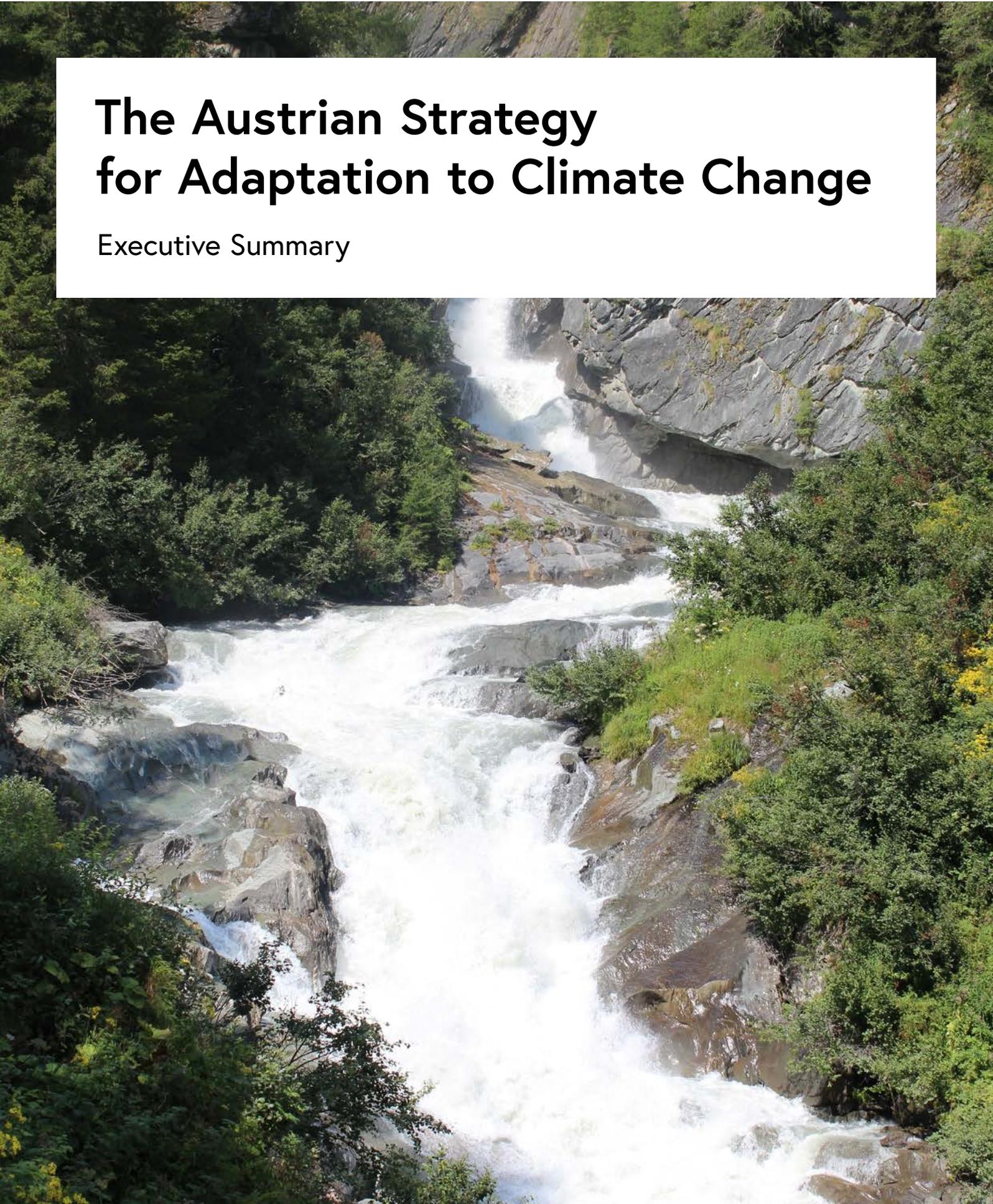


The Austrian Strategy for Adaptation to Climate Change

Executive Summary



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Vienna, 2024

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1 Introduction

Climate change is becoming increasingly noticeable in Austria. It is confirmed by measurements and observations and is progressing faster than the global average (Stangl et al. 2022). Since 1880 the average surface temperature in Austria has increased by almost 2°C (APCC 2014; CCCA 2021). 15 of the 16 warmest years from more than two and half centuries of recorded observations have occurred since 2000 (Haslinger et al. 2022; Stangl et al. 2022).

In its sixth assessment, the Intergovernmental Panel for Climate Change is clearer than ever before: The extent, speed and magnitude of the impacts of climate change significantly exceed previous estimates. Human activities are clearly responsible for global warming (IPCC 2023). This increases the urgent need for rapid implementation of mitigation and adaptation measures (IPCC 2023).

With the Paris Agreement (UNFCCC 2015), a global legally binding climate protection agreement with obligations for developed and developing countries was adopted for the first time. In the Paris Agreement, adaptation to climate change is seen to be as important as mitigation. In addition, the European Climate Law (VO (EU) 2021/1119) provides a binding framework for EU-wide net zero emissions by 2050 and adaptation to climate change.

For several years, Austria has been pursuing this two-pillar principle of climate policy, which relies on the one hand on reducing greenhouse gas emissions to mitigate climate change directly and on the other hand on adapting to the impacts of climate change that can no longer be avoided. Adaptation to climate change must be based on the latest scientific knowledge and current political framework conditions. Climate change is taking place faster and more strongly than expected. The consequences are felt more and more clearly in all regions of the globe and, given their speed, they present humanity with enormous challenges (IPCC 2023). The environment, economy and society are no longer able to keep up without controlling interventions. A precautionary adaptation policy must show the way into the future. Austria was one of the first EU states to combine a strategic concept for climate change adaptation with a comprehensive action plan to implement concrete recommendations for action. The first version of the Austrian strategy for adapting to climate change was approved and adopted by the Council of Ministers in 2012 and in 2013 it was acknowledged in the Conference of State Governors. Since then the implementation of the recommendations for action in the strategy has been carried out. In 2017 the first update of the strategy was published. In this revised version of the strategy, in which, among others, all affected governmental departments, the federal states, interest groups, stakeholders and NGOs were involved, key results from the first progress report (2015) were also integrated. In 2021 the second progress report (BMK 2021) was published.

This highlighted current developments and successes in implementation, as well the need for further action and provides the basis for this revision of the strategy.

Furthermore, the last progress report showed that awareness with respect to adaptation to climate change has increased significantly since the first report. Progress could be documented in all areas of action. Many new initiatives were started by the federal government, the federal states and local governments. They focus on the practice-oriented expansion and transfer of knowledge, as well as the implementation and evaluation of adaptation measures.

For years, the federal and state governments have been cooperating increasingly on adaptation within the framework of the Austrian Adaptation Strategy. The focus is particularly on cross-sectoral areas of action, the successful implementation of which is, due to their complexity, promoted through close cooperation. Some examples of activities are presented below:

- Within the framework of a Federal – State Working Group on the topic of personal precautionary measures, the development of a Natural hazard and climate change check for municipalities was initiated and supported. This aims to increase the risk awareness and capacity for precautionary measures within the scope of action of municipalities.
- Since the start of the KLAR! Programme (Climate Change Adaptation Model Regions) in 2016, there is an even closer cooperation between the federal and federal state governments in order to counteract the impacts of climate change at the regional and local levels and to utilize opportunities accordingly.
- In order to sensitize stakeholders at the regional level to the consequences of climate change, regular dialogue events have been held since 2013 to transfer knowledge and highlight a wide range of options for action. These were carried out through cooperation between the BMK, the Climate and Energy Fund, the federal states and the Federal Environment Agency.
- The Austrian Network of Innovative Climate Change Adaptation for Practitioners at Regional Level (Adaptation Network, KWAN for short) was established in 2021 as a platform for cooperation and exchange of experience. The BMK, the federal states and the Climate and Energy Fund support the network activities in the form of a core steering group.
- Since 2017, climate status reports have been published annually on behalf of the nine federal states and the Climate and Energy Fund. The reports show how extreme weather events are to be considered in the context of climate change and what effects they have.
- The EU Climate Change Adaptation Mission aims to support regions and local authorities in their efforts to implement preventive and coping measures and to strengthen resilience to the effects of climate change. As of June 2023, there were 15 Austrian signatories to the Mission Charter. The Austrian Mission Action

Group CLIMATE CHANGE ADAPTATION has been supporting national implementation since the end of 2021.

Cross-sectoral considerations of adaptation requirements and the important cooperation of all affected stakeholders and governance levels are particularly challenging. Coordination and cooperation within and across sectors and a coordinated approach must be further promoted. Despite all recognisable progress, there is still a clear need for further action. The progress of climate change clearly points to the increasingly urgent need for good adaptation practice. Synergies between climate change adaptation, climate change mitigation, biodiversity conservation and health must be utilised to a greater extent and maladaptation must be avoided. In particular, the social dimension of climate change must also be incorporated into the measures taken, taking particularly vulnerable groups into account.

A “policy of many small, but also large steps” is needed, taking climate change aspects into account in all relevant planning. What is also needed is a socio-environmental transformation of society and the economy and a new awareness of the full significance of sustainability. Already today, the possible consequences of climate change must be systematically considered in all relevant planning and decision-making processes at national and local level. Coordination and cooperation, both within and across sectoral boundaries and across all administrative levels, should be further strengthened.

This is also an important step to avoid maladaptation. Maladaptation refers to measures that are predominantly reactive and, as pure symptom control, are promising in the short term at most, but prove to be counterproductive in the long term. The importance of avoiding maladaptation has increased worldwide. This is the conclusion of the IPCC’s Sixth Assessment Report (IPCC 2022). The current revision of the Austrian Strategy for Adaptation to Climate Change also demonstrates an increasing concern with regard to avoiding maladaptation. With the help of clear criteria, it makes a concrete contribution to promoting good adaptation practice (see also Context, Chapter 7). The avoidance of maladaptation and thus also cost-intensive adjustment for the national budget ultimately emphasises the need for a stronger link between budgetary and climate policy considerations. In line with Article 2.1.(c) of the Paris Agreement (UNFCCC, 2015), the federal government’s green budgeting method will be gradually taken into account in the implementation of this strategy. This means that criteria for a more impact-oriented approach to measures will be considered in the future. All of the federal government’s listed activities will also be covered by the budget within the upper limits of the applicable federal financial framework. Science and research play an essential role in avoiding maladaptation and supporting well thought-out, effective adaptation practice with a sound basis. Questions relating to adaptation to climate change are now an integral part of climate research. However, there is still an urgent need for further research, particularly with regard to the methodological evaluation of the effectiveness of adaptation. Likewise, good communication and education in

adaptation are key foundations for action, driving forward adaptation processes and measures and avoiding maladaptation.

The costs of action (climate change mitigation and adaptation measures) are almost certainly much lower than the medium to long-term costs of inaction (Steininger et al. 2020). This means that although adaptation requires sufficient resources, it reduces the damage caused by climate change and therefore has very positive effects.

This strategy forms the framework for successful adaptation policy throughout Austria. It is divided into two parts:

- the “Context” as a strategic framework with basic information and
- the “Action Plan” with detailed recommendations for action for the 14 fields of activity.

In the following chapters, the 14 fields of activity covered in the action plan are summarised in condensed form.

2 Agricultural sector

Agricultural activity has always been a climate-sensitive sector that has to adapt to climatic conditions and weather patterns due to its direct exposure. In particular, the annual distribution of precipitation is significantly influenced by regional topographies and climatic regions. The agricultural sector focuses on ensuring agricultural production and supply, as well as the preservation of the cultural landscape, in the face of the challenges of climate change. The areas of arable farming, grassland farming, fruit growing and viticulture, vegetable and ornamental plant cultivation as well as animal production, including fishing and beekeeping, are specifically addressed, considering both conventional and organic farming methods.

The possible negative effects of climate change on Austrian agriculture include yield and quality losses as well as decreasing yield security due to increasing dry periods and increased climate variability and unpredictability of weather events over the course of the year. Critical factors such as heat and drought stress, new or more established harmful organisms, a possible increase in the occurrence of extreme events, heavy precipitation, erosion, hail, late frost, but also water utilisation conflicts are among the major challenges.

The overarching objective of the agricultural sector is to ensure sustainable, resource-conserving, climate-friendly agricultural production of high quality and sufficient quantity to maintain security of supply, as well as to maintain or improve the ecosystem services of agriculture and ensure resilience to changing climatic conditions and their consequences.

In order to achieve this goal and thus make an important contribution to maintaining the security of food supplies, a range of different measures must be implemented to a greater extent. Among other things, it is necessary to build up and restore or preserve soil sustainably, a resource that is difficult to regenerate, both in agriculture and other sectors. Humus build-up and careful soil cultivation are key elements in this respect. In general, agricultural management, from plant cultivation to plant protection, plant nutrition and agricultural process engineering, must be adapted to long-term climatic developments and organic farming must be further strengthened due to its resource-conserving, environmentally friendly farming methods. A review of site suitability under changing climatic conditions aims to enable the selection of suitable crop species and varieties and to secure long-term yield potential.

The demands on plant breeding are also increasing, and the breeding of climate-fit crops must be stepped up further. Equally important is the continuation of research into and control of alien, invasive pathogens in crop and ornamental plants. Possible control measures to deal with established pathogens include preventative measures such as suitable site and variety selection, crop rotation, the selection of robust crop species and varieties and establishing a diverse range of species and site-adapted cultivation. Late frost damage in vines, apples and speciality crops is another major challenge in the field of plant protection that has been intensified by climate change.

Landscape elements such as trees, bushes, (multi-use) hedges and biodiversity areas can positively change the microclimate around agricultural land and the landscape and achieve a variety of favourable effects for agricultural production. Together with species-rich meadows and pastures, these biodiversity-promoting landscape elements provide important habitats, food and refuge areas for numerous animal and plant species in the agricultural landscape. Because pollinators and beneficial insects also benefit from these landscape elements and the latter also protect surrounding agricultural land from wind and water erosion, the resilience of agriculture to climate change-induced, more frequent damaging and extreme weather events is increased.

It can be assumed that there will be an increase in the area and intensity of irrigation in Austria's drought-prone regions. This development must be controlled taking the long-term regional situation and water availability into account, and potential conflicts of use must be considered in good time. In addition to increasing the efficiency of existing irrigation systems, it will also be necessary to select appropriate crop types and varieties as well as adapted management measures. Protected cultivation (greenhouses and foil tunnels) must be optimised in terms of energy use and construction to meet the challenges of the climate crisis.

The further development of organic farming should be promoted and considered in the recommendations for action. Soil life is promoted through humus-building measures, largely closed nutrient cycles combined with the avoidance of the use of synthetic chemical pesticides and fertilisers and the implementation of humus-building and humus-preserving forms of cultivation. Furthermore, material inputs into water bodies are reduced or avoided and greenhouse gas emissions are reduced. In combination with the use of diverse crop species and varied crop rotations, as well as the cultivation of rare crops and the promotion of beneficial organisms, organic farming also increases the animal and plant diversity of agricultural landscapes.

Existing alpine pastures must be preserved and abandoned pastures revitalised. Natural hazards such as soil erosion, mudflows and avalanches are reduced through site-adapted alpine pasture management. Alpine pastures have a high level of biodiversity and are among the most species-rich habitats in the Alps. Animal welfare and animal health must also be further promoted under changing climatic conditions. Direct and indirect effects of climate change influence the health of farm animals and can have a negative impact on production. The risks in agriculture will continue to increase due to

the consequences of the climate crisis, and new insurance models can offer options for risk diversification.

Table 1: Overview of the twelve recommendations for action in agricultural sector.

No.	Title of the recommended action	Goal
2.5.1	Sustainable building-up, restoration and conservation of soil as a resource	Increasing the resilience of agricultural production to the impacts of climate change by protecting or restoring soils, natural soil functions, building up, maintaining and stabilising an optimal humus and nutrient content, water absorption and water storage capacity in the long term and careful use of soil as a resource.
2.5.2	Adaptation of agricultural management to changes caused by climate change	Demand-orientated and standard-related crop production, plant protection, plant nutrition and agricultural process engineering as a contribution to yield security and food security under changing climatic conditions.
2.5.3	Reviewing the suitability of crop locations due to changing environmental conditions and developing recommendations for crop selection	Selecting suitable crops for the respective site conditions, expanding the range of crops and ensuring sustainable food security.
2.5.4	Breeding climate-resilient crops	Provision of plant species, seed mixtures and new breeds of varieties that are better able to tolerate climate change-related challenges. In particular, the focus is on heat-tolerant and water-efficient arable and grassland plants and varieties with a low susceptibility to diseases and harmful organisms.
2.5.5	Research into and control of alien invasive pests affecting crop and ornamental plants	Improving the level of knowledge regarding invasive alien pests in order to be able to react quickly and efficiently if necessary. Comprehensive monitoring, optimisation and expansion of warning systems and improvement of information and data transfer.
2.5.6	Environmentally friendly and sustainable implementation of plant protection measures	Optimisation of plant protection measures against established pests and other climate change-related challenges by changing the time and method of application and promoting an environmentally friendly and sustainable range of plant protection products, ideally combined with the development towards a long-term reduction in the use of plant protection products.

No.	Title of the recommended action	Goal
2.5.7	Integrated landscape design and improvement of agroecosystems including preservation and maintenance of landscape elements	Improvement of the agro-ecological situation (production and site protection) through biodiversity-promoting agricultural use and preservation of natural biodiversity through the reduction of areas exposed to wind, wind speeds and soil erosion as well as improvement of water retention by reducing evapotranspiration.
2.5.8	Increased establishment and promotion of water-saving irrigation systems and improvement of irrigation planning, including conflict management	Increased efficiency in irrigation and water use through the use of modern technological methods that allow irrigation to be optimised in terms of timing and quantity.
2.5.9	Optimisation of protected cultivation (greenhouses and foil tunnels)	Increasing the efficiency of energy and water consumption in greenhouses and polytunnels, particularly with regard to the increasing heat load in summer. Protecting greenhouses and polytunnels against more extreme events.
2.5.10	Preservation of existing alpine pastures and revitalisation of abandoned alpine pastures	Increasing the resilience of farms, promoting the health and well-being of alpine animals, mitigating natural hazards and climate risks, strengthening biodiversity and providing recreational opportunities for alpine pasture visitors.
2.5.11	Promotion of animal welfare and animal health under changing climatic conditions	Increase knowledge and assess the impact of climate change on animal welfare and health. Reducing the thermal stress of farm animals in combination with species-appropriate, stress-free husbandry. Development of preventive and, if needed, veterinary measures as a basis for decision-making by authorities and farmers.
2.5.12	Risk minimisation and the development and expansion of risk diversification instruments	Reduction of production risks and further development of insurance models to maintain a (small) farming structure and secure area-wide farming.

3 Forestry sector

Austria is one of the most densely forested countries in Central Europe. The total forest area is 4,015 million ha, i.e. almost half of Austria's national territory. Of this, 3,362 million ha are used as productive forest (BFW 2022). The central goal of forestry is to preserve the forest and its multifunctional effects through sustainable forest management (Austrian Forestry Act). Forests fulfil, for example, a protective function against natural hazards, a production function and a recreational function. They contribute to improving air quality and are of great importance for biodiversity conservation. Sustainably managed forests and forest soils are very important for climate change mitigation as carbon reservoirs. Forests and forest management are particularly sensitive to climate change. Forest management decisions are made for long production periods. In addition, forests are characterised by natural site conditions and are therefore directly affected by climate change. Well-planned, forward-looking adaptation measures and the avoidance of maladaptation in forestry are therefore of great importance.

The impacts of climate change on forestry are already clearly recognisable. Site conditions are changing and with them the vegetation, growth processes, ecosystem services and the entire interplay of species. Increased temperatures and changes in precipitation patterns are accompanied by increased drought stress and pose key challenges for forest ecosystems and forest management. Extreme events - such as the more frequent occurrence of droughts, storms or natural hazards - also increase the risk of forest damage (Glade et al. 2020). In addition to the direct impact, serious secondary damage occurs more frequently, such as mass propagation of pests after storm damage (Lexer J.M. 2022). The increased occurrence of more intense heatwaves and droughts is also expected to increase the risk of forest fires (BML 2022). Forests are often exposed to other stressors (e.g. wildlife impact, pollution, recreational pressure). When different stressors interact, the vulnerability of forest ecosystems to climate change is further increased.

The overarching goal of the forestry sector is to increase the stability, climate resilience and adaptability of forests, safeguard the multifunctional services provided by forests and ensure sustainable management that is adapted to climate change.

In order to increase the resilience and adaptability of forests to climate change, a number of important measures are already being implemented in forestry, but there is still a need for further action (BMK 2021). A forward-looking, site-adapted choice of tree species and origin, taking climate change into account, is essential. This requires information

on how the site suitability of tree species will change in the medium and long term as a result of climate change. Dynamic forest type mapping, which should be available as far as possible throughout Austria, assists in this respect. Similarly, forward-looking forest management also includes the timely introduction of (natural) regeneration measures, taking climate change-related site changes into account. In many places, structurally rich, site-adapted mixed forests are less susceptible to disturbance and more adaptable to climate change than structurally poor, non-site-adapted uniform stands. Diversity adapted to local conditions should therefore be increased at all levels (such as genetic, species-specific, structural, habitat diversity, etc.). Furthermore, soil-conserving management is essential in order to preserve forest soils and their important natural ecosystem services (such as carbon storage or water availability and quality) in the long term. Another focus is on minimising additional stressors besides climate change. This includes minimising damage caused by game (especially in protective forests). Furthermore, monitoring of pollution from emissions (such as nitrogen, acid and sulphur inputs, ozone, heavy metals and dust) must continue and this pollution must be reduced as much as possible to protect forest ecosystems. Visitor management measures should be considered in order to minimise the impact of recreational pressure.

Increased occurrence of biotic and abiotic damaging events requires improved crisis and disaster management. This also includes preventive measures on disturbed areas that increase the stability, resilience and adaptability of forests. Preventive action is essential and should be strengthened through ongoing advisory activities, education, training and awareness-raising among relevant stakeholders. Preventive measures are also essential to protect against forest fires. In addition to forestry, possible changes in wood quality and tree species must be anticipated in the area of wood processing.

Table 2: Overview of the nine recommended actions in the forestry sector.

No.	Title of the recommended action	Goal
3.5.1	Adaptation of the choice of tree species and origin as well as the tree species mix, taking forest regeneration and promotion of diversity into account	Increasing the stability, climate resilience and adaptive capacity of forests and reducing the susceptibility of the forest ecosystem to disturbance (e.g. by harmful organisms or storms). Strengthening a site-adapted choice of tree species and origin, taking climate change into account in the course of sustainable forest management. Increasing the diversity adapted to the respective site conditions at all levels (genetic, species-specific, structural, habitat diversity, etc.) and timely initiation of (natural) regeneration measures.

No.	Title of the recommended action	Goal
3.5.2	Soil-conserving cultivation	Preservation of the physical and ecological functions of the soil, in particular as a water and carbon reservoir and nutrient supplier.
3.5.3	Reduction of damage caused by game	Reducing the impact of game and grazing (peeling and browsing) as a prerequisite for climate change-adapted forest regeneration and maintaining stand stability.
3.5.4	Advisory services, training and further education on adapting forests to climate change	Ongoing advisory services, education, training and awareness-raising for relevant stakeholders (such as forest managers, people from the administration, interest groups, training centres and, in particular, all forest owners) to increase the stability, climate resilience and adaptive capacity of forests, taking the latest research findings into account.
3.5.5	Adaptation and improvement of disturbance and disaster management	Damage limitation in the event of increased biotic and abiotic damage events (such as windthrow or pest calamities).
3.5.6	Precautionary measures to prevent and combat forest fires	Development of further preventive measures, awareness-raising and continuation of forest fire monitoring and early warning systems to minimise the risk of forest fires. Development or revision of operational plans for fighting forest fires.
3.5.7	Maintaining, improving and restoring forest biodiversity and the ecosystem functions of forest habitats	Consideration of biodiversity conservation and enhancement in forest management adapted to climate change.
3.5.8	Pollution control to strengthen the climate resilience of forests and their ecosystem services	Protection against pollutants, in particular avoiding the eutrophication of (nutrient-poor) forests through nitrogen compounds and micro-aerosols, to strengthen the climate resilience of forests and their ecosystem services.
3.5.9	Forward-looking consideration of possible changes in wood quality and tree species in wood processing	Development of innovative, efficient techniques for processing wood in order to be optimally prepared for any changes in wood quality and tree species and to increase the added value of the wood utilisation chain and the substitution of materials with higher life cycle emissions with durable wood products.

4 Water management sector

Water management is one of the sectors most affected by climate change, as the water cycle is directly dependent on climatic factors. For every degree of warming, the air can absorb around 7 % more water vapour, which means that more evaporates, thereby changing the water balance. Furthermore, warming leads to a shift in precipitation from snow to rain and to an increased occurrence of extreme events relevant to water management, such as dry periods and droughts on the one hand and extreme precipitation events and floods on the other.

The changed water cycle is having an impact on water resources in Austria, which not only serve as the basis for our drinking water supply and thus the provision of services of general interest for society, but are also needed to ensure food security and safeguard the economic location and ecosystem services. Locally and seasonally, there are already quantitative and qualitative challenges in meeting the water requirements for different uses, including ecological requirements. At the same time, flood events have increased in around one fifth of catchment areas over the last 30 years. Due to the impacts of climate change, the available groundwater resources in Austria could decrease by around 23% by 2050, while at the same time the demand for water could increase. Without countermeasures, the future demand for groundwater may exceed the available groundwater resources in some regions by 2050 (BMLRT 2021a).

The natural functionality of Austria's watercourses is already severely impaired in some cases due to human utilisation. In relation to the water body length of watercourses, only around 44 % (excluding ubiquitous EU pollutants) have no risk of failing to meet the objectives of the Water Framework Directive. The rise in water temperature in rivers and lakes has averaged around 1.5 °C over the last 30 years (BMLRT 2022). Temperature maxima in particular exert particular stress on living organisms and, in combination with low water levels, lead to reduced oxygen levels. This can lead to algal blooms and potentially harmful consequences for human and animal health (Borgwardt et al. 2020; Waldner et al. 2020). Furthermore, around 957,000 people in the risk areas of the designated HQ100 floodplains are potentially affected by fluvial or pluvial flood events (BMLRT 2021b).

Due to the numerous current uses of water, the uses still to be expected and the impacts of climate change on water resources, regional conflicts related to water use may arise in the future (BMLRT 2022).

The overarching objective of the water management sector is the sustainable protection of water resources as the basis of life and habitat for humans, fauna and flora, as well as ensuring the supply of high-quality drinking water, the environmentally friendly purification of wastewater, the prevention of harmful substance inputs into ground and surface waters and the strengthening of the protection of the population and landscape against natural hazards under changing climatic conditions.

To safeguard our water resources (groundwater and surface water), management must be forward-looking, climate-resilient and sustainable. This is the only way to ensure sufficient water resources for the maintenance of drinking water supplies and the supply of industrial water, while also guaranteeing ecological requirements. In order to be prepared for the increasing number of extreme events, adaptive management with robust measures for both drought and floods is required. Such measures require an improved decision-making basis for understanding the effects of climate change on water resources. This will be ensured by continuing and promoting further data collection with a view to creating long-term consistent data bases. Increasingly scarce water resources require close cooperation and good coordination between the relevant stakeholders based on improved information on water requirements and water use as well as the coordination of supply and demand. This is not only important in terms of water quantity, but also with regard to water temperature, which can have a negative impact on the efficiency of industrial processes in particular. Awareness of the careful use of water as a resource must be present throughout the population and must be improved for individual target groups.

Table 3: Overview of the ten recommended actions for the water management sector.

No.	Title of the recommended action	Goal
4.5.1	Forward-looking, climate-resilient and sustainable management of groundwater resources	Reducing the risk of negative impacts of climate change and socio-economic changes on groundwater resources and groundwater-dependent ecosystems to ensure the good quantitative and chemical status of groundwater bodies by 2027 and beyond.
4.5.2	Forward-looking, climate-resilient and sustainable management of surface waters	Reducing the risk of negative climate change-related and socio-economic impacts on surface waters to achieve and safeguard the good ecological status or potential and the good chemical status of surface waters by 2027 and beyond.

No.	Title of the recommended action	Goal
4.5.3	Maintaining the drinking water supply	Increasing the qualitative and quantitative reliability of the drinking water supply through the use of planning and technical measures.
4.5.4	Maintaining the service water supply	Ensuring the economical, efficient, balanced and situation-adapted supply of service water for the various fields of activity.
4.5.5	Adaptive drought risk management with robust measures	Ensuring that water management objectives are met in the event of low water and low groundwater levels, including preventive measures to minimise damage.
4.5.6	Adaptive flood risk management with robust measures	Reduction of potential flood-related adverse impacts on human health, the environment, cultural heritage and economic activities.
4.5.7	Continuation of data analysis and promotion of further harmonised data collection on water resources and the underlying influencing factors	Reducing knowledge deficits regarding the effects of climate change on water resources.
4.5.8	Improved information and coordination regarding water demand and water utilisation	Creation of a regionalised, coordinated, representative data basis on the actual water demand and water use of different user groups and the ecological requirements for the sustainable, cross-sectoral management of water resources.
4.5.9	Increased consideration of water temperatures in water management measures	Preventive measures to avoid or minimise the increase in water temperatures with regard to the use and protection of aquatic ecosystems.
4.5.10	Conscious use of water as a resource	Conservation of water resources through targeted awareness-raising among the population and, in particular, individual target groups and the accelerated use of economical and efficient technologies.

5 Tourism sector

The tourism sector is a key economic factor and makes a large contribution to Austria's gross domestic product (GDP). Tourism is one of the sectors that is currently already heavily affected by the impacts of climate change and at the same time contributes significantly to global greenhouse gas emissions. On a global level, the tourism sector is responsible for 8 to 11% of greenhouse gases. The largest share of tourism-related greenhouse gas emissions is attributed to transport at around 50% (World Travel & Tourism Council 2021). For Austria, the tourism industry is estimated to account for 4.6% of total emissions (Pröbstl-Haider et al. 2020). When developing and implementing measures in the tourism sector, both mitigation and adaptation must be considered in order to make the best possible use of synergies and avoid negative interactions.

However, the impacts of climate change not only pose challenges, they also offer certain opportunities for a stronger focus on year-round tourism, which must be made climate-fit and sustainable. Potential is found in offers that are environment-orientated and those that do not depend on the weather and changes of weather, such as wellness, culture, sport, events and further diversification of tourism offers. Numerous opportunities for additional offers can contribute significantly to the attractiveness of holiday destinations. In any case, offers should be promoted which, as far as possible, do not require additional energy and have no negative impact on the environment.

The overarching goal of the tourism sector is to consolidate Austria's position as a climate-fit, sustainable tourism location by utilising climate change-related potential and promoting climate and environmentally friendly adaptation measures.

In order to contribute to securing Austria's position as a climate-resilient, sustainable and attractive tourism destination, the impacts of climate change must be given greater consideration. Austria as a tourism location needs to be further developed through the increased implementation of sustainable adaptation measures. In particular, these should also contribute to climate change mitigation so that synergies can be utilised. In addition, the development, provision and improvement of regional climate data as a basis for decision-making for adaptation measures should be promoted.

The development of climate-fit, sustainable year-round tourism is also important. The spring and autumn seasons are becoming increasingly important (Pröbstl-Haider et al. 2020). In addition, the trend towards "sustainability" and "regionality" is intensifying. Increased efforts to attract new target groups, e.g. older people who can be severely

affected by heat, play an important role. Furthermore, year-round tourism that is not restricted by season is advantageous for employees and employers in the tourism sector.

Winter sports regions threatened by climate change require support in the creation of snow-independent offers, so that long-term value creation can be secured through forward-looking diversification. The strengthening of climate-fit, sustainable summer tourism should also be promoted. In particular, the utilisation of climate change-related opportunities in summer tourism and the protection of holidaymakers from the consequences of climate change (such as heat or rockfall) must be considered. Urban tourism must be made climate-fit and year-round offers must be established to a greater extent.

Last but not least, successful implementation requires close cooperation and collaboration with all other sectors and their stakeholders in order to achieve a sustainable and climate-fit tourism offering. Tourism has close interfaces with numerous sectors, such as transport infrastructure including aspects of mobility, spatial planning, agriculture, forestry, ecosystems/biodiversity, energy and water management. In order to avoid maladaptation, the consequences for nature conservation, climate change mitigation and other fields of activity should be weighed up with foresight in the planning of measures as part of a holistic approach.

Table 4: Overview of the seven recommendations for action in the tourism sector.

No.	Title of the recommended action	Goal
5.5.1	Increased consideration of climate-related impacts and integration of adaptation requirements in tourism strategies	Further development of strategic considerations on the topic of climate change and tourism for the development and accelerated implementation of adaptation measures: The aim is to contribute to securing Austria's position as a climate-resilient, sustainable and attractive tourism destination.
5.5.2	Further development of Austria as a tourism location through increased implementation of sustainable adaptation measures, which also contribute, in particular, to climate change mitigation	Increasing the attractiveness and utilising the potential of holiday destinations through the (further) development and implementation of climate-friendly, sustainable tourism offers that take account of regional conditions and the respective starting situation and also contribute to reducing greenhouse gas emissions.
5.5.3	Provision of comprehensive regional data as a basis for the development of tourism adaptation measures	Creation of a robust, comprehensive, region-specific basis for decision-making, taking climate scenarios into account, to reduce knowledge deficits and as a basis for developing sustainable adaptation measures.

No.	Title of the recommended action	Goal
5.5.4	Promotion of climate-fit, sustainable year-round tourism	Consideration of the impacts of climate change and the resulting adaptation requirements in the development and implementation of offers that support year-round sustainable tourism.
5.5.5	Support for winter sports regions threatened by the impacts of climate change in the creation of snow-independent offers	Long-term safeguarding of added value from winter tourism through forward-looking diversification of the offer.
5.5.6	Strengthening climate-fit, sustainable summer tourism	Utilising climate change-related opportunities in summer tourism and protecting holidaymakers from the impacts of climate change.
5.5.7	Strengthening climate-fit, sustainable city tourism	Increased consideration of adaptation requirements in city tourism offers and increased provision of year-round offers.

6 Energy sector – focus on electricity

Energy is fundamental to the functioning of our society; there is no area that is not permanently dependent on the availability of energy. Energy shortages and prolonged supply disruptions represent a threatening scenario. Numerous factors, such as economic growth, technological innovations, demographic trends and the framework conditions of the energy market, influence the energy sector and the consequences of climate change also have an impact on supply and demand.

More intense and more frequent extreme weather events can have a negative impact on both generation plants and the grid infrastructure. Large and small-scale interruptions to the transmission and distribution grids, e.g. due to mudslides, landslides, windthrow, snow or ice loads, could occur more frequently in future. In particularly devastating cases, weather-related disruptions to the energy infrastructure can lead to large-scale power outages due to cascading effects. High temperatures reduce the capacity of power lines. Seasonal changes in discharge behaviour and longer periods of drought in summer are relevant for hydropower.

From the perspective of adaptation, the focus is on ensuring or reducing the impact on generation, the grid infrastructure and the supply to end customers. This sector is significantly influenced by developments and measures in the area of mitigation of climate change.

The central goal of the Austrian federal government is to achieve climate neutrality by 2040. An integrated network infrastructure plan (NIP) for the electricity and gas sectors is being developed to strengthen the existing security of supply and energy security in Austria. The impacts of climate change will affect the availability of renewable energy sources and may jeopardise the energy infrastructure. This must be considered in all energy policy and energy management decisions in order to make the energy system resilient and fit for the future.

The overarching objective of the energy sector is to ensure the security of energy supply by taking a systemic overall view of the energy system, reducing energy consumption, increasing energy efficiency, diversifying and decarbonising energy sources, using technology and decentralising the energy system in order to reduce vulnerability to the impacts of climate change.

In order to reduce vulnerability to climate impacts, a climate-resilient energy infrastructure must be ensured. Grid expansion should increasingly consider the possible increase in extreme weather events and the future regional (re)distribution of supply and feed-in. Energy storage plays a key role in ensuring a stable and secure supply due to the spatial and temporal fluctuations of renewable energy sources.

From an adaptation perspective, decentralisation and diversification of the energy supply and energy infrastructure are also an important aspect of increasing resilience. The increase in decentralised feed-in requires an improved grid infrastructure in the form of smart grids and adapted electricity grid management. By expanding and increasing the power capacity of the electricity grids and expanding storage capacities, the overall system can be made more flexible, thus improving the interaction between flexible producers and consumers.

Maintaining security of supply is a high priority in the face of advancing climate change and must be considered in energy industry decisions and in the restructuring of the energy system. It is linked to the integration of decentralised energy generation. The necessary grids and power capacities must be created through adjustable power plants and loads. As a basis, holistic risk analyses are required which, in addition to climate risks, also include other possible crises (such as pandemics, wars or cyber-attacks on energy infrastructure), technical innovations as well as environmental and social aspects.

A revised National Energy and Climate Plan (NECP) to achieve the climate targets by 2030 must be submitted to the EU Commission by June 2024. In order to make the best possible use of synergies and due to the sometimes long lead times for measures in the energy sector, it is necessary to integrate the challenges of climate change into the energy strategies at various levels without delay.

The close interlinkages in the energy sector make it necessary in strategic planning for mitigation of and adaptation to climate change to consider both of these, to utilise synergies and to avoid contradictory activities wherever possible.

Table 5: Overview of the six recommendations for action in the energy sector - focus on electricity.

No.	Title of the recommended action	Goal
6.5.1	Securing a climate-resilient energy infrastructure	Reducing the vulnerability of the energy infrastructure to the impacts of climate change by utilising technologies and potentials.
6.5.2	Increased research and market introduction of new energy storage options	Balancing supply bottlenecks and surpluses.

No.	Title of the recommended action	Goal
6.5.3	Promotion of decentralised energy generation and feed-in	Increased use and optimisation of regional renewable resources and optimisation of power grids and their operation in order to avoid large-scale disruptions caused by more intense and frequent extreme weather events due to climate change.
6.5.4	Making the electricity system more flexible	Optimise the electricity system for the interplay of generation and consumption to avoid critical load peaks and bottlenecks.
6.5.5	Consideration of the impacts of climate change in energy industry decisions and research activities	Increasing security of supply through increasingly diversified energy carrier structures and far-reaching avoidance of negative impacts on other sectors and their adaptive capacity.
6.5.6	Consideration of the impacts of climate change in energy strategies	Consideration of electricity and cooling energy requirements, the vulnerability of grids and generation plants to extreme weather events and the change in the supply of renewable energy sources due to climate change in energy strategies, mission statements or programmes of measures.

7 Construction and Housing sector

For reasons of sustainability, buildings that are planned, constructed or renovated today must also be able to function in 30 years' time and beyond under the climatic conditions that will prevail in the future and withstand extreme weather events. One particularly important issue is the prevention of indoor overheating in summer. The heat island effect in urban areas makes it difficult to apply sustainable, resource-saving adaptation strategies such as passive cooling of buildings. Measures are therefore necessary not only on or in the building, but also in the area around the building and the settlement as a whole, in order to improve the microclimate, e.g. through nature-based solutions (NBS). There is also a need to adapt to the possible increase in extreme events such as heavy rain, hail and storms. Structural measures to adapt to climate change must be implemented in a way that considers circularity of material use and should always take climate change mitigation aspects into account. Building with wood, for example, makes a significant contribution to climate change mitigation.

The overarching goal of the building and housing sector is to ensure that the quality of staying in a building is good through planning, construction, structural engineering and utilisation-related adaptation measures on buildings and in their surroundings.

Protecting buildings from overheating in summer is becoming increasingly important. The negative effects range from loss of comfort and serious health consequences to increased electricity consumption by air conditioning systems. Keeping buildings cool under future climatic conditions will require a mix of measures on and in the building as well as outside. The aim is to utilise the cooling potential of outdoor spaces with little or no technical input. The heat island effect that increasingly occurs in urban areas can be effectively reduced through a variety of open space and urban planning measures. Not only heat, but also the increasing intensity and frequency of heavy rainfall events must be considered. Care must be taken to ensure that the measures applied take social aspects into account and do not exclude vulnerable groups. Nature-based solutions (NBS) in particular are becoming increasingly important.

Regulations, laws and standards should therefore be increasingly adapted to future requirements and climatic conditions. The expected increase in climate risks requires structural adaptation measures for newly constructed buildings, but also, with limited possibilities, for existing buildings. By increasing water retention in, on and

around buildings, localised flood events can be effectively avoided or reduced. Suitable risk transfer mechanisms offer additional protection for livelihoods.

In future, structural measures to protect against extreme weather events and natural hazards should also be increasingly subsidised. The need for information on possible climate risks and natural hazards must be met through public relations work and awareness-raising. Further interdisciplinary and transdisciplinary research activities are required for the successful implementation of adaptation measures. The results of relevant research projects must be continuously utilised for ongoing processes and the review of existing instruments.

Concrete climate-fit, sustainable and innovative solutions should be spread as widely as possible. The New European Bauhaus as part of the Green Deal and the federal government's Building Culture Guidelines (BKA 2017) offer numerous starting points for the implementation of climate change-adapted architecture and building culture. As a basis for the increased implementation of adaptation measures, corresponding qualifications must be broadly anchored.

Table 6: Overview of the eleven recommended actions in the building and housing sector.

No.	Title of the recommended action	Goal
7.5.1	Implementation of structural measures in new and existing buildings to protect against heat	Reduction of solar heat input to protect against heat through structural measures to ensure thermal comfort indoors and in apartment-related outdoor spaces (courtyards, balconies, loggias, patios, etc.).
7.5.2	Accelerated use of passive and active cooling with alternative, energy-efficient and resource-saving technologies	Ensuring thermal comfort in interior spaces in new and existing buildings through the use of passive and energy-efficient, resource-saving, active cooling strategies.
7.5.3	Improvement of micro-/meso-climatic conditions as part of building, urban and open space planning	Optimisation of living conditions for the population by reducing the heat island effect, unsealing and improving the infiltration capacity of soils as part of building, urban and open space planning.
7.5.4	Adaptation of building standards, norms and laws to the impacts of climate change	Consideration and integration of adaptation requirements in building standards, norms and laws.
7.5.5	Protection of buildings against climate risks including risk transfer mechanisms	Adaptation of buildings (new and existing) to protect against hydrological, gravitational and meteorological natural hazards.

No.	Title of the recommended action	Goal
7.5.6	Increasing water retention on and around buildings	Prevention of localised flood events and the associated damage to buildings through structural measures on and around buildings.
7.5.7	Examination and further development of funding instruments to take account of climate change aspects in new and existing buildings	Greater consideration of adaptation requirements in the funding of new and existing residential and non-residential buildings.
7.5.8	Public relations work and awareness-raising on the topic of adapting to the impacts of climate change in the area of construction and housing	Creating awareness and disseminating knowledge on the topic of adaptation to the impacts of climate change and the necessary adaptation measures in the private, commercial, administrative and political sectors.
7.5.9	Research on adapting to the impacts of climate change in the area of construction and housing	Improvement of the knowledge base and the data basis for the ongoing improvement of adaptation to the impacts of climate change.
7.5.10	Pilot projects 'Climate change-adapted building culture'	Demonstrating the feasibility and advantages of 'climate change-adapted building culture'.
7.5.11	Training and further education on the topic of adapting to the impacts of climate change in the area of construction and housing	Strengthening qualifications in the construction industry in order to accelerate the forward-looking implementation of adaptation measures.

8 Protection against natural hazards

Natural hazards and all the associated consequences characterise the habitat in Austria. As climate change progresses, (extreme) events will increase in frequency, intensity and extent and also affect regions that were previously spared. In order to make the management of these climate risks and their cumulative and cascading effects even more effective in the future, a more systemic approach and even closer links between the affected sectors are required. Protection against natural hazards can only be successful in the future if all possibilities for prevention are utilised in all relevant sectors.

The best measure to protect against natural hazards is to avoid the hazard itself and, subsequently, threatened zones. In many valley and mountain regions, however, there are hardly any areas available that offer a high degree of protection against natural hazards due to intensive land use on the one hand and the impact and superimposition of natural disasters on the other. In many cases, to promote hazard and risk awareness as well as personal responsibility, specialised federal and provincial offices and other institutions offer unbureaucratic assistance as initial information centres.

The overarching objective for protection against natural hazards is to maintain or improve the protection of people, the environment and material assets against natural hazards, taking integral risk management and the impacts of climate change into account.

In general, protective measures safeguard the existing settlement and economic area against natural hazards up to the limit of a quantitatively specified event. In view of advancing climate change, the mere existence of protective measures is no guarantee for the sustainable protection of a specific location. Sustainable spatial development with increased involvement of hazard zone planning and risk mapping contributes efficiently and effectively to hazard prevention in dealing with natural hazards and climate risks. For example, appropriate measures to ensure water retention in the area and to reactivate natural floodplains must be anchored in both supra-local and local spatial planning.

Measuring systems for the continuous observation (monitoring) of natural phenomena help to analyse and evaluate hazard processes and, based on this, to derive appropriate strategies for dealing with natural hazards. Forecasts and (early) warning systems help to prevent or minimise potential damage. The expansion of monitoring, forecasting and (early) warning systems must be further accelerated, taking vulnerable groups into account and providing simple, barrier-free communication. Intensive research

activities in the areas of climate modelling, hydrology, meteorology, geomorphology and interaction with the natural environment are still necessary in order to provide the information and framework conditions required for planning in natural hazard management at a spatially and temporally high resolution.

Risks cannot be completely avoided, so a residual risk remains. Therefore, in addition to technical, spatial planning, awareness-raising and organisational options for dealing with natural hazards, private risk prevention is also extremely important, but is currently only used to a limited extent. An important sensitisation measure at municipal level (and subsequently also in the private sector) is the precautionary check for natural hazards within the context of climate change. Furthermore, as part of integral risk management, it is expedient to promote special concepts for the protection of individual properties through building measures (technical property protection) or the adapted use of these properties.

Table 7: Overview of the seven recommendations for action to protect against natural hazards.

No.	Title of the recommended action	Goal
8.4.1	Promoting hazard and risk awareness and personal responsibility	Increasing hazard and risk awareness and the resilience of actors at regional and local level, especially among mayors as key multipliers.
8.4.2	Promotion of sustainable spatial development with increased inclusion of hazard zone planning and risk visualisation	Keeping areas that are endangered by natural hazards or climate risks free or managing their use in a risk-oriented manner.
8.4.3	Promotion of water retention in the area and reactivation of natural floodplains	Reduction of runoff peaks by securing or expanding water retention.
8.4.4	Promotion of monitoring, forecasting and (early) warning systems	Expansion of the scope of data and information on natural hazards and climate risks and the resulting possibility of forecasting and (early) warning.
8.4.5	Promotion of R&D in relation to the effects of climate change on event probabilities and dealing with uncertainties	Ongoing further development of the understanding of natural processes and their social components (Glade et al. 2020). Provision of a decision-making basis for planning in natural hazard and climate risk management, based on technological developments and knowledge.
8.4.6	Optimisation of risk transfer mechanisms	Raising awareness of the need for supplementary, comprehensive insurance-based personal precaution.

No.	Title of the recommended action	Goal
8.4.7	Promotion of protective measures for properties and critical infrastructures as a contribution to personal precaution	Reduction of damage to buildings and infrastructure and minimisation of the risk to potentially affected persons with regard to the effects of natural hazards and climate risks.

9 Crisis and disaster management

The impacts of climate change and a possible increase in natural hazards will bring about changes in the management of crises and disasters. Climate change will have an impact on both the frequency and intensity of natural disasters (IPCC 2022). Austria has a well-functioning and comprehensive system of civil protection and disaster relief. A key principle of crisis and disaster management in Austria is that of subsidiarity, which provides for damage events to be dealt with at the lowest qualified level. The severe weather events of recent years have impressively demonstrated the importance of a functioning crisis and disaster management system in order to overcome the major challenges posed by natural disasters. Volunteers play a significant role in this area in particular and are an integral part of the system. The coordination of all parties involved is of crucial importance for effective and successful crisis management. The federal government has agreed on the development of a legal framework for state crisis and disaster management, taking federal and state responsibilities into account (Federal Crisis Security Act (B-KSG), further development of the Austrian Security Strategy). The security and defence policy dimension of climate change will also become increasingly relevant and must be considered.

The overriding objective of crisis and disaster management is to plan for dealing with crises and disasters and to deal with them quickly and professionally, paying particular attention to the challenges posed by changing climatic conditions.

In order to strengthen the risk awareness of the Austrian population, optimal and target group-orientated forms of risk communication must be defined and implemented. The limits of protection, the residual risk and the responsibility of those involved and affected must also be made clear and easy to understand. Risk analyses must be carried out at national or subnational level and updated every three years (BMI 2018). A holistic system analysis, including consideration of multiple risks, is necessary in order to capture the effects of the climate crisis (European Union 2021). Based on this, risk reduction measures must be planned and implemented.

A national ASDR platform has been set up to implement the Sendai Framework Programme. The comprehensive exchange between and networking of authorities, research institutions, aid and emergency organisations, companies and the population are essential and must be continued and strengthened. Building on the State Crisis and

Disaster Management Strategy (SKKM) adopted in 2009, the Federal Crisis Security Act (B-KSG) aims to define a comprehensive and nationwide process for crisis management and prevention. The aim of the B-KSG is to ensure Austria's security and resilience, even in the face of new and uncertain threat scenarios, through the comprehensive further development of state crisis management. The preservation of voluntary work and its quality is also a matter of overriding importance, as aid and emergency organisations are an essential pillar of disaster management. In addition to the deeper integration of research and industry, the population in particular must also be involved in a more participatory manner in order to better take their needs and interests into account.

In order to strengthen crisis and disaster management, it seems appropriate to review the financing mechanism within the framework of the disaster fund on the basis of the risk analyses currently being prepared. The insurance industry plays an important role here. A further developed insurance solution could ease the financial and administrative burden on the disaster fund, contribute to awareness-raising through deductibles integrated into the model and increase personal precaution. Training opportunities in the field of crisis and disaster management, which increasingly integrate the effects of climate change, should be further expanded and inter-organisational cooperation strengthened. Research activities that focus on the systematic study of topics relevant to Austria regarding crisis and disaster management and the broad communication of results contribute to an essential knowledge base.

Table 8: Overview of the nine recommendations for action in the field of crisis and disaster management.

No.	Title of the recommended action	Goal
9.4.1	Inclusive risk and crisis communication to improve behaviour in the event of an incident	Increasing risk awareness among the population in order to improve adequate behaviour in the event of an incident.
9.4.2	Increased consideration of the risks of climate change in the national risk analysis	Further development of the methodology for assessing disaster risks as a basis for coordinated, integrative, risk-based and cost- and benefit-oriented planning of measures in Austria, taking sufficient account of the risks of climate change.
9.4.3	Continuation and expansion of the ASDR platform	Comprehensive exchange and networking between the ASDR platform and relevant institutions such as the BMI, improvement of knowledge transfer from research and promotion of a broad-based dialogue to strengthen the community.

No.	Title of the recommended action	Goal
9.4.4	Increased consideration of the effects of climate change in state crisis and disaster management	Preparing and increasing the resilience of state crisis and disaster management to future climate change-related challenges.
9.4.5	Maintaining and improving the framework conditions for volunteer work in the area of crisis and disaster management	Strengthening volunteer work as one of the main pillars of civil protection in Austria.
9.4.6	Promoting participatory approaches in risk and crisis management	Strengthening self-preparedness and personal responsibility through comprehensive, accessible information in simple language and the transparent creation and preparation of emergency plans with the involvement of the relevant stakeholders and, where feasible, civil society.
9.4.7	Making financing and funding instruments in the area of crisis and disaster management more flexible	Creation of a financing mechanism for short-, medium- and long-term activities for integrated crisis and disaster management on the basis of defined criteria and within the upper limits of the applicable Federal Financial Framework Act (BFRG).
9.4.8	Expansion of training and further education programmes in the field of crisis and disaster management	Expanding and deepening the competences of crisis and disaster management actors in the areas of natural hazards, climate change and its security policy implications.
9.4.9	Continuation and networking of research activities and development of innovations related to crisis and disaster management	Promotion of inter- and transdisciplinary research activities, provision of a basis for decision-making and development of technical innovations, the content of which results from, or is developed in the course of, the implementation of the SKKM and the goals of the B-KSG.

10 Health sector

According to the WHO, climate change is the greatest health challenge of the 21st century. In Austria, climate change-related health risks such as deaths and damage caused by heat, flooding or forest fires as well as the occurrence and spread of infectious diseases and allergens are on the rise. The functionality of public healthcare systems is increasingly facing challenges due to climate change (EC 2021a; EEA 2022). There is a great need for action in Austrian health policy, particularly in the areas of prevention and care for particularly vulnerable population groups such as the elderly, chronically ill people, people with disabilities, people with mental illnesses, children, low-income or educationally disadvantaged people (APCC 2018). The adverse health impacts of climate change will affect people of all ages and social classes to varying degrees. Most health impacts are expected to be caused by heat, exacerbated by a lack of cooling at night, especially in urban areas (APCC 2018; BMSGPK 2021). People who work outdoors or under heat stress are considered to be particularly affected. Indirect effects and risks occur (as a result of enhanced dispersion and living conditions) in relation to carriers of pathogens, allergenic plants and animals, the impairment of the quality and/or contamination of groundwater, drinking water and food, as well as an increased concentration of certain air pollutants or an increase in UV radiation.

The overarching goal of the health sector is the forward-looking implementation of suitable measures to manage and prevent direct (e.g. heatwaves) and indirect (e.g. the spread of allergenic and toxic plants and animals) health impacts caused by climate change.

In order to mitigate the current and future health impacts of climate change, the population can be informed and empowered to act through targeted (risk) communication. Communication should be target group-specific, barrier-free and in simple language and lead to action in the interest of maintaining one's own health. Heat stress, in particular, should be reduced, as epidemiological studies show an increase in illness and mortality rates during periods of heat and negative effects on the well-being, performance and psyche of the population are also to be expected. Heat protection plans support a coordinated approach and should be continuously evaluated, further developed or redrafted and implemented (nationally, regionally and locally). To strengthen a climate-resilient healthcare system, the health-related climate expertise of staff in the health, care and social sectors must also be improved.

Adequate monitoring, early warning and surveillance systems support the prevention and minimisation of damage, injuries, deaths and panic among the population. Continuous data collection in the areas of groundwater and drinking water, food control, infectious diseases, species monitoring, pollutants, flooding, weather and climate is necessary in order to be able to make statements about significant changes and derive measures. For example, measures for the early detection, prevention and control of the arrival and spread of 'new' vectors and pathogens are another important contribution to minimising the health impacts of climate change.

The shift or extension of the growing season is accompanied by an earlier start and longer duration of the pollen season. In conjunction with air pollutants, this can also lead to an increase in pollen allergenicity or higher pollen concentrations in the ambient air with impacts on the symptoms of allergy sufferers (Luschkova et al. 2022). There is a need for improved risk management with regard to the spread of allergenic and toxic species, but also generally improved handling of ultraviolet radiation and air pollutants such as ozone or particulate matter. Air pollutants influence the climate and the climate in turn influences the distribution and formation of air pollutants.

Protecting the population from natural hazards is also highly relevant. These can lead to deaths, injuries, post-traumatic stress disorder, property damage, social and economic disruption or environmental damage. If infrastructure is destroyed, the supply of medicines and medical products may be interrupted. Patients may also be cut off from extramural care or medical facilities. Attention must also be paid to the contamination of water, soil and food after flood events, which can be caused by contaminated sites, industrial plants, oil storage facilities, petrol stations etc. Prevention in these areas must be stepped up. Finally, adverse impacts on food safety must be avoided and the supply of safe food to the population must be maintained. Higher temperatures reduce the shelf life of perishable foods and favour the proliferation of microorganisms. Ensuring continuous cold chains will therefore become increasingly important, and compliance with current hygiene standards for drinking water and food could also become more complex in future.

Table 9: Overview of the nine recommended actions in the health sector.

No.	Title of the recommended action	Goal
10.5.1	General public relations work on the health consequences of climate change	Raising awareness and informing the population to strengthen resilience and health-related climate literacy.
10.5.2	Training and further education on climate-related topics in the health, care and social sectors	Strengthening the health-related climate competence of all people working in the health, care and social sectors and of multipliers in dealing with climate-relevant health issues as well as training climate managers as a contribution to establishing a climate-resilient healthcare system.
10.5.3	Linking and further development of existing monitoring and early warning systems	Preparing the healthcare system, aid and emergency organisations and the population for climate change-related changes and acute situations in order to prevent / reduce health impacts by developing a joint, coherent monitoring structure that links existing systems. These should be adaptable to the respective risks (e.g. heat, heavy rain, floods, storms, cold, drought, forest fires, infectious diseases, pollen load, (air) pollutants, UV radiation).
10.5.4	Dealing with the health impacts of heat and drought	Reduction of heat stress to avoid negative health effects on the population and of the health consequences of drought.
10.5.5	Dealing with vectors and vector-borne infectious diseases	Reduction or prevention of vector-borne infectious diseases, expansion of knowledge, early detection, prevention and control of vectors.
10.5.6	Dealing with the spread of allergenic and toxic species	Prevention/reduction of adverse health impacts caused by allergenic and poisonous plants and animals.
10.5.7	Dealing with air pollution and other pollutants	Reduction or prevention of adverse health effects due to changes in exposure to pollutants as a result of extreme weather events and climate change.
10.5.8	Dealing with the health impacts of natural hazards	Protection of the population from physical and mental health impacts in the event of a disaster as a result of natural hazard events such as floods, mudslides, landslides, rock-falls, avalanches, storms and hail.
10.5.9	Maintaining food safety under changing climatic conditions	Avoidance of adverse impacts on food safety due to climate change in order to maintain the supply of flawless food to the population.

11 Ecosystems and biodiversity

Biodiversity is our natural, irreplaceable basis of life and indispensable for sustainable economic activity and human well-being. The preservation of biodiversity is not an end in itself, but a necessity and is our responsibility - also considering future generations (BMK 2022). The biodiversity crisis affects us just as much as the climate crisis. It is essential to solve both crises together, as emphasised by the World Biodiversity Council and the Intergovernmental Panel on Climate Change (IPCC 2023; Pörtner et al. 2023). Biodiversity and ecosystems are threatened by various factors, including, in particular, changes in land use, direct resource extraction, pollutant inputs, alien 'invasive' species and climate change (IPBES 2019). In Austria, half of all habitat types are considered endangered. More than half of all amphibians and reptiles, almost half of all fish and a third of all birds and mammals are critically endangered in Austria (Umweltbundesamt 2022). Furthermore, around 37% of native ferns and flowering plants are endangered, extinct or threatened with extinction. The impacts of climate change are also becoming increasingly relevant as an endangering factor in Austria. Changes due to climate change are clearly visible in the distribution areas, phenology, physiology and morphology as well as in the behaviour and interaction of animal and plant species. Mountain habitats and wetlands are particularly affected due to the rise in temperature and changes in the water balance. Nature-based solutions (NBS) represent an effective approach to utilising synergies between climate change adaptation, climate change mitigation and biodiversity conservation. They simultaneously contribute to the preservation, improvement or restoration of functioning ecosystems, habitat connectivity and adaptation to climate change and/or climate change mitigation.

The overarching goal with regard to ecosystems and biodiversity is to strengthen the resilience of ecosystems and to preserve, improve and restore biodiversity in order to reduce the negative impacts of climate change on people and nature and to safeguard natural resources for current and future generations.

The functions of ecosystems, such as food production, provision of renewable raw materials, flood protection, soil formation, carbon storage and protection against soil erosion, are directly and indirectly influenced by climate change. In order to increase the adaptability of (endangered) ecosystems, habitats and species, it is necessary to anchor the impacts of climate change more firmly in the legal and strategic foundations and

instruments of nature conservation. The resilience of habitats and species is strengthened through forward-looking planning and implementation of relevant adaptation measures. In order for this to be supported by as many stakeholders as possible and the general public, there is still a need for increased awareness-raising and target group-orientated knowledge transfer. However, the relationships between biodiversity and climate change (including the effectiveness of measures) are complex. Research and monitoring are still urgently needed to expand the knowledge base.

Furthermore, implementation steps that have a direct impact on the land and significantly strengthen the resilience of habitats and species to climate change must be accelerated. This includes, for example, the development and implementation of species and biotope conservation projects, especially for endemic and subendemic species. Of particular relevance is the safeguarding and creation of functioning biotope networking systems with habitat corridors to enable migration and the genetic exchange of individual populations. Wetlands are particularly hard hit by the effects of climate change, making the protection and restoration of wetland habitats and their ecosystem services important measures. An even stronger focus must be placed on sustainable, biodiversity-promoting agriculture and forestry in order to reduce the loss of habitats and species due to climate change.

Last but not least, successful implementation requires close cooperation and collaboration with all other sectors and their stakeholders (such as agriculture, forestry, water management, tourism, spatial planning and transport infrastructure). Together with climate change adaptation, biodiversity conservation is also considered to be a cross-cutting issue, which emphasises the importance of mainstreaming in other sectors (BMK 2022).

Table 10: Overview of the thirteen recommended actions for ecosystems and biodiversity.

No.	Title of the recommended action	Goal
11.5.1	Integration of climate change into nature conservation instruments	Consideration of the impacts of climate change and presentation of the possible need for action in nature conservation instruments.
11.5.2	Strengthening biodiversity-promoting agriculture and forestry	Site-adapted and biodiversity-promoting utilisation of the cultural landscape in a broad, horizontal approach that contributes to the preservation and development of a species-rich cultural landscape and provides habitats, feeding grounds and retreats for animal and plant species.

No.	Title of the recommended action	Goal
11.5.3	Strengthening endangered populations and species and their habitats	Reducing the threat to species and habitats that are endangered by climate change or climate-sensitive through habitat conservation and connectivity.
11.5.4	Conservation and networking of protected areas and habitats	Development of a functional network of habitats and protected areas (biotope network system), including buffer zones and corridors, to increase the probability of survival of species, populations and habitats and to maintain the corresponding ecosystem services and the nature conservation value of protected areas under a changing climate.
11.5.5	Protection of wetland habitats, their ecosystem services and biodiversity	Protection of wetland habitats, their ecosystem services and biodiversity by ensuring sufficient water quality and quantity under climate change and increasing water storage and retention capacity in the landscape.
11.5.6	Strengthening aquatic biodiversity and integrated catchment area management as well as reducing severe water warming	Protection and restoration of aquatic biodiversity, improvement of aquatic ecology in combination with flood protection, promotion of integrative catchment area management and watercourse re-naturalisation as well as prevention of severe warming of watercourses.
11.5.7	Improving the knowledge base through research on the effects of climate change on ecosystems/biodiversity	Increasing knowledge on the effects of climate change on ecosystems and biodiversity as a basis for and to support the implementation of measures.
11.5.8	Increased consideration of climate change in existing monitoring systems and expansion of monitoring and early warning systems	Continuation, financing, adaptation, supplementation and consolidation of existing environmental monitoring networks or those currently being established with the overarching aim of utilising the knowledge gained for early warning systems and measures.
11.5.9	Strengthening knowledge transfer on the importance of biodiversity and ecosystems for climate change adaptation	Creating greater awareness of the central importance of biodiversity and ecosystems for the sustainable, climate-resilient development of society and introducing the topic into education.

No.	Title of the recommended action	Goal
11.5.10	Preservation of ecosystem services	Raising awareness about and preserving ecosystem services in all affected areas (e.g. contribution to water retention, flood protection, food security and production of high-quality regional food, biodiversity, groundwater recharge, CO ₂ sequestration, etc.) to accelerate sustainable, biodiversity-promoting land use.
11.5.11	Adaptation of the range of leisure and holiday activities	Expansion of sustainable, biodiversity-promoting leisure, recreation and tourism activities and increased utilisation of synergies between adaptation to and mitigation of climate change and biodiversity conservation in tourism.
11.5.12	Consideration of nature conservation objectives and adaptation requirements in the design of public and private buildings and open spaces in residential areas	Creation of refuges for animal and plant species (especially rare and endangered species), improvement of the local climate and increase in water retention through the development of biodiversity-promoting, climate-fit open and green spaces in populated areas.
11.5.13	Consideration of the impact of Austrian activities and climate change adaptation measures on ecosystems / biodiversity in a European and global context	Reducing the threat to species and habitats that are endangered or sensitive to climate change through habitat conservation and connectivity.

12 Transport infrastructure including aspects of mobility

Transport infrastructure plays an important role in terms of climate change in two respects. The transport sector is one of the main emitters of greenhouse gases in Austria with a share of 30% (Umweltbundesamt 2021). At the same time, transport infrastructure is exposed to ever greater risks due to more frequent and more intense extreme weather events (e.g. heat, storms, floods, avalanches, mudslides and landslides). This can lead to more damage to infrastructure elements and obstructions to the flow of traffic. The European Commission's publication 'Technical guidelines for ensuring the climate resilience of infrastructure in the period 2021-2027' therefore comprises two pillars: Measures to mitigate climate change and those to adapt to its impacts (EC 2021b).

In order to tackle climate change effectively, a mobility transition is necessary. Reducing the volume of private transport and moving towards more public transport and active mobility requires a well-developed transport infrastructure that is safe and climate-resilient for all users. In addition, the switch from motorised private transport to more land-protecting modes of transport (such as cycling, walking and public transport) can be used as an opportunity to reduce the amount of sealed (traffic) surfaces. Unsealing or no further sealing increases water retention in the area, improves the local climate and thus contributes to adaptation to climate change. It is particularly important to avoid maladaptation and to utilise synergies between climate change adaptation and mitigation.

The transport infrastructure sector, including aspects of mobility, comprises the planning, construction, management and utilisation of passenger and freight transport infrastructure.

The overarching goal of the transport infrastructure sector, including aspects of mobility, is to ensure a functional, safe and climate-resilient transport system.

Forward-looking natural hazard and incident management is essential to ensure a functional, multimodal and climate-compatible transport system under changing climate conditions. Central to this are both measures to reduce the risk of failure and damage (e.g. due to heat or heavy rainfall events) and the consideration of indirect effects of traffic disruptions (e.g. maintaining multimodal alternative structures). Natural hazard and incident management across the entire transport system is therefore crucial. Risk prevention also includes, in particular, the ongoing improvement of information and early

warning systems for transport infrastructure. Incident and damage documentation should be implemented or expanded and a standardised or at least comparable nationwide damage survey should be introduced.

Adaptation requirements to strengthen resilience and prevent damage to transport infrastructure must be considered in laws, standards and guidelines. The mobility transition requires, among other things, increased use of public transport and active mobility. To ensure that these are also attractive in the summer months, it is essential to improve thermal comfort in public transport, transport stations and company buildings and to provide shade for cycling and walking infrastructure. Cleverly combined mitigation and adaptation strategies (e.g. shading with photovoltaic systems, tree planting after demolition/parking space reduction, shaded cycle paths instead of parking lanes, shaded pavements and ground floor arcades, etc.) must be increasingly used, considered and communicated in traffic and open space planning.

The (further) education and continued training of relevant professional groups must be increasingly orientated towards the requirements and solutions described above. In addition, the population also needs to become more aware of and accept the necessary measures for a climate-resilient transport infrastructure and a climate-adapted, climate-friendly transport system.

Table 11: Overview of the nine recommended actions in the transport infrastructure sector, including aspects of mobility.

No.	Title of the recommended action	Goal
12.5.1	Ensuring a climate-resilient transport infrastructure for a functioning transport system	Ensuring a functional, multimodal and climate-friendly transport system under changing climate conditions. Avoiding damage to infrastructure, disruptions and the resulting downstream effects and protecting transport users.
12.5.2	Adaptation of legal standards for the construction and operation of transport infrastructure	Review and consideration of adaptation requirements in laws, standards and guidelines to increase resilience and prevent damage to transport infrastructure.
12.5.3	Ensuring thermal comfort in public transport, transport stations and their surroundings	Maintaining operational safety and ensuring thermal comfort (quality of stay and length of stay) in public transport during periods of heat stress for passengers and staff. Reducing thermal stress in transport stations and service buildings as well as on footpaths and cycle paths.

No.	Title of the recommended action	Goal
12.5.4	Consideration of micro-/meso-climatic conditions in transport and open space planning	Ensuring adaptation to extreme weather events and thermal comfort through appropriate infrastructure, transport and open space planning, particularly in settlement areas.
12.5.5	Reduction of sealed traffic areas	Increasing water retention, creating retreats for animal and plant species (including rare and endangered species), improving the local climate in populated areas, increasing climate change-adapted green spaces and green infrastructure (horizontal and vertical) by reducing sealed traffic areas.
12.5.6	Expansion and continuing further development of information and early warning systems	Continuing improvement of information and early warning systems for transport infrastructure as a contribution to risk prevention and forward-looking natural hazard and incident management.
12.5.7	Training and further education on the topic of adaptation to the consequences of climate change in the area of transport infrastructure	Increasing the level of knowledge and skills for adapting to the impacts of climate change among relevant professional groups by providing appropriate information in (further) education and training.
12.5.8	Research and development for adaptation to the impacts of climate change in the area of transport infrastructure	Further research and implementation of innovative technologies and pilot projects with the aim of optimising adaptation to the impacts of climate change.
12.5.9	Awareness-raising and pilot projects on climate-resilient transport infrastructure	Dissemination of knowledge about adaptation to climate change in the transport sector, including with the help of pilot projects. Strengthening acceptance and knowledge for the implementation of necessary measures for a climate-resilient transport infrastructure and an adapted transport system or suitable mobility measures.

13 Spatial planning

The entire spectrum of all settlement areas, infrastructures and open and green spaces is influenced by climate change. At the same time, land use has an impact on the climate, climate change adaptation and greenhouse gas emissions. Spatial planning therefore plays a central role in both climate policy fields of action – mitigation of and adaptation to climate change. The Austrian Spatial Development Concept 2030 (ÖREK 2030) states that tackling the climate crisis is a priority objective (ÖROK 2021).

The impacts of climate change potentially influence all areas of spatial development and a large number of land uses are affected. These include the uses and utilisation requirements of all economic sectors (such as agriculture and forestry, tourism, water management, etc.). The spatial requirements of all population groups as well as the natural systems and their ecosystem services are also closely related to climatic conditions and are affected by the impacts of climate change. This explains the urgent need to establish good climate change adaptation practice as an essential component of planning processes and to avoid maladaptation.

The overarching objective of spatial planning is the consistent application and further development of existing objectives, legal requirements, instruments and processes of spatial planning to ensure sustainable, climate-resilient spatial development.

The need for action in spatial planning arises in particular in the sense that it creates fundamental framework conditions for the sustainable and careful use of soil as a resource. The aim of future-oriented spatial development is to substantially reduce further land consumption and soil sealing and to strengthen climate-resilient and climate-friendly settlement development. This includes, above all, high-quality (re)densification and space-efficient internal development by utilising the potential of the development plan and building regulations.

Natural soil functions (such as infiltration capacity) must be given greater consideration in planning procedures and decisions. There is also a need for forward-looking conservation, management and networking of green and open spaces in order to strengthen their ecosystem-based adaptation functions. Another key issue is the contribution of spatial planning to the prevention of risks from natural hazards. Land use planning, land conservation, land use regulation and nature-based hazard prevention contribute significantly to the avoidance and reduction of natural hazard-related risks. Foresighted hazard prevention and responsible management of residual risk within the scope of spatial planning should be further strengthened and secured. The legal

anchoring of climate change adaptation in spatial planning law as well as the consistent application and further development of existing instruments are fundamental to climate-resilient spatial development. In addition, spatially relevant, easily accessible climate impact and adaptation knowledge is just as important for decision-making processes as it is for the further development of the competence to act among actors in spatial planning.

The consequences of climate change have a cross-sectoral impact and transcend political and administrative boundaries. Therefore, the contribution of spatial planning to climate change adaptation often lies in a co-operative, moderating, advisory or stimulating role (CLISP 2011). Cooperation, networking and coordination with spatially relevant sectoral planning and specialist disciplines (such as water management, energy industry, etc.) as well as other stakeholders are of central importance here (Schindelegger et al. 2022). It is important to establish new integrative framework conditions in order to systematically integrate climate change adaptation into planning processes and instruments at all planning levels (in the sense of ‘climate proofing’) (Schindelegger et al. 2021).

Table 12: Overview of the nine recommended actions for spatial planning

No.	Title of the recommended action	Goal
13.5.1	Reduction of further land use, soil sealing and urban sprawl, taking the natural soil functions into account	Substantial reduction of further land use for settlement and transport purposes, soil sealing and urban sprawl with a view to achieving the target path of the 2020-2024 government programme to reduce land use in order to protect soil resources, green spaces and open spaces with their nature-based services for climate change adaptation and climate and biodiversity protection and to develop climate-resilient and climate-friendly settlement structures. Natural soil functions should be given greater consideration in planning procedures and decisions, and high-quality soils should be safeguarded in order to maintain the adaptive capacity of natural systems and ensure climate- and crisis-resilient supply and food security.
13.5.2	Safeguarding, development and networking of multifunctional open and green spaces with nature-based adaptation functions	Precautionary preservation of green and open spaces with climate-related functions, strengthening their multifunctional services for adaptation to heat, drought, heavy rainfall and flooding as well as securing areas for green and blue infrastructure inside and outside the settlement area.

No.	Title of the recommended action	Goal
13.5.3	Promotion of adaptation measures in development planning and building law	Improving the microclimate in densely built-up settlement areas in order to avoid overheating and heat island effects, reduce flood risks from heavy rainfall, increase infiltration and water storage capacity and improve the socio-spatial qualities of open spaces; strengthening high-quality, climate-resilient and climate-friendly densification and land-efficient internal development by fully utilising the potential of the development plan and building regulations.
13.5.4	Prevention of risks from natural hazards in spatial planning	Protection of human life, settlement areas and infrastructure from fluvial floods, pluvial flood events and other (e.g. gravitational) natural hazards, taking the impacts of climate change into account; avoidance and reduction of natural hazard-related risks through land use planning, land conservation, land use regulation and nature-based hazard prevention; ensuring forward-looking hazard prevention and responsible management of residual risk.
13.5.5	Regulations for the preventive handling of zoning and building stock in hazard and residual risk areas	Damage prevention and risk reduction for existing building land designations, construction work and existing buildings in flood and natural hazard risk areas; ensuring forward-looking hazard prevention in residual risk areas as well.
13.5.6	Strengthening inter-municipal, regional and city-regional cooperation	Cross-municipal and regional implementation of land use planning and other spatially relevant measures to adapt to the impacts of climate change by expanding forms of cooperation in spatial planning.
13.5.7	Increasing the climate resilience of the energy system by taking adaptation into account in spatial energy planning	Increasing the climate, extreme weather and crisis resilience (failure and supply security) of energy generation and energy infrastructure; increasing the adaptability of the energy system through lower energy consumption, higher energy efficiency and decentralised renewable energy supply; stronger consideration of the spatial characteristics of the energy system.

No.	Title of the recommended action	Goal
13.5.8	Provision, preparation and communication of practice-orientated data and information bases, competence and capacity building and networking of stakeholders	Creation, demand-oriented processing and transfer of improved spatially relevant climate impact and adaptation knowledge that is directly usable for decision-making processes in spatial planning. Strengthening the competences and capacities of spatial planning institutions and actors in the sense of developing 'climate spatial planning'.
13.5.9	'Climate proofing' of spatial plans, development concepts, procedures and spatially relevant projects	Systematic and forward-looking consideration of climate change impacts and adaptation measures in planning processes and instruments as well as strengthening the necessary capacities and competences of spatial planning; ensuring the long-term climate resilience and adaptability of spatial development to current and future impacts of climate change.

14 Economy

Different economic sectors and companies are affected differently by climate change. Operational infrastructure or production can be jeopardised by extreme events. However, new opportunities can also arise, particularly in the area of product development, and locational advantages can be strengthened, which also contribute to international competitiveness. It is essential to consider opportunities and risks with foresight and to act decisively. Companies are increasingly integrating climate risks into their decision-making processes or operational risk management, although further measures will be required in line with future developments. The capacity to adapt to the impacts of climate change varies depending on the size of the company and the sector. The climatic conditions in Austria also show considerable regional differences. (International) value chains have different points of intervention for climate risks depending on the sector. It is therefore important to develop solutions for appropriate climate risk management based on the company's own risk profile.

However, the domestic economy is not only affected by climate change in Austria, but also by climate change in other regions of the world from which Austria obtains raw materials or intermediate inputs. Furthermore, climate changes in regions that represent important sales markets for products and services from Austria must also be considered. Based on insurance data, the total damage caused by extreme weather events in Austria between 1980 and 2020 is estimated to be EUR 15.6 billion (EEA and NatCatSERVICE 2022). In addition, there are indirect consequential effects, which can sometimes be far greater than the direct costs of repairing damaged systems. The increasing probability of damage may result in an adjustment of insurance premiums and deductibles. Climate and energy policy targets at international, European and national level are in turn increasingly leading to stricter regulations and can result in significant follow-up costs for companies if they do not strengthen their climate resilience in good time and take a resource-saving approach.

Within the context of climate change, the overarching goal of economic activities is to increase the resilience of production and trade by minimising climate change-related risks and developing climate-friendly products and services that support adaptation.

In order to increase the adaptability of the Austrian economy, it is necessary for companies to take greater account in planning and decision-making processes of the effects of climate change on their economic activities. Climate risk analyses increase the awareness of companies. Climate risk analyses should be based on existing frameworks such as the

recommendations of the Taskforce on Climate-Related Financial Disclosures (TCFD) and regulatory requirements such as the EU taxonomy. An important recommendation for action is to increase the resilience of one's own business location. This requires measures to protect staff and ongoing operations from extreme weather events (heavy rain and flooding, heat, storms and hail) and to secure the energy supply. This also includes the corresponding review and adaptation (or creation) of operational emergency plans and early warning systems.

The dependence of the domestic economy on climate change in other regions of the world must also be considered. It is therefore very important to monitor climate-related risks along the value chain more closely and to avoid disruption. Furthermore, climate-friendly products, technical processes and services that support adaptation must be developed and used. Such innovations can include, for example, processes aimed at increasing resource and energy efficiency or contributing to the circular economy. They also include storm- and flood-proof construction methods or the use of alternative financing models. The framework conditions for research, development and innovation must be optimised to support such innovations. Ongoing further development and establishment of risk assessment procedures for all economic activities (financial and real economy), taking climate scenarios and transformation risks into account, is necessary. The requirements of the European Green Deal should also be increasingly broken down to be relevant for Austria and communicated to the responsible bodies.

In the insurance industry, it is essential to increase the awareness and resilience of insurance customers to the impacts of climate change. Excessive loss potential jeopardises the general insurability of losses and risk diversification for insurance companies. The population's awareness of changing hazard situations and the resulting need for (personal) precautions and insurance must be increased and the further development and possible introduction of natural disaster insurance must be considered.

Table 13: Overview of the seven recommendations for action for economic activities.

No.	Title of the recommended action	Goal
14.5.1	Establishment of climate risk management as part of general corporate risk management	Raising awareness among companies of the impact of climate change on their economic activities and value chain; preparing the economy for future regulations (e.g. EU taxonomy requirements) in the area of climate change adaptation and their indirect impact on SMEs; promoting the implementation of climate risk analyses among companies.
14.5.2	Increasing the resilience of the operating site, including energy supply security and ensuring health and safety in the workplace	Increasing the resilience of the operating site to the natural hazards relevant on site and to protect staff and ongoing operations; securing the energy supply to reduce the impact of climate change and ensuring the health and physical well-being of employees with respect to climate risks such as heat stress and UV radiation.
14.5.3	Securing the supply of raw materials, deliveries, transport networks and production	Consideration of the growing climate-related risks along the value chain in order to ensure security of supply and, in particular, to avoid disruptions in the supply chain, price and quantity fluctuations and quality losses.
14.5.4	Development of products, technical processes and services that are climate-friendly and support adaptation	Increasing resilience and regenerative capacity and utilising opportunities through innovative products, technical processes and services.
14.5.5	Promotion of adequate future scenario-based risk assessments	Application and ongoing further development of risk assessment procedures for all economic activities, taking climate scenarios and transformation risks into account, by actors in the financial and real economy to improve risk awareness and as a basis for specific preventive measures.
14.5.6	Raising awareness among the population to avoid damaging events and strengthening personal responsibility through services of the insurance industry	Expansion of services relevant to adaptation, such as raising awareness and strengthening the resilience of insurance customers to the impacts of climate change.
14.5.7	Better risk diversification for insurers and thus increased insurability of climate- and weather-induced losses	Examination and possible introduction of natural catastrophe insurance (Nat-Cat insurance).

15 Cities – Urban green and open spaces

Thanks to their diverse functions, green and open spaces make a significant contribution to improving the quality of life in cities. Their importance is increasing in many respects due to climate change. Green and open spaces reduce the ‘heat island effect’, provide fresh air corridors, can increase the penetration depth of cold air into the urban area, regulate the water balance, relieve the sewage system through their infiltration capacity, contribute to air pollution control and provide habitats for native animal and plant species. They make a significant contribution to healthy living due to their recreational value, as places for exercise, meetings and experiencing nature, as well as their balancing function with regard to climatic stress, air pollution and noise. Many of these services are particularly effective if the open and green spaces are of a high quality and sufficient size and are planned and permanently established as a strategic network in an urban area (in the sense of ‘green and blue infrastructure’).

Cities and urban areas have a high population density and a concentration of assets and critical infrastructure. This makes them particularly vulnerable to climate change. The climate in cities usually differs fundamentally from that of the surrounding countryside. It has higher air and surface temperatures, as well as altered wind, humidity, precipitation, radiation and air quality conditions. The high degree of sealing in cities not only contributes to heat stress, it can also lead to the drainage capacity of the existing sewage system being overstretched and the risk of flooding being increased in the case of more frequent heavy rainfall events. Extreme weather events such as thunderstorms, storms etc. can cause damage to buildings, infrastructure facilities such as the sewage system, traffic routes and even urban vegetation. In summer, rising temperatures and changing precipitation patterns expose plants to increasing drought stress. A climate change-adapted, forward-looking urban rainwater management system should not discharge water into the sewer system, but store it on site (Fuchs-Hanusch et al. 2022).

The overarching goal of the creation of urban open and green spaces is to optimise the quality of life in urban areas under changing climatic conditions by creating and maintaining easily accessible open and green spaces and improving their diverse functions.

In order to improve the quality of life in urban areas under changing climatic conditions, it is important to review and adapt urban and spatial development plans, development plans and zoning plans with regard to their climate resilience. Greater integration of green and blue infrastructure in the planning of urban development areas and the protection of existing trees are essential. Soil sealing should be avoided as early as the zoning stage and unsealing should be promoted. Adaptation services of open and green spaces must increasingly be ensured through forward-looking, adapted water management. As an increased demand for drinking and industrial water can generally be observed during heatwaves, more conflicts over the use of water resources are possible in the future. In order to improve the urban water balance, water retention must be increased, rainwater management improved, land unsealing promoted and the increased use of grey water for irrigation and water-saving measures accelerated (Fuchs-Hanusch et al. 2022).

Urban open and green spaces can help to protect biodiversity. At the same time, diverse, resilient and well-connected green spaces with their ecosystem functions can make a significant contribution to improving the quality of life under changing climate conditions in cities. A biodiversity-promoting, climate-fit design of green and blue infrastructure plays a major role here. It is equally essential that soil functions, especially water storage and water filtering functions, are also optimised in urban open and green spaces.

Urban open and green spaces are managed by different stakeholders. Improved networking and cooperation between all affected groups is therefore important and must encompass all different specialist areas (e.g. transport planning, spatial planning, green space management, nature conservation, etc.) as well as the public and private sectors. In addition, interdisciplinary and transdisciplinary research as well as target group-orientated knowledge transfer, information and advisory services are required.

The recommendations for action for urban open and green spaces are not only aimed at cities and urban areas, but are also important for the settlement areas of all Austrian municipalities.

Table 14: Overview of the six recommendations for action for urban green and open spaces

No.	Title of the recommended action	Goal
15.5.1	Adaptation of planning and maintenance strategies for urban open and green spaces	Climate-friendly urban development by taking climate change into account in the planning, realisation and maintenance of urban open and green spaces.
15.5.2	Adaptation of water management for open and green spaces	Optimisation of the water supply to maintain the ecosystem services of open and green spaces under changing climatic conditions.

No.	Title of the recommended action	Goal
15.5.3	Preserving and fostering the biodiversity of urban open and green spaces	Improvement of ecosystem functions and biodiversity as well as expansion of urban open and green spaces.
15.5.4	Adaptation of land management in urban open and green spaces	Optimisation of soil functions, in particular the water storage and water filter function.
15.5.5	Raising awareness, networking and adapting the training and further education of all groups concerned (public and private)	Expansion of the level of knowledge and improved networking and cooperation between all groups concerned.
15.5.6	Expanding the knowledge base through inter- and transdisciplinary research on urban open and green spaces	Knowledge development and transfer on climate-resilient urban open and green spaces.

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Abbreviations

AAR14	Österreichischer Sachstandsbericht Klimawandel 2014 (Austrian Assessment Report 2014)
ACRP	Austrian Climate Research Programme (funded by the Austrian Climate and Energy Fund)
APCC	Austrian Panel on Climate Change
ASDR	Austrian Strategy for Disaster Risk Reduction
BFW	Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft (Federal Research and Training Centre for Forests, Natural Hazards and Landscape)
BKA	Bundeskanzleramt (Federal Chancellery)
B-KSG	Bundes-Krisensicherheitsgesetzes (Federal Crisis Security Act)
BMI	Bundesministerium für Inneres (Federal Ministry of the Interior)
BMK	Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie (Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology)
BML	Bundesministerium für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft (Federal Ministry for Agriculture, Forestry, Regions and Water Management)
BMLFUW	Bundesministerium für Landwirtschaft, Forstwirtschaft, Umwelt und Wasserwirtschaft (Federal Ministry for Agriculture, Forestry, Environment and Water Management)
BMLRT	Bundesministerium für Landwirtschaft, Regionen und Tourismus (Federal Ministry for Agriculture, Regions and Tourism)
BMSGPK	Bundesministerium für Soziales, Gesundheit, Pflege und Konsumentenschutz (Federal Ministry for Social Affairs, Health, Care and Consumer Protection)
CCCA	Climate Change Centre Austria
EC	European Commission
EEA	European Environment Agency
EU	European Union
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
KLAR!	Klimawandelanpassungsmodellregionen (Climate Change Adaptation Model Regions)
KWAN	Österreichische Netzwerk innovativer Klimawandelanpassung für Praktiker:innen auf regionaler Ebene, kurz Anpassungsnetzwerk (Austrian Network for innovative Climate Change Adaptation, in short Adaptation Network)
NECP	National Energy and Climate Plan

NBS	Nature-based Solutions
NGO	Non-Governmental Organisation
ÖREK	Österreichisches Raumentwicklungskonzept (Austrian Spatial Development Concept)
ÖROK	Österreichische Raumordnungskonferenz (Austrian Conference on Spatial Planning)
R&D	Research and Development
SDG	Sustainable Development Goal
SKKM	Staatliches Krisen- und Katastrophenschutzmanagement (State Crisis and Disaster Management Strategy)
SME	Small and Medium-sized Enterprises
TCFD	Taskforce on Climate-Related Financial Disclosures
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VO	Verordnung (Regulation)

