

Vulnerability and adaptation to climate change in Europe

Significant changes in climate and their impacts are already visible globally, and are expected to become more pronounced. In Europe, mountain regions, coastal zones, wetlands and the Mediterranean region are particularly vulnerable. Although there could be some positive effects, many impacts are likely to be adverse. Existing adaptive measures are concentrated in flood defence, so there is considerable scope for adaptation planning and implementation in other areas, such as public health, water resources and management of ecosystems.

The need for adaptation

Projections for 2100 suggest that temperature in Europe will have risen by between 2 to 6.3 °C above 1990 levels. The sea level is projected to rise, and a greater frequency and intensity of extreme weather events are expected. Even if emissions of greenhouse gases stop today, these changes would continue for many decades and in the case of sea level for centuries. This is due to the historical build up of the gases in the atmosphere and time lags in the response of climatic and oceanic systems to changes in the atmospheric concentration of the gases.

The Environment Council of the European Union has recently confirmed the EU indicative target of a maximum of 2 °C global temperature increase above pre-industrial levels in order to avoid severe adverse

impacts of climate change. Achieving such a target will require substantial reductions of global greenhouse gas emissions over and above those already agreed under the Kyoto Protocol. There is also growing recognition that Europe must adapt to the climate change impacts that inevitably will occur.

Vulnerability

Vulnerability refers to the risk of adverse impacts from climate change, including extreme weather events and sea level rise, on both natural and human systems.

Regional vulnerability

Regions:

South-eastern Europe, the Mediterranean and central European regions are the most vulnerable to climate change. Here, considerable adverse

impacts are projected to occur on natural and human systems that are already under pressure from socio-economic factors, such as changes in land use, for example. Northern and some western regions of Europe, on the other hand, may experience beneficial impacts, particularly within agriculture, for some period of time.

Mountains and sub-arctic areas:

Impacts of temperature rise on snow cover, glaciers and permafrost are likely to have adverse impacts on winter tourism. There could also be an increased risk of natural hazards, and loss of plant species and habitats. Mountainous regions, like the Alps, are particularly vulnerable to climate change and are already suffering from higher than average increases in temperature.

Coastal zones:

Climate change could have profound impacts on coastal zones due to sea level rise and changes in frequency and/or intensity of storms. This would result in threats to ecosystems, infrastructure and settlements, the tourism industry and human health. Habitats and coastal ecosystems on the Baltic, Mediterranean and Black Seas in particular are at high risk. It is projected that the Mediterranean and Baltic coasts will experience considerable loss of wetlands.

Vulnerability by issue

Ecosystems and biodiversity:

Observed temperature rise and changes in precipitation patterns already affect various aspects of Europe's natural systems. The most vulnerable ecosystems are the European arctic and mountains, coastal wetlands and ecosystems in the Mediterranean region. Projected climate change is expected to lead to considerable losses of species and habitats throughout Europe.

Agriculture and fisheries:

Climate change and increased CO₂ concentration could have a beneficial impact on agriculture and livestock systems in northern Europe through longer growing seasons and increasing plant productivity. In the south and parts of eastern Europe the impact is likely to be negative. In fisheries, changes in fish migration patterns are expected to occur. Resource over-exploitation is currently a more pressing factor threatening the sustainability of commercial fisheries in Europe.

Forestry:

Climate change will probably result in yield increases in commercial forests in northern Europe. Mediterranean regions and continental Europe will experience decreases due to more frequent droughts. In addition, increased risks of fire are likely in southern Europe.

Water resources:

Temperature rise and changing precipitation patterns are expected to exacerbate the already acute water shortage problem in southern and south-eastern regions. Changes in frequency and intensity of droughts and floods are projected, which could cause significant financial and human loss throughout Europe.

Tourism:

Unreliable snow cover resulting from temperature rise is likely to lead to a loss in winter tourism. Water shortage, water quality problems, and more frequent and intense heat waves in southern Europe could cause notable reductions in summer tourism. New opportunities for tourism may arise in other areas.

Human health:

Changes in frequency and intensity of extreme weather and climate events could pose a serious threat to human health. These threats may either be direct, such as heat waves and flooding, or indirect, for example by the spread of tick-borne diseases. Particularly vulnerable sections of the population would be elderly people with limited access to health care services.

Energy:

Temperature rise is likely to increase energy demand for air conditioning in the summer, particularly in southern Europe. Such extra power demand, compounded by climate change induced reduction in hydro-production and problems with cooling water availability, could cause disruption to energy supplies.

Adaptation

Strategies and policies

Adaptation refers to policies, practices and projects which can either moderate damage and/or realise opportunities associated with climate change.

At global level, the 2004 UN Framework Convention on Climate Change agreed to develop a five year, structured programme of work on the scientific, technical and socio-economic aspects of impacts, vulnerability and adaptation to climate change.

So far, the integration of climate change considerations into key EU environmental policies, such as the EU Biodiversity Strategy, the habitats directive and the water framework directive, has not yet taken place to any great extent. Neither has such integration occurred in other relevant EU policy areas, such as the common agricultural policy (CAP).

At EU and national level, a number of research programmes assessing the implications of potential climate change impacts have been planned or are

about to commence. Research started more recently in support of planning of national and international adaptation measures. In 2004, the European Commission initiated the development of a European action programme on flood risk management, including a possible future Floods Directive. In this context, climate change has been mentioned as a key issue. Then, in October 2005, the Commission launched the second phase of the European Climate Change Programme. This programme is primarily

aimed at identifying additional measures to reduce greenhouse gas emissions in order to achieve the Kyoto Protocol targets. Here, for the first time, it was agreed to address adaptation issues.

A consultation process with stakeholders will be held in 2006 to discuss the EU role in climate change adaptation policies. The aim is to integrate adaptation into relevant European policy areas in order to identify good, cost-effective practice in the development of

adaptation policy, and to foster learning. The Commission aims to publish a green paper by the end of 2006.

At national level, strategies are currently under preparation in Denmark, Finland, and the United Kingdom. In many EEA member countries adaptation measures are either planned or taking place in the context of natural hazard prevention, environment protection and sustainable resource management.

Examples of actual or planned measures are:

Austria	Natural hazards and tourism in the Alps
Belgium	River flood risk management
Finland	Hydropower generation, infrastructure (transport, buildings) and forestry
France	Health sector and forestry
Italy	Coastal zone management and tourism in the Alps
Norway	Infrastructure (buildings) and forestry
Netherlands	River flood risk management and coastal zone flood defence
Spain	Agriculture (droughts)
Sweden	Forestry
Switzerland	Hydropower generation, ecosystems and tourism in the Alps
United Kingdom	River flood risk management, coastal zone flood defence and insurance

Adaptation challenges

Developing and implementing adaptation measures is a relatively new issue. Existing measures are very much concentrated in flood defence,

which has enjoyed a long tradition of dealing with weather extremes. Concrete policies, measures and practices outside this area are still scarce. Therefore, there is considerable scope for adaptation planning

and implementation in areas such as public health, water resources and management of ecosystems. Currently, there are a number of challenges facing climate change adaptation.

These challenges include:

- improving climate models and scenarios at detailed regional level, especially for extreme weather events, to reduce the high level of uncertainty;
- advancing understanding on 'good practice' in adaptation measures through exchange and information sharing on feasibility, costs and benefits;
- involving the public and private sector, and the general public at both local and national level;
- enhancing coordination and collaboration both within and between countries to ensure the coherence of adaptation measures with other policy objectives, and the allocation of appropriate resources.

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