climate Action and are ideal for implementing measures to preserve and restore degraded ecosystems, thus ensuring the permanence of the measures. This is why the EU protected area targets for 2030 also establish a close link to NbS and the associated restoration measures. The action plan on protected areas will define and supplement Germany's contributions to achieving the goals outlined in the EU Biodiversity Strategy.

Our actions:

By 2026, we will launch an action plan on protected areas together with the Länder, which will include measures to strengthen protected areas for Nature-based Climate Action, to increase the resilience of protected area networks and to further develop management of protected areas. We will explore funding options for climate managers who can support existing protected area administrations or other local institutions in developing plans for NbS.

5. Forest ecosystems

Healthy forests can sequester large volumes of greenhouse gases: trees, like all plants, remove CO₂ from the atmosphere, convert it through photosynthesis and release oxygen. The resulting carbon compounds are stored, leading to the formation of wood – and the tree grows. This is how large quantities of carbon remain permanently sequestered in forests. At the same time, near-natural forest ecosystems are important habitats for many species of flora and fauna and also improve the local climate and water balance. They also serve as important recreational areas for people.

However, the last National Forest Inventory, published in 2012, identifies only 36% of Germany's forest as near-natural. The findings of the latest National Forest Inventory, which is currently under way, will show how the drought years 2018 to 2020 have affected this figure. In recent years, non-natural forests in particular have proven to be especially susceptible to drought damage and pest infestation. Near-natural forest ecosystems can develop if we systematically convert existing non-natural forests and restore damaged forest areas. The climate change adaptability and resilience of forests hinge on the biodiversity and structural richness of near-natural forest ecosystems.

In addition, we want to expand forest cover in Germany overall. This will allow us to increase the capacity of forests to sequester carbon in the long term and create valuable habitats. It

will also contribute to the goal of planting three billion new trees in Europe, as laid down in the EU Biodiversity Strategy for 2030 and the EU Forest Strategy. Furthermore, an increase in forest cover would enhance the diversity of the landscape and the habitat quality for many species and thus also improve habitat connectivity.

Measures

5.1. Increasing forest cover to promote biodiversity

Increasing forest cover is considered a suitable measure to strengthen the sink function of forests in the long term. Forests in Germany are very unevenly distributed. In regions where agriculture is predominant, especially in the north of Germany, increasing forest cover has the potential to improve structural diversity in the landscape, habitat connectivity and thus habitat quality for many species, while at the same time having positive effects on the local water balance, for example.

Since the forest also provides wood as a renewable raw material and wood processing secures jobs, especially in rural areas, this measure is generally also suitable for supporting structures in rural areas. The EU Biodiversity Strategy and the EU Forest Strategy include the target of planting an additional three billion trees in Europe. The United Nations Strategic Plan for Forests 2017-2030 goes one step further, aiming to increase global forest cover by three percent by 2030. It is also in Germany's interest to make a positive contribution to reaching these goals. The measure maximises synergies between climate change mitigation and biodiversity conservation.

Our actions:

Through an exchange between the Federation and Länder, we will discuss ways to implement new afforestation of near-natural forests on as large an area as possible – 10,000 ha/year are planned – on suitable areas according to biodiversity guidelines.

5.2. Creating species-rich, near-natural and climate-resilient mixed deciduous forests through forest restoration and conversion

The damage to forests caused by drought and other disasters in 2017-2020 has also shifted the focus to the general condition of forests. One result of this consideration is that large parts of Germany's forests are not sufficiently close to their natural state and are therefore not well adapted to the challenges posed by the climate crisis. Given the prediction that

extreme weather events will become more frequent as the climate crisis intensifies, there is an urgent need to better adapt existing forests to the climate crisis through active forest conversion and to restore damaged areas to once again become species-rich, climate-resilient forests. This also includes measures that are suitable for improving the local water balance in the long term. The following measure addresses both forests in protected areas and managed forest areas.

In the first package of measures for the implementation of the Climate Action Programme 2030, the German government has made a total of around 480 million euros available under the Joint Task for the Improvement of Agricultural Structure and Coastal Protection (GAK). This will support private and municipal forest owners, and has the aim of promoting near-natural and therefore climate-resilient forest management and remedying damage caused by extreme weather events. This amount was co-financed by the Länder, making a total of around 800 million euros available for the period until 2023. The GAK funds currently available will be maintained beyond 2023 and, if possible, increased. From 2023 onwards, 75% of the available funds will be earmarked for forest conversion.

Our actions:

Where possible, we will continue existing financial support through the GAK and make measures that have not been explicitly addressed through the GAK eligible for separate funding.

5.3. Financial incentives for additional climate and biodiversity services in forests

Forests make a vital contribution to climate change mitigation. This makes the preservation of forests, their sustainable management and their long-term adaptation to the impacts of the climate crisis national challenges that are in the interest of society as a whole. The measure aims to support private and municipal forest owners in increasing the resilience of forests and their ability to adapt to climate change, enhancing forest biodiversity and preserving the valuable natural carbon sink function of forests. The required activities go beyond the previous standard of forest certification schemes and thus help to encourage additional climate and biodiversity services in the forest.

Our actions:

We will develop suitable funding instruments to increase the share of private and municipal forest area with proven climate-adapted and near-natural management. By temporarily reducing timber harvesting, we will help increase carbon sequestration in stable, ecologically valuable deciduous forests.

We will amend the Federal Forest Act (Bundeswaldgesetz) with the aim of establishing regulations representing good professional practice that promote biodiversity and resilience and protect the soil.

5.4. Protecting old-growth, near-natural beech forests

Under the coalition agreement, the German government is committed to stopping logging in old-growth, publicly owned, near-natural beech forests.

This will be implemented in a first step on land owned by the Federation in its role as a pioneer in biodiversity conservation and climate action. The contribution of the other public forest owners, i.e. the Länder and municipalities, can be made through a voluntary alliance. Ways to expand the scope of these activities to privately owned forests will also be evaluated. Long-term financing is needed for this step.

The measure directly supports Nature-based Climate Action by preserving ecologically valuable, natural carbon sinks, also in protected areas. The EU Biodiversity Strategy also includes the goal of identifying and protecting old-growth forests. The measure thus creates synergies between climate action and biodiversity conservation.

Our actions:

We will rapidly implement a logging ban in old-growth, near-natural beech forests on federally owned land. Our aim is to create funding opportunities for municipal and private forest owners through a voluntary alliance.

6. Soils as carbon sinks

Soils are the main land-based carbon sinks. They play an important role in the release and sequestration of greenhouse gases, especially CO₂. Healthy soils also strengthen the resilience of ecosystems to the climate crisis. Soil conservation and soil-friendly management that improves humus content are needed to prevent greenhouse gas emissions, to stabilise and as far as possible increase the organic carbon content in soil in the form of humus.

Agriculture, which accounts for the most land use in Germany, has a special role to play here. Impacts on soil vary greatly according to the type of farming being practised. Soil management must be geared towards improving the capacity of soils for Nature-based Climate Action as carbon sinks, but also as water reservoirs and filters, and towards preserving and promoting soil biodiversity. Not least, more careful management of our soils is crucial for securing our basic food supply in the long term.

Measures

6.1. Systematically promoting the preservation and creation of new structural elements and areas, especially in agricultural landscapes, with a positive impact on climate and biodiversity

The aim is to maintain and expand integrated structural elements and areas with a positive impact on climate and biodiversity in agricultural landscapes. Hedges, hedgerows, agroforestry systems, tree rows and copses contain more humus than cropland, which means they have a greater capacity to store carbon in the soil, and they sequester carbon in the woody vegetation for a longer period of time. In addition, they have other, positive ecological effects: they reduce erosion (incl. humus removal) on adjacent cropland, stabilise the water balance (incl. dew formation) of the surrounding area, reduce nutrient discharge into water bodies and greatly increase biodiversity in the landscape. Especially in the second half of the last century, there was a considerable decline in these structural elements.

Today, the preservation of hedgerows and similar landscape elements is enshrined in regulatory and funding legislation (under the CAP), but any full or partial expansion of the areas depends on dedicated funding. Existing GAK funding measures show that these have not been adequate so far to significantly increase area. In addition to sufficiently generous funding per hectare, it is advisable to provide initial and ongoing (nature conservation) consultation services and, if necessary, ensure cooperation between agriculture and nature conservation to achieve the greatest possible synergies.

Our actions:

We will support the creation and maintenance of field copses, hedges and tree rows with native species as well as orchards and agroforestry areas (existing areas in 2021: approx. 95,700 ha; area to be added by 2030: approx. 200,000 ha). At EU level, we are advocating an improvement of the EU legal framework.

6.2. Converting cropland into grassland for permanent preservation, especially in places at risk of erosion or in floodplains

In agricultural landscapes, integrated areas that sequester carbon will be preserved and expanded. Areas or soils used as permanent grassland have greater humus content than those used for crop farming. Converting cropland into permanent grassland thus benefits climate change mitigation and precautionary soil and water conservation. This is because it also reduces erosion (including humus removal) and generally also nutrient discharge into

groundwater and surface waters. Conversion to permanent grassland will therefore be systematically pursued, especially in places at risk of erosion and in floodplains. Conversion is also an important issue for nature conservation because permanent grassland can accommodate more threatened species and habitats compared to cropland.

Since use as permanent grassland is generally less profitable than use as cropland and the market value of the land is significantly diminished because its use is restricted over a longer period of time, conversion of cropland to permanent grassland requires sufficiently generous funding to harness the potential of the measure to contribute to climate change mitigation.

The measures should also be implemented in existing protected areas.

In addition to conversion, forms and intensities of use that promote biodiversity are useful for ensuring that objectives are achieved, and therefore appropriate funding options must be made available.

Our actions:

We will support

- the establishment and maintenance of extensive permanent grassland, heaths and riparian zones to be permanently preserved
(existing areas in 2021: approx. 795,000 ha; area to be added by 2030: approx. 503,000 ha)
- measures to upgrade areas in floodplains (conversion of cropland to grassland, in peatlands with rewetting)
(existing areas in 2021: approx. 220,000 ha; area to be added by 2030: approx. 66,000 ha)
- management and use of areas in floodplains to promote biodiversity
(existing area in 2021: approx. 330,000 ha; area to be added by 2030: approx. 86,000 ha)

6.3. Further expanding organic farming

Organic farming is a resource-efficient and environmentally compatible form of farming that is guided by the principle of sustainability and circular economy. Organic farming therefore has considerable potential to help protect and build up humus layers, thus preserving and restoring soil fertility, improving soil life and the water balance and reducing erosion. The formation of humus sequesters carbon in the soil, making a contribution to climate change mitigation. For example, eliminating the use of synthetic chemical pesticides also helps

increase biodiversity. Organic agriculture's contribution to Nature-based Climate Action lies particularly in the build-up of humus.

In addition, the system-based approach of organic farming generally leads to lower greenhouse gas emissions per unit of land (CO₂ equivalent per hectare) than conventional production. By not using mineral fertilisers, organic farming requires less fossil energy and therefore achieves greater independence. It sets high standards in livestock farming with its focus on animal well-being.

Our actions:

The German government's coalition agreement envisages expanding organic farming to 30% of agricultural land by 2030. To sharpen its focus on the higher target and strengthen organic farming further, the "Organic Farming – Looking Forwards" strategy will be further developed into the German government's strategy. To this end, we will first evaluate and realign the strategy's existing measures in a participatory process. We will then also take a look at other fields of action across all ministries and identify key policymaking levers to strengthen the organic food sector in Germany. When the Budget Act 2022 enters into force, the Federal Organic Farming Scheme and other forms of sustainable agriculture (BÖLN) will once again focus on promoting organic farming measures, as it did in the years 2002-2010, and will be continued as the Federal Organic Farming Scheme. We will also review further development of the protein crop strategy, which is not limited to organic farming.

6.4. Amending the Federal Soil Protection Act

Soil can make a significant contribution to climate crisis adaptation and mitigation. After the oceans, soil is the world's second largest carbon sink and stores more CO₂ in the top metre of soil than is found in the atmosphere and all vegetation combined. Peatlands and soils used for agriculture in particular have enormous potential for carbon sequestration. However, through land use change and unsustainable use and management, soils can also be a source of greenhouse gases or completely lose their carbon sink function as a result of devastation and land sealing. Functional soils, for example with mixed deciduous forests, can mitigate certain impacts of the climate crisis, such as the increasing effect of heat accumulation in urban areas in summer. Measures to preserve and enhance carbon stocks in the soil also improve soil quality, biodiversity and agricultural productivity, and increase the resilience of ecosystems to the climate crisis. Sustainable soil management that enables

carbon stocks to form or carbon stocks typical to specific locations to be preserved is fundamental to climate change mitigation.

Our actions:

We will adapt the Federal Soil Protection Act to meet the challenges of the climate crisis to ensure that it adequately reflects the importance of soil for Nature-based Climate Action and for adaptation to the impacts of the climate crisis.

6.5. Strengthening soil biodiversity as an essential contribution to Nature-based Climate Action

The services of soil organisms are extremely important for climate change mitigation, as they are largely responsible for the formation of soil and humus. Humus is essential for both climate change mitigation and adaptation to the climate crisis because it sequesters carbon and contributes to healthy soil hydrology. The diversity of soil organisms is established in different forms and typical compositions in the habitat types (biotopes) of the landscape. To assess how they have changed due to the climate crisis, we need a habitat-specific reference for good ecological soil status.

However, due to a lack of information on soil biocoenoses, it is not possible to adequately assess the diversity and vulnerability of soil life. Comparisons of existing data across networks often fail because standards and uniform methodologies are lacking.

Our actions:

We will harmonise methodological standards and conduct a baseline survey for different types of land use in order to collect habitat type-specific soil biological reference data for good ecological soil status and derive suitable measures for climate change mitigation and adaptation to the climate crisis. We will establish a nationwide soil biodiversity monitoring network in close cooperation with the National Soil Monitoring Centre, with the National Centre for Biodiversity Monitoring and the Federal Agency for Nature Conservation.

6.6. Financial support to purchase equipment for conservation tillage

Soil life plays an essential role in carbon sequestration in the soil. Soil organisms build and maintain a soil structure that can store the carbon they convert in the form of stable humus compounds over the long term. This is the only way to preserve and even increase the potential of the largest terrestrial carbon sink.

Intensive tillage after fertilisation or before planting, in some cases by deep and rotating ploughing, disturbs both the soil structure and soil life. Carbon from organic matter can then no longer be converted into stable humus compounds and integrated into the soil structure. Instead, most of it escapes back into the atmosphere as CO₂, thereby considerably reducing the capacity of the soil to sequester carbon.

Investments in equipment for conservation tillage, as well as mulch and no-till systems without total herbicides, preserve soil structure in the long run and promote soil life, which enables long-term carbon accumulation in soils. At the same time, conservation tillage promotes soil fertility and the capacity of the soil to retain water. In the context of climate adaptation, this makes a significant contribution to reliable crop yields in agriculture, where growing conditions have become more difficult as a result of the climate crisis.

Our actions:

We will support investments in new equipment for conservation tillage, as well as for mulch and no-till farming without total herbicides.

6.7. Strengthening the set of measures for de-sealing and land recycling, taking into account the landscape level – developing the basis and funding for tailor-made de-sealing projects

In its coalition agreement 2021-2025, the German government committed to the goal of improving rainwater infiltration and reducing the risk of flooding with de-sealing projects. In some cases, these de-sealing measures can restore natural soil functions and help secure ecosystem services. Especially in dense urban areas with high pressure of use, these ecosystem services can play a key role in climate adaptation. De-sealing helps to:

- reduce heat stress and dry air, create green spaces and recreational areas
- reduce dry soil and low water levels, fluctuations in groundwater levels and floods and high water levels
- reduce changes in soil development, soil suffosion and erosion
- reduce biodiversity losses
- use the natural cooling function of soils, particularly in urban environments
- improve landscape hydrology and create climate-resilient landscapes through targeted de-sealing measures

Achieving the qualitative improvement of natural soil functions and its associated contribution to climate adaptation through de-sealing and renaturation measures poses a considerable challenge in the context of infill development (e.g. new development on empty sites,

redensification measures, etc.) sought by policymakers. When deciding whether to de-seal surfaces and/or whether and how to rebuild, land use pressure in the region plays a crucial role. When it comes to land recycling, requirements for the reduction of (new) land sealing must be more firmly integrated. For new buildings, this can be achieved, for example, by functional de-sealing with permeable surfaces or partial de-sealing with high-quality renaturation. Provisions under regulatory and planning law, information and advisory services for municipalities, as well as specific targeted funding options will play an important role in the promotion of de-sealing projects.

Our actions:

- We will continue to develop the legal instruments: creating a viable version of the de-sealing provision in the Federal Soil Protection Act (BBodSchG); broadening the possibilities for mandating and enforcing de-sealing measures in the Federal Building Code (BauGB); strengthening the reference to soil function in the impact/compensation assessment
- We will create an information exchange platform for cities and municipalities to develop solutions for efficiently leveraging de-sealing potential and implementing de-sealing projects
- We will provide the results to the communication and information platform www.aktion-flaeche.de, e.g. so they can be combined with other advisory structures for Nature-based Solutions
- We will continue to develop funding and financing options for de-sealing measures with the goal of permanent renaturation
- There are also individual projects as best-practice examples linked to relevant information campaigns and teaching materials

7. Nature-based Climate Action in settlement and transport areas

Green and open spaces in cities and towns are important recreational areas. In parks, urban forests, green belts and avenues, the services of plants for the urban climate can be felt: they improve air quality by removing pollutants and CO₂, give shade on hot summer days and provide additional cooling through transpiration. Interconnected green spaces act as cooling and fresh air channels and offer habitat and refuge for many animal species. It is crucial to preserve and support this nature in our midst.

Beyond our settlements are far larger ecosystems. However, most of these are dissected by roads or railway lines, and the towns and villages on their margins encroach on them more and more. We want to counteract this increasing fragmentation of our landscape. We will

effectively reduce interventions in nature and landscape, improve connectivity of already fragmented habitats and restore ecological permeability.

Measures

7.1. Supporting municipalities in the transition to green space management and establishing an appropriate framework

Municipalities are key actors for achieving our climate targets. They have a large number of green and open spaces that can contribute to climate change mitigation and adaptation. An environmental design and management of these spaces is very important for these functions. Suitably designed and managed spaces and green structures perform a wide range of ecosystem services, in particular for recreation, health and biodiversity.

The new funding programme set up under the Federal Action Plan on Nature-based Solutions for Climate and Biodiversity will support municipalities in the transition to near-natural green space management. This will cover the costs of setting up a tailored management plan, procuring the necessary equipment (e.g. for maintenance), training staff and mobilising citizen participation (e.g. wildflower adoptions).

Our actions:

From 2023, we will support 20 municipalities each year in their transition to near-natural green space management. We will encourage networking among the participating municipalities.

7.2. Planting 150,000 additional urban trees by 2030

A new investment programme will be set up to support tree planting in towns and cities as a measure for climate change adaptation and biodiversity conservation. To this end, suitable tree species will be identified and included in “positive lists”. Furthermore, we will support development of strategies for the municipality as a whole. Examples are city-wide street tree plans, including the launch and continuation of “adopt-a-tree” campaigns. The new trees will mainly be planted in town and city centres. Research by the Federal Agency for Nature Conservation and many other institutions verifies the effectiveness of trees for removing carbon dioxide from the atmosphere, improving the local climate and promoting biodiversity, and highlights their benefit for recreation and quality of life in towns and cities. The overall impact of trees is greatly influenced by how the green spaces are designed and managed. A

healthy, long-lived tree population is a prerequisite for high carbon sequestration. From 2023 to 2030, a total of at least 150,000 additional trees will be planted in municipalities.

Our actions:

We will support municipalities in developing street tree plans and planting a total of 150,000 additional trees by 2030.

7.3. Creating natural urban climate oases

Even small green spaces have been shown to improve the local climate in densely built settlements that are prone to overheating. Research by the Federal Agency for Nature Conservation and many other institutions attests to the effectiveness of trees and shrubs for sequestering carbon and promoting biodiversity, and highlights their benefit for recreation and quality of life in towns and cities. Providing forest gardens, wooded areas, nature experience areas, accessible, near-natural parks and protected areas in and around towns and cities has positive effects for the local climate. These areas not only improve the microclimate in the immediate living environment, but also offer spaces for exercise, recreation and social interaction, thus helping children in particular to thrive both physically and mentally.

Our actions:

We will support municipalities in setting up natural urban climate oases, such as spaces for experiencing nature, urban forests, forest gardens and inclusive parks.

7.4. Developing and implementing a model for the water-smart city

The water-smart city model will be developed for practical implementation. The aim is to bolster water management's contribution to Nature-based Climate Action and hence its role in promoting urban nature and measures for adapting to the climate crisis. The goals are to de-seal as much land as possible, to step up storage, infiltration, evaporation and use of rainwater in urban areas, achieve an intact urban water balance with good water availability for urban vegetation, strengthen evaporative cooling and reduce the risks from flooding. Urban water bodies will again become important habitats for native fauna and flora and places for people to experience nature and relax close to their home.

Water ecology and opportunities for people to experience their natural surroundings will also be integrated. This will include further clarifying approaches, social acceptance and possible risks to the environment and health and drawing up model recommendations. Different fields such as municipal land management, building and water law, financing and liability issues

and current technical rules will be brought together and adaptation needs identified. The aim is political confirmation of the smart-water principle, e.g. in decisions of the relevant ministers' conferences.

Our actions:

- We will work with specialist bodies from urban development, water management and nature conservation to draw up a joint model for the water-smart city
- Subsequently, we will review the legal framework for implementing the water-smart city, adapt the conditions and introduce support and funding options

7.5. Research for activating federally owned properties for urban green infrastructure and preparing pilot projects

As possible sites for urban green infrastructure and urban development, federally owned properties in urban centres such as railway lines, federal roads, federal shipping lanes etc. hold great potential for Nature-based Climate Action, adaptation to the climate crisis and recreation. Research under this measure will examine how Nature-based Solutions can be implemented on federal properties in city centres, demonstrating this with model examples. As an essential component of liveable and future-proof cities, urban green infrastructure is vital in this context. Besides playing a role for Nature-based Climate Action, urban green infrastructure also supports adaptation to the climate crisis, provides space for recreation, exercise and social interaction and promotes health, environmental justice and urban nature.

The BMUV will invite relevant ministries to a joint dialogue on how federally owned properties can be integrated more effectively into urban green infrastructure networks and used for Nature-based Climate Action. We will assess the potential of urban federal properties for NbS and identify the federal land available in selected cities. Feasibility studies for activating urban green infrastructure will also be carried out. To this end, talks will be held between stakeholders from the Federation, Länder, participating municipalities and other local actors, and concrete strategies prepared.

We will cooperate with partners to activate federally owned properties and draw up proposals for jointly promoting urban green infrastructure on federal and other publicly owned properties, and for accompanying research. This can also advance implementation of the strategy for considering biodiversity concerns on federal properties (Strategie zur vorbildlichen Berücksichtigung von Biodiversitätsbelangen für all Flächen des Bundes, StrÖff), and strengthen synergies with biodiversity conservation.

Our actions:

At federal level, we will analyse positive examples, opportunities and obstacles, estimate the land available in built-up areas and its potential climate effects, and present recommendations.

At local level, we will identify potential areas available and formulate concrete, site-specific strategies to make greater use of federally owned properties for urban green infrastructure and NbS. At the same time, we will advance dialogue and cooperation between the ministries on the role model function of government properties for Nature-based Climate Action in settlement and transport areas.

7.6. Digital technologies and Nature-based Climate Action in municipalities

Digital technologies such as AI hold great potential for data collection, monitoring, modelling and identifying concrete action areas and options for Nature-based Climate Action. For instance, digital technologies can model which urban locations are particularly likely to become heat islands or suffer heavy rainfall, and how this can be counteracted with NbS.

However, the beneficial use of digital technologies hinges on a number of conditions being met. These include a high-performance digital infrastructure, standards for data collection and accessibility, and the availability of qualified personnel. Municipalities often find it difficult to meet these requirements. There are, however, significant opportunities to leverage economies of scale for the implementation of digital technologies. Once developed, analysis and modelling methodologies and the necessary digital infrastructure could be made available to different municipalities, thus reducing the implementation costs of individual applications.

Developing a suitable support structure first requires a systematic analysis of the needs of the target group and relevant stakeholders, e.g. with regard to data accessibility. Moreover, the respective needs must be considered from a technical point of view, to determine how they can be met through specific technical support. Based on this, the corresponding structures and support options will be set up successively in the appropriate institutions. They could, for example, be attached to supraregional centres of competence and support structures like the Agencies for Nature-based Climate Action.

Our actions:

We will systematically analyse concrete potential and support needs for the use of digital technologies for NbS in urban areas. Based on this, concrete scenarios for building supraregional support services will be developed and implemented, aimed

at advising and assisting different stakeholders in the implementation of digital technologies.

7.7. Advising municipalities on strengthening Nature-based Climate Action in urban land use planning

Under this measure, municipalities will be advised on implementing strategies for Nature-based Climate Action in their urban land use planning. Urban land use planning is an important tool for applying Nature-based Solutions at scale. It can lay down requirements to preserve open spaces relevant for Nature-based Climate Action (e.g. cropland, pastures, forested areas), to minimise land use in building projects and to ensure that there are sufficient green and open spaces in populated areas as well.

Land-use changes are relevant for the climate. If they are associated with construction work, they generally constitute an intervention in existing ecosystems and impact the terrestrial carbon cycle, because they disturb the natural carbon reservoirs soil and vegetation. Estimates indicate that land use and land-use change account for around 10% of total greenhouse gas emissions in Germany.

The measure specifically envisages consultation services to support municipal development plans. This will build on the lessons learned from the now concluded support for climate-friendly land management strategies under the National Climate Initiative. The services must be considered in the context of support for municipalities under the BMUV Immediate Action Programme for Climate Adaptation and the funding measures under the guideline on promoting climate action in municipalities (Local Authorities Guideline).

Our actions:

- By the end of 2023 we will determine the consultation needs of municipalities for drawing up strategies for Nature-based Climate Action as part of urban land use planning and identify a suitable executing agency to implement the measure
- By the start of 2024, a guide on considering NbS in urban land use planning will be made available to municipalities. A plan for providing consultation services will then be drawn up in cooperation with the executing agency
- In 2024 we will also begin pilot consultation measures in representative municipalities

7.8. Package of measures for minimising land use – formulating target agreements

In its National Sustainable Development Strategy, the German government sets the goal of reducing land use for settlement and transport infrastructure from today's figure of around 54 hectares a day to under 30 ha per day by 2030. This path is aimed at achieving net-zero land use by 2050 in line with circular flow land-use management.

Reducing land use is a core component of sustainable development. Avoiding land use, i.e. conserving natural spaces as carbon sinks, is playing an increasingly important role in Nature-based Solutions. It is also important for conserving agricultural land and biodiversity.

The coalition agreement envisages underpinning the land use goal of the National Sustainability Strategy with concrete measures.

We will scrutinise planning law instruments as well as those under finance and support policies to determine their effectiveness for space-saving planning and building. Measures will be proposed for further developing these instruments or improving their use. This work will be closely coordinated with the EU Soil Strategy, the Climate Adaptation Strategy and the National Strategy on Biological Diversity of the BMUV.

Our actions:

- As part of the research and development project “Federation-Länder Dialogue on space-saving”, we will develop components for target agreements on reducing land use and take these as a basis for developing a package of space-saving measures
- Legal instruments and funding and financing options will be further developed during implementation of the measures
- We will maintain the knowledge and communication portal www.aktion-flaeche.de

7.9. Strengthening the Federal Defragmentation Programme by building further wildlife crossing aids.

The fragmentation of habitats by the transport network (road, rail) and increasing traffic density have led to habitat isolation and a decline in the quality of fauna and flora habitats that are still intact. Exchange within and between populations, colonisation of new habitats and important vector functions of animals are impaired or no longer occur to an adequate extent.

To implement the biodiversity strategies of both Germany and the EU, and the German government's Sustainable Development Strategy, existing fragmentations must be reversed

and measures put in place to prevent new ones. The goal is to restore ecological permeability for all species affected by fragmentation.

To reduce the impact of fragmentation caused by the federal transport network, the Federal Defragmentation Programme was set up in 2012. It defines 93 priority segments where defragmentation measures are needed. These measures are funded from the remediation budget of the Federal Transport Ministry. However, implementation of the programme is progressing only slowly.

Our actions:

We will update the Federal Defragmentation Programme to take into account the fragmentation effects of roads, railway lines and other linear infrastructure. Implementation will be continued with funding of three structures per year.

7.10. Incorporating wildlife crossing aids in federal transport infrastructure

In the National Biodiversity Strategy, the German government committed to restoring ecological permeability of fragmented spaces. The Länder are responsible for creating the Natura 2000 network and promoting the transboundary biotope network. The nationally important habitat connectivity axes are a particular focus. To effectively incorporate crossing aids into the infrastructure network, they need to be designed in a nature-friendly way and connected to the surrounding landscape. Environmental design and hinterland connection of crossing aids must form part of an overall concept at regional and local level. These measures include:

- Incorporation into existing habitat connectivity and species protection strategies of the Länder
- Integration into municipal landscape planning
- Involvement of local land users in environmental design
- Cooperation with local stakeholders, nature conservation groups and user associations

Responsibility for habitat connectivity, hinterland connection and environmental design in line with nature conservation goals lies with the Länder and municipalities

Our actions:

The Federation will fund model projects for developing solutions.

8. Data collection, monitoring, modelling and reporting

To pursue biodiversity conservation and climate action effectively, we need to systematically record the status and development of our ecosystems. Only this will enable us to recognise trends quickly and counter them where necessary. Emissions reporting in the LULUCF sector is only as accurate as the available data for ecosystems in this sector. We need to expand capacities in this area.

There are already many institutions gathering a range of data on ecosystems in Germany. We will improve networking among them, as often correlations only become apparent when observations from different fields are combined. We will also continue to harness and incorporate data from new sources, for instance satellite remote sensing. The expanded data basis will be used to adapt and improve the tools for ecosystem modelling. A more robust characterisation of the current conditions will allow more reliable projections of future ecosystem developments, also with a view to the goals of the Climate Change Act.

Measures

8.1. Improving accuracy and usefulness of emissions data and projections for reporting – enacting an ordinance in accordance with section 3a of the Climate Change Act

The new section 3a of the amended Federal Climate Change Act lays down the first concrete targets for net emissions in the LULUCF sector. For example, CO₂ emissions from drained peatlands and CO₂ removals in forests (negative emissions) are counted towards LULUCF emissions. However, these are considerably more difficult to determine than emissions in other sectors covered by the Climate Change Act, such as gas or coal power plants, and consequently there are still a lot of uncertainties.

In light of this, reporting on Nature-based Climate Action will be improved significantly. This must include examining to what extent marine ecosystems can also be considered. Links between the data sources currently used will be strengthened, especially with regard to the LULUCF emissions balance, and additional data sources will be integrated, in particular from satellite remote sensing. To ensure the additionality of LULUCF measures and preclude double counting, digital systems will be used to improve reporting accuracy.

The Climate Change Act contains the option of laying down rules for the calculation and accounting of CO₂ emissions and removals in the LULUCF sector in an ordinance. The relevant EU provisions must be complied with. The German government will enact a

corresponding ordinance as soon as possible in order to improve the planning bases for the LULUCF sector.

Our actions:

By the end of 2023, we will submit a ministry draft for the ordinance pursuant to section 3a of the Climate Change Act.

8.2. Reviewing intervals and form of the National Forest Inventory, expanding digitalisation of forest monitoring

The National Forest Inventory and the Carbon Inventory are carried out alternately every five years, gathering data on forests and their development. The intervals and form of the National Forest Inventory must be reviewed and where necessary adjusted in line with new requirements and new technical possibilities. Digitalisation of forest monitoring will be expanded as needed. This should include a review of new options for using remote sensing and integrate them into the overall forest monitoring strategy.

Our actions:

Under the lead responsibility of the BMEL, we will review the intervals and form of the National Forest Inventory and establish a digital forest monitoring system.

8.3. Establishing a National Soil Monitoring Centre at the German Environment Agency (UBA)

Soil is an asset to be protected, and robust and comparable data on long-term changes to soil quality and functions are needed to support climate adaptation measures. Soil quality surveys and soil monitoring programmes fall under different areas of responsibility and often focus on selected technical issues. This has resulted in poor comparability of the data and often prevents general statements on soils being made that are applicable across different monitoring networks. However, in order to develop climate policies and monitor the success of adopted measures, the climate action programmes of the EU and the German government need comparable national data on soils. The decision to establish a National Soil Monitoring Centre was enshrined in the coalition agreement for the 20th legislative period.

Our actions:

Drawing on emissions reporting structures, we will establish a National Soil Monitoring Centre at the German Environment Agency (UBA), in close cooperation with the Thünen Institut and other data-gathering institutions, with the aim of

collating the soil quality data collected in Germany and making this data as widely usable as possible.

To this end, we will bring together and network specialists from different fields active in soil-related monitoring and data gathering, with the aim of using data evaluation and modelling to produce joint, nationally harmonised, robust statements on soil status and changes. All institutions related to soil monitoring will be involved – from the Federation, Länder, science and research.

8.4. Further developing national biodiversity monitoring with the goal of determining the contribution of Nature-based Climate Action to biodiversity conservation

This Action Plan is aimed at effectively promoting both climate change mitigation and biological diversity. It therefore covers a wide range of measures and topic areas. A sound scientific data foundation is needed to determine to what extent the desired effects for biodiversity conservation are achieved.

The national monitoring programmes currently in place or being set up for nature conservation, as well as other data collection in the fields of environment and land use, already provide scientific support for the Action Plan. This will be taken as a starting point for work with leading institutions to establish or build on monitoring programmes in the entire landscape. The results can be used to draw conclusions on trends in the size and quality of the habitats promoted by the Action Plan, and to compile lists of representative or typical species.

Protected areas, wilderness, connected habitats and small-scale structures in agricultural landscapes will also play an important part. Based on existing activities, we will develop a system to monitor protected areas, wilderness and habitat connectivity. This system must be capable of describing changes in the size of habitats, their quality and typical species. To this end, programmes for monitoring characteristic species groups will be further expanded. To help expand the data basis, citizen involvement in specialist and nature conservation associations will be promoted and training provided. The data basis will be analysed using scientific methodologies which enable the Action Plan's contribution to biodiversity conservation in Germany to be described.

Our actions:

By 2024, we will develop and gradually implement a plan for monitoring biodiversity in the context of the Action Plan. This will provide a basis for identifying and quantifying the effects of the Action Plan on biodiversity conservation in Germany.

8.5. Monitoring the climate effects of measures for the ecological development of rivers, including waterways

Measures under the Blue Belt programme and water management measures at rivers and waterways enhance the condition of floodplains, improve connections between rivers and floodplains and increase the naturalness of riverbeds and banks. This leads to positive climate-relevant effects, for instance in the causal relationship between flooding area and flooding frequency. It also promotes beneficial changes in land use and de-sealing, and positively impacts the soil and groundwater balance, biodiversity and material turnover, including nutrient and carbon retention. A systematic classification using relevant parameters and models will allow a credible assessment of climate-related effects of measures implemented as part of ecological river development under the Blue Belt programme.

Our actions:

- We will draw up a monitoring strategy for assessing the climate effectiveness of measures and determine the actual status, target status and trends
- We will develop and apply projection models
- We will establish long-term monitoring and progress assessment

8.6. Improving forecast capabilities of water balance analyses

The status of the water balance is decisive for the functioning of ecosystems and their natural processes. The natural balance of infiltration, evaporation and surface run-off are the processes underlying the water balance. To understand the impacts of ground and surface waters and their ecosystems, we need a more extensive, interdisciplinary nationwide exchange.

The goal is to cooperate with the Länder to develop accurate forecasts of the available water resources. This will enable regional and supraregional analyses and allow suitable measures to be formulated for securing a near-natural, regional water balance which takes the water needs of the ecosystem into account. The forecasts will serve as the basis for assessing individual projects. These include nationwide water balance modelling (with hydrogeological models), tied in with climate models as a basis for analysing medium to long-term water resources and water needs in all regions of the country. The model anticipates changes in the landscape (e.g. forest conversion).

Our actions:

We will develop a coordinated joint programme of work for the competent federal authorities aimed at offering joint, integrated data and services. The projects

envisaged in the programme of work will be implemented by the competent federal authorities or through the award of research and development contracts.

8.7. Determining land requirements for water body development corridors

If watercourses and floodplains are given the space to develop, they will again be able to perform numerous functions and ecosystem services and build long-term resilience to the impacts of the climate crisis.

The land needed for water body development corridors must be determined on the basis of expert assessment, taking into account sustainable water resource management and the needs of nature conservation and the water industry. The improvements in ecosystem services associated with the additional space for rivers and floodplains and the impacts on current and future uses, including conflicting uses, will be set out. The aim is to create a sound scientific basis to secure land under spatial planning procedure for future water body development. This approach will first be examined more closely in simulations and pilot projects.

Our actions:

- We will review and update the methodology for determining the land requirement for water body development corridors
- Using suitable examples, we will identify and map (GIS) the land requirement for water body development corridors and analyse the effects on ecosystem services and uses; pilot projects and simulations for incorporating the results into spatial planning will be carried out
- Subsequently, we will conduct a nationwide survey and mapping (GIS) of the land requirement for water body development corridors using an agreed methodology. The findings will be communicated to the regional planning authorities

8.8. Targeted support for research on monitoring and modelling terrestrial and marine ecosystems and harnessing AI

A good data basis is a prerequisite for improving the status of our ecosystems and conserving biodiversity as the climate crisis progresses. Often, however, there is a lack of state-of-the-art equipment, data in the necessary quality and quantity, and statistical-mathematical processes for identifying correlations in the data and using them for projections.

To expand the data basis, we especially need to tap existing data sources that have not yet been used for ecosystem monitoring, and collect new data. Moreover, new methodologies

can be developed using the modern techniques referred to above to collect new data on parameters not previously considered. The most important aspect, however, is to develop models using the broadest possible data basis that reliably describes the behaviour of ecosystems, thus enabling projections to be made on their future development.

Artificial intelligence (AI) can play a role in this. For example, smart sensors allow data to be collected more efficiently, automatically categorised and evaluated in real time. AI systems help recognise patterns in large data sets, thus facilitating modelling – especially in those fields which stretch the limits of conventional modelling methods.

To leverage this potential and make it visible and usable on a large scale, ambitious, application-oriented research and development projects must be funded. The initiative AI lighthouse projects for the environment, climate, nature and resources is one such tool for supporting high-visibility environmental AI projects.

Our actions:

We will initiate research into new approaches for monitoring e.g. carbon stocks in soil, or marine habitats, to ensure their continued function in the ongoing climate crisis.

In a new programming cycle of the AI lighthouse projects initiative, we will support around 15 projects which will use new techniques and AI-based monitoring, modelling and projection methodologies to capture the changing state of ecosystems more accurately and generate new findings for forward-looking nature and climate policies.

8.9. Tapping remote sensing potential for Nature-based Climate Action

With new technology and evaluation procedures, remote sensing holds largely untapped potential for greatly improving the data on ecosystem status and changes and on projections for the future development of our ecosystems. Robust use of Earth observation data (such as that from the European Copernicus programme, flyovers and survey and sensor networks) can significantly streamline and optimise environmental and nature conservation monitoring at the different administrative levels (Federation, Länder, municipalities). A basic, cross-cutting task is to consolidate and coordinate data use and accessibility in the field of Nature-based Climate Action.

Besides quality-assured data access and the development of better data products, this requires coordination among the responsible institutions. Pilot applications must be translated into operational structures and processes. Services for accessing data products must be developed with concrete objectives for Nature-based Climate Action in mind. Only

this will enable environmental protection and nature conservation authorities throughout the country to make long-term use of Earth observation data and develop policy recommendations for Nature-based Climate Action.

Operationalising satellite services is already well established in atmospheric, climate and agricultural monitoring. For example, remote sensing data improve weather analyses and the quality of forecasts. In recent years, satellite remote sensing has also been widely used for situation assessment and planning in the context of civil protection, and is now embedded in authority structures. These benefits should be used for environmental and nature conservation monitoring as well.

Federal administration currently lacks the extensive expertise and resources needed to implement this, and the scientific community must therefore be involved in setting up and coordinating the work. The goal is to develop modular services and processes for accessing data products, making them operational and ultimately transferring to the ministry the necessary resources for maintaining the procedures.

Our actions:

Together with partners from science and industry, we will transfer scientific findings from remote sensing to a tool box for efficient operational monitoring of the terrestrial and marine environment, and so significantly advance implementation of NbS.

9. Research and capacity building

Ecosystems are comprised of diverse interdependencies that can be very complex. Climatic conditions, nutrient supply, landscape type and many other factors influence the occurrence of animal and plant species. These in turn impact living conditions in and around the respective ecosystem. However, the accelerated climate crisis is affecting the balance of our ecosystems, forcing them to adapt quickly to new conditions. We need in-depth research on these interactions in our changing ecosystems. The better we understand the interdependencies, the more precisely we can tailor the options for Nature-based Climate Action.

We are already familiar with many measures which can effectively advance climate action and biodiversity conservation – this Action Plan on Nature-based Solutions for Climate and Biodiversity is a testament to that. What is vital, however, is that this knowledge is available in the places where measures can be implemented. Stakeholders who own or manage

suitable sites need support in planning and implementing NbS, and contact points which cover a broad spectrum of knowledge.

Measures

9.1. In-depth research on Nature-based Climate Action

In-depth research into the interdependencies and changes in and between different ecosystems is crucial for deriving options for effective, targeted Nature-based Solutions. In particular in view of the accelerating climate crisis, we need to understand the current developments in our ecosystems and quickly develop NbS which can be implemented as soon as possible.

The German government already supports a range of research projects on NbS, especially under the Research for Sustainability strategy (FONA). In future we will ensure that NbS issues are sufficiently addressed. In this way we will continue adding to our knowledge of Nature-based Climate Action and building the corresponding research capacities. We need to develop the requisite expertise now so that science can keep abreast of developments in the coming years and decades.

Our actions:

We will systematically take stock of ongoing and planned research on NbS and compare it with the research needs in this field. Calls for research will be issued in cases where these needs are not adequately covered.

9.2. Trilateral Wadden Sea research – the UNESCO World Heritage Site Wadden Sea and the challenges of climate crisis and biodiversity loss

The impacts of the climate crisis, in particular the rise in sea levels and temperature, and growing frequency of extreme weather events, will have a major effect on the Wadden Sea as a unique, dynamic, diverse and highly productive ecosystem and on its socio-economic structures. Additional pressures arising from unsustainable uses and continued high inputs of nutrients and pollutants impair the Wadden Sea and its functions.

To improve projections on the future development of the Wadden Sea ecosystem and in light of existing pressures, more accurate data are needed on climate-related changes and their impacts on coastal stability and the Wadden Sea ecosystem, and ecosystem functions must be evaluated.

The planned research programme comprises interdisciplinary projects involving all relevant stakeholders and user groups of the Wadden Sea region. It builds on approaches and findings from ongoing coastal research activities funded by the Federal Ministry of Education and Research (BMBF).

Based on these results and on existing knowledge, recommendations for action and solutions are to be drawn up for the protection and long-term conservation of the UNESCO World Heritage Site Wadden Sea. These will focus in particular on the physical, biogeochemical and ecological processes and high productivity and biodiversity of this ecosystem, with the aim of improving and preserving its socio-economic functions (e.g. natural coastal protection) and ecosystem services (e.g. natural carbon sink) for the long term. To this end, specific proposals for the restoration of degraded Wadden Sea ecosystems are to be developed and pilot projects implemented where suitable.

Our actions:

This will be Germany's contribution to a trilateral, coordinated research programme aimed at creating the bases for permanently protecting the Outstanding Universal Value and integrity of the UNESCO World Heritage Site Wadden Sea.

9.3. Applied research on the potential of Nature-based Solutions for climate change adaptation

Nature-based Solutions are a key component in climate change mitigation and adaptation and for strengthening biodiversity. NbS can make society and ecosystems more resilient to the impacts of the climate crisis and help combat climate change.

Possible research areas are the potential and limits of NbS (including in combination with technical solutions), with a focus on integrated solutions in natural spaces. Examples are flood prevention in low mountain ranges, groundwater recharge, retention areas in watercourses and natural coastal protection. A specific field of research might be assessing the possibilities and limitations of NbS in urban spaces for water-smart urban development (sponge city).

The applied research in this measure is aimed at turning the opportunities offered by NbS into practical options for action, especially in climate change adaptation, and where possible quantifying the co-benefits for climate change adaptation and mitigation, especially Nature-based Climate Action. This will be followed by an assessment of the adaptation and mitigation effects of NbS. Another component of this research will be to analyse the potential for implementing NbS.

The applied research will formulate criteria for identifying synergies between adaptation to the climate crisis, nature conservation and NbS, and highlight practical approaches for evaluating these synergies.

Our actions:

We will quantify co-benefits in order to assess the potential of NbS for Nature-based Climate Action, climate change adaptation and biodiversity conservation, and evaluate the effectiveness of measures (ex ante and ex post).

9.4. Scientific support for projects, programmes and measures under the Federal Action Plan on Nature-based Solutions

The Action Plan will be underpinned with scientific support. The purpose is to review the effectiveness and efficiency of the Action Plan and its measures, and to mobilise financing of applied scientific studies to fill knowledge gaps in the development and implementation of NbS projects, programmes and measures. The following clusters are planned:

- Overarching evaluations and studies on projects, programmes and measures under the Action Plan
- Scientific support for the duration of especially suitable and/or innovative projects and programmes
- Scientific support on interdisciplinary issues (e.g. public perception and acceptance of the Action Plan and its projects, programmes and measures; analysis of interactions between climate action, biodiversity conservation and people; examining and assessing both specific and overarching impacts)

Our actions:

By mid-2023 we will establish scientific support for the Action Plan. From 2024, the Scientific Advisory Board for Nature-based Climate Action will evaluate the scientific support (see measure 9.5).

9.5. Establishing the Scientific Advisory Board for Nature-based Climate Action at the BMUV

Nature-based Climate Action is an important cross-cutting topic in the work of the BMUV, and brings together core competences. An independent scientific perspective will help optimise the planning on Nature-based Climate Action of the BMUV to ensure it is as effective as possible. Connections and interactions between different measures must be considered, and it needs to be ensured that the Action Plan has a positive impact overall. It

also has to be determined whether supplementary measures are necessary in the course of implementation.

To that end, work in the field of Nature-based Climate Action needs the systematic support of interdisciplinary scientific expertise. We will therefore set up a permanent Scientific Advisory Board for Nature-based Climate Action, comprised of specialists from relevant disciplines whose expertise can directly inform the ministry's work in the field of Nature-based Climate Action.

Our actions:

In 2023, the BMUV will appoint a Scientific Advisory Board for Nature-based Climate Action comprised of specialists from relevant disciplines. It will be asked to provide expert assessments on issues related to Nature-based Climate Action.

9.6. Establishing Agencies for Nature-based Climate Action

Nature-based Climate Action can only have broad success if local stakeholders are informed of the support options and can be enlisted to implement corresponding measures. In many cases, support will also be needed to develop joint projects of different stakeholders, coordinate measures with co-benefits, submit project applications and implement specific measures. Knowledge on the goals, opportunities and particular features of Nature-based Climate Action and the various relevant disciplines involved needs to be generally improved to ensure a high standard of implementation. Alongside this, it is important to improve the network of actors and improve local cooperation for NbS.

We want to provide advice and information on NbS through dedicated Agencies for Nature-based Climate Action, and support potential applicants in identifying, developing and submitting suitable measures. The Agencies will be established and their functions defined in close coordination with the Länder. The Agencies are the first and central points of contact for questions on implementing NbS. The Agencies' work will target agricultural and forestry operations, other land owners and managers, administrations and authorities, associations and interested members of the public. Where relevant, the Agencies should also foster good relations with regional protected area administrations such as national parks and biosphere reserves.

A priority task of the Agencies will be advising on available funding and assisting in the formulation of funding applications. In addition, Agencies can offer advice and support to municipalities, river basin and land development associations, e.g. on peatland and soil protection, and assist other key actors in planning NbS. The launch and implementation of NbS will be accelerated. The Agencies will cooperate with the responsible local offices.

Our actions:

First, we will establish a national Centre of Competence for Nature-based Climate Action (federal body), to serve as a nationwide contact point for questions relating to NbS. The Centre of Competence will work with the Länder to set up regional Agencies for Nature-based Climate Action.

9.7. Making measures under the German Adaptation Strategy (DAS) funding programme permanent, with a focus on Nature-based Climate Action

The DAS funding programme was revised in 2021 and focuses on supporting municipalities and municipal institutions in promptly implementing the necessary processes for climate change adaptation and transformation in an integrated, sustainable way. A major focus is on the use of synergies and positive side effects for the sustainability goals, especially in relation to climate change mitigation, Nature-based Solutions and biodiversity – and thus automatically contributes to Nature-based Climate Action. The support is specifically aimed at establishing positions for adaptation managers in municipalities who have the task of drawing up and implementing sustainable climate change adaptation strategies with a focus on NbS. In addition, the funding also covers the realisation of an investment project selected from the sustainable climate change adaptation strategy.

The second support element of the DAS programme comprises a competition to develop outstanding, innovative climate change adaptation strategies which generate synergies with sustainability and which are trialled through an investment project.

The Action Plan on Nature-based Solutions for Climate and Biodiversity will gear certain measures under the DAS programme more specifically to Nature-based Climate Action. This includes broadening the role of climate change adaptation managers and expanding the consultation and qualification services of the Zentrum KlimaAnpassung (climate adaptation centre), aligning its work more towards Nature-based Climate Action.

Our actions:

- We will open a funding window to promote climate change adaptation managers
- We will support follow-on investment projects from the first programming round, limited to NbS only
- We will open the first funding window for innovative model projects

9.8. Funding guideline on Nature-based Solutions with a focus on rural municipalities

Municipalities and their surroundings, especially in rural areas, hold great potential for greenhouse gas reduction and/or sequestration, biodiversity conservation and strengthening ecosystem resilience. Municipal projects should deliberately tap the synergies between climate action, nature conservation and measures to counter the impacts of the climate crisis. The projects can include measures for directly protecting, strengthening and restoring natural ecosystems. The main areas of support will be published in a funding guideline. One priority area may be contributing to the creation of a nationwide network of extensively managed margins and verges in municipalities. As “paths to diversity” these can enhance the nature experience and promote biodiversity and environmental education (citizen science).

Our actions:

Before the end of 2022 we will draw up a funding guideline to support projects with a particular focus on Nature-based Climate Action in rural municipalities.

9.9. Advancing Nature-based Climate Action through landscape planning

A range of ecosystems play a significant role in Nature-based Climate Action, for instance, old-growth forests, floodplains and peatlands. Alongside the active management of their use, planning safeguards are needed for these sites. Landscape planning pursuant to section 8 ff of the Federal Nature Conservation Act (BNatSchG) can serve as a model for measures here by identifying suitable areas, quantifying their potential services and integrating safeguards in overall spatial scheduling and urban land use planning.

Landscape structure planning is key here. It specifies provisions of the landscape programme, while also fulfilling essential service functions for municipal landscape planning, such as preparing regional climate scenarios, compiling information on abiotic environmental media (e.g. carbon-rich soils) and land uses, or by drafting regional sensitivity and vulnerability analyses. Landscape planning procedures must also fulfil their legal mandate by addressing conflicting goals through internal assessment. Potential synergies or conflicts with other disciplines or planning levels can also be identified or averted on the level of the landscape master plan.

Our actions:

In model projects we will test how the respective levels of landscape planning contribute to identifying and safeguarding sites and ecosystems for NbS and draw up transferable guidelines for action for planning regions (landscape master plan) and municipalities (landscape plan). This will ensure that the needs of nature and landscape are taken into greater consideration in relevant planning procedures.

9.10. Promoting education for Nature-based Climate Action

The educational measures on Nature-based Climate Action will target many people through activities and projects in early childhood education, schools and professional training. Three main educational packages are envisaged:

- Educational materials for young children, primarily focussing on forests and urban green spaces
- Projects on raising awareness, practical know-how and problem-solving abilities of school children of all ages in relation to Nature-based Climate Action. Creation of interdisciplinary teaching and study materials as a tool box for primary and secondary schools. This will include innovative analogue and digital materials and an interactive digital setting for nationwide comparison of skills acquired (for example, serious game/simulation/video competition)
- Projects to promote further education institutions for a range of professional groups, dealing with all matters related to Nature-based Climate Action; elaborating, testing and evaluating qualification and further training services for vocational trainers

Our actions:

We will support projects producing educational materials for early-childhood education, a tool box for schools and further education measures for vocational trainers.

9.11. Mobilising private capital for Nature-based Solutions for climate and biodiversity

Public budgets alone will not be able to cover the enormous funding requirement for Nature-based Solutions. For this reason, private financiers need to be brought on board for the conservation of natural carbon sinks. A particular challenge in this context is for NbS to be reflected in investment decisions as an ecosystem service and hence a public good. In addition, we need to protect carbon sinks not only nationally, but across the globe. That is why supply chains (e.g. verifying that they are deforestation free) are relevant for NbS and should be taken into account in investment decisions.

Our actions:

We will task the German government's Sustainable Finance Advisory Board with developing concrete options for mobilising private capital for the conservation of natural carbon sinks and ecosystem protection, and take these into consideration

in the implementation and further development of the German Sustainable Finance Strategy.

10. Cooperation in the EU and the international community

Nature-based Solutions can only succeed in close cooperation at international and EU level. We will continue to promote NbS and advocate an ambitious approach in bilateral and international cooperation and all relevant EU processes.

Germany made NbS a cross-cutting topic for the climate and environment track of the G7 negotiations. At European level, the European Commission has drawn up a number of legislative proposals and initiatives based on the Green Deal and the Fit for 55 package with a focus on NbS. The Action Plan will also be a central tool for transposing the EU legal instrument on nature restoration into national law. This instrument legally enshrines the goals of the EU Biodiversity Strategy for 2030 on the restoration of ecosystems.

We will support NbS at international level too, continuing to play our part in implementing the Convention on Biological Diversity, the Paris Climate Agreement, the Convention to Combat Desertification, the UN Decade of Ecosystem Restoration, the UN 2030 Agenda and many other important regulations and initiatives relevant for Nature-based Climate Action. In bilateral cooperation formats, e.g. via the International Climate Initiative (IKI) or climate partnerships, as well as in the German government's development work, Nature-based Solutions will play an important role.

Measures

10.1. Advancing ambitious design of Nature-based Solutions in all relevant EU processes

The cross-cutting topic of Nature-based Solutions is linked to a number of different processes at EU level. Many are part of the European Green Deal and its Fit for 55 package. However, it is important to take a broader view and anchor NbS in many different fields.

Among the main processes and projects are:

- the Regulation on the inclusion of greenhouse gas emissions and removals from land use (LULUCF Regulation)
- the legal instrument for restoring ecosystems in the framework of the Biodiversity Strategy for 2030
- the Forest Strategy

- the Soil Strategy
- the certification framework for carbon removals announced in the Commission communication on sustainable carbon cycles
- the Water Framework Directive
- the Marine Strategy Framework Directive
- the Directive on corporate due diligence (sustainable supply chains)
- the Regulation on deforestation-free supply chains
- the Destination Earth initiative

Our actions:

We will continue to advance NbS in all EU processes, urge the Commission and the Council to take an ambitious approach and work to prevent greenwashing.

10.2. Enshrining Nature-based Solutions in international climate partnerships and in other bilateral cooperation formats

Climate partnerships are becoming more important in the German government's international climate policy. These partnerships and other bilateral cooperation projects on climate and environmental topics will also incorporate Nature-based Solutions as a way of harnessing the synergies between nature conservation and climate action.

Our international cooperation can act as a catalyst for advancing NbS as a global undertaking. Throughout the world, forests and soils are often a significant source of greenhouse gas emissions. Countries and regions with biodiversity hotspots (e.g. tropical forests, peatlands, mangroves), dynamic industrialisation pathways and high climate vulnerability (e.g. Amazon, Congo Basin, Indonesia, India, southern Africa) are particularly affected by degradation. Better protection, sustainable management, conservation and restoration of ecosystems and their carbon sink function can therefore play an important role in achieving nature conservation and climate targets, advancing climate change adaptation and mitigation and forwarding the United Nations Sustainable Development Goals in general.

International partnerships and cooperation projects will raise awareness of NbS in partner countries and develop joint pilot initiatives. Besides drawing up agreements on specific ecosystem conservation and restoration measures, in our climate partnerships and other joint activities we will agree on how to work together at global level for ambitious implementation of biodiversity and climate targets and how we can increase international NbS financing. The programme aims to raise awareness of policy-makers in the partner countries of the benefits and uses of NbS, offer consultation services and develop pilot initiatives in selected countries.

Our actions:

The German government will step up its efforts to anchor NbS as a priority area for political cooperation under international climate partnerships and bilateral cooperation formats. The BMUV will offer partner countries consultation services (e.g. support for the development of national action plans for NbS, integration of NbS in national development plans, assistance in meeting environmental and social standards) and work with partner countries on joint pilot initiatives (nexus approaches to NbS and for strengthening local value creation).

10.3. Raising international financing for Nature-based Solutions as part of biodiversity financing, including through multilateral development banks

Nature-based Solutions can play a key role in biodiversity conservation and climate action in countries of the Global South. For that reason, we need to increase capacity building and step up implementation of measures, both of which will require additional funding.

Alongside bilateral cooperation, multilateral development banks can substantially increase their role in financing NbS in the Global South.

Our actions:

Up to 2025, we will significantly raise the German government's international biodiversity financing, including expanding international financing for NbS.

We will press for a much larger contribution by multilateral development banks to funding NbS as part of their biodiversity financing.

10.4. Mainstreaming Nature-based Solutions in international cooperation

The German government is urging greater consideration and stronger integration of Nature-based Solutions in international cooperation. The goal here is an ambitious international NbS policy based on the understanding of the UNEA 5.2 Resolution on Nature-based Solutions (UNEP/EA.5/Res.5). NbS hold great potential for climate action, biodiversity conservation, climate adaptation, raising resilience and achieving other SDGs of the United Nations.

This measure will better integrate NbS into multilateral formats such as the Rio Conventions (UNFCCC, UNCCD, CBD) and the G7 and G20. This will create a joint understanding of the advantages of NbS, secure increased funding and better implementation and establish robust social and environmental standards. International cooperation will strengthen the framework conditions needed and expand opportunities for experience sharing.

Our goal for the coming years is to maintain NbS as an integral component of the work and discussions of the G7 and in future of the G20 too. Together with G7 and G20 member states, we want to become international pioneers of Nature-based Solutions.

Our actions:

The German government will step up its efforts to mainstream NbS as a priority topic of international and multilateral cooperation (G7, G20, Rio Conventions). As part of its cooperation in the above formats, the German government will also establish platforms for exchanging experience on NbS, thus improving the understanding and integration of NbS into the Rio Conventions and the G7 and G20 formats.

Implementing and reporting on the Action Plan

The aim is to begin implementing all measures of the Federal Action Plan on Nature-based Solutions for Climate and Biodiversity during the current legislative period and establish the corresponding funding facilities.

In 2025 at the latest, the German government will publish a progress report on implementation of the Action Plan. This will include an evaluation of the measures implemented and an assessment of whether adjustments are needed.

As many measures are long term, regular review will be needed after 2025. This must include comparing the Action Plan to the latest knowledge on the climate crisis and what is needed to combat it. In particular, trends in the emissions balance in the LULUCF sector must be considered.

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