

Climate Change Adaptation

1 Introduction

It is impossible to address biodiversity loss without addressing climate change. Climate change affects biodiversity in multiple ways through complex interactions among and between species and their habitats. Protected areas play an important role in regulating the climate by making a key contribution to climate change mitigation and adaptation. Hence climate change response can be divided into “mitigation” (actions that reduce the amount of carbon dioxide and other heat-trapping gases in the atmosphere) and “adaptation” (an adjustment by human or natural systems to the changing climate). Protected areas hold great promise as part of a “natural solution” to climate change. Forests, wetlands, grasslands, and marine ecosystems conserved in protected areas store vast amounts of carbon in vegetation, soils, and water. Sequestering and storing CO₂ is an important ecosystem service of protected areas and protected area managers should take CO₂ sequestration and the CO₂ stored in protected areas into consideration when deciding on the objectives of the site and the activities needed to achieve these objectives. Another important ecosystem service is the supporting resilience in so called socio-ecological landscapes. This does not only apply to coastal areas but to landscapes in general as landscape diversity is a crucial element to enhancing resilience against disasters.

Large intact protected areas support adaptation by allowing species to move and respond to changing local conditions. The primary focus of these guidelines is however on adaptation. Preparing for change at protected area sites is critical but at the same time we have to acknowledge that adaptation cannot be accomplished at the local level alone.

2 Threats and Changes

Natural England’s Climate Change Risk Assessment and Adaptation Plan (2015) assesses the climate change related risks to the work of Natural England and sets out how to respond them. It includes actions that can be taken to build resilience and help the environment to withstand change, but also recognises that the natural environment is dynamic and in some cases change is inevitable; so we will have to plan and manage for this.

While this report is primarily about responding to risks, it is important to recognise that there are also opportunities to manage the environment in ways that, as well as benefiting conservation, can help to reduce the impacts of climate change on people. For example, management of vegetation within catchments can help to reduce flooding by absorbing excess rainfall and reducing run-off, and can be an alternative to ‘hard’ engineering. Catchment management using natural vegetation can also reduce vulnerability to drought. Green spaces can help to reduce temperatures within urban areas and allowing the development of coastal marshes can help to protect against sea level rise. The way we manage the natural environment can also help to mitigate climate change. Some habitats, particularly woodlands, wetlands and blanket bog are important carbon sinks and play a vital role in management of carbon dioxide, the most important greenhouse gas. Good habitat management, together with new habitat creation and restoration, can provide cost-effective means of reducing greenhouse gas concentrations, and Natural England has an essential role in delivering and supporting this.

Looking to the future, we are working with partner organisations across government, the private and charitable sectors to recognise the value of our natural capital and develop new approaches to managing it sustainably. Climate change adaptation and mitigation are essential elements of this.

The report lists an overview of the changes and impacts of climate change on species, habitats, protected areas etc.

Changes that impact species and habitats include:

- Changes in precipitation, droughts soil moisture, which are especially damaging for wet grasslands, wetlands including peatlands.
- Changes in climate can affect the productivity and survival of species in addition to changing the timing of their annual cycles. As a result species may alter their interactions with other species through changes in competitiveness, predator-prey relationships, parasitism and disease. A key issue is any change in the establishment or spread of non-native species including invasive species, pests and pathogens.
- Acidification in marine environments, resulting from high carbon dioxide concentrations in the atmosphere, threatens sensitive species and may lead to change in community structure. Although strictly not a climate issue, it is tightly linked because of the common causation in carbon dioxide emissions.
- Effects of hydrological extremes, particularly droughts, on freshwater ecosystems can threaten species of conservation concern.
- Policy and market responses to the global effects of climate change, primarily around the sustainability, supply and cost of food and energy.

Threats to the condition of protected sites

- Tipping points in the interactions between climate and ecosystem responses may result in sudden loss of designated features. Tipping points may be crossed as a result of an extreme climatic event or series of events that push an ecosystem into an alternative stable state. An ecological “regime shift” could, for example, arise from a storm surge and coastal flooding event that transformed a coastal reed bed habitat into a salt marsh. Understanding the proximity of tipping points is an important area of research.
- Gradual change will reduce our ability to maintain our currently applicable management objectives as habitat and species features adjust from those given. In the future it may mean that our current designations fail to protect habitats and species because the guidelines/legislation which support them do not reflect the current and future changes expected in the environment.
- Interactions between different aspects of environmental change combine to degrade protected sites. Climate change will interact with all the other pressures on ecosystems, including land use change, pollution and invasive species. These complex interactions are poorly understood and have the potential to reduce the capacity for designated features to adapt autonomously or to influence human adaptation interactions.

For further reading see the report of Natural England.

<http://publications.naturalengland.org.uk/publication/4599517514039296>

3 European policies on Climate Change Adaptation

To provide guidance on how to adapt to the impacts of climate change in among others biodiversity policy the European Commission adopted the EU adaptation strategy in April 2013. (<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0216>)

The strategy provides several recommendations for policy adjustments including legal enforcement of connectivity requirements and the implementation of adaptive management plans for each

Special Area of Conservation (SAC) of the Natura 2000 network. Guidelines for dealing with climate change in the management of Natura 2000 sites were developed in 2013 by the European Commission to facilitate site management and decision making at local and regional levels. The guidelines specify the need to move from a static conservation perspective to an adaptive management approach, which involves the consideration of potential climate impacts and the design of management actions that take those impacts into account. (<https://climate-adapt.eea.europa.eu/eu-adaptation-policy/sector-policies/biodiversity>)

Further guidance on climate change adaptation can also be found in:

- EU Guidance Document Number 24 – River Basin Management in a Changing Climate, technical report – 2009 – 040, Common Implementation Strategy for the Water Framework Directive (2000/60/EC), p.16, Brussels, Belgium. (https://circabc.europa.eu/sd/a/a88369ef-df4d-43b1-8c8c-306ac7c2d6e1/Guidance%20document%20n%2024%20-%20River%20Basin%20Management%20in%20a%20Changing%20Climate_FINAL.pdf)
- Progress and results of the CLISP project: Climate Change Adaptation by Spatial Planning in the Alpine Space, available at www.clisp.eu and the CLIMALPTOUR project: Climate Change and its Impact on Tourism in the Alpine Space at www.climalptour.eu

4 The Copernicus Climate Data Store

When it comes to adaptation planning the first step is to build a strong foundation that involves assembling available knowledge and resources, planning for change, and developing a long-term capacity for informed, flexible management.

The first question to be answered however is; what are the predicted changes in climate for a specific region and site. The best source to find information about how the climate is going to change is to go to the Copernicus Climate Change Data Store (C3S) :

<https://cds.climate.copernicus.eu/#!/home>

The Copernicus Climate Data Store contains the geophysical information needed to analyse climate change indicators in a consistent and harmonised way. The CDS provides free access to the past, present and future climate data. It is a one-stop shop for users to explore climate data. Easy access to climate indicators via the CDS provides scientists, policy makers and businesses with the necessary information to help make decisions for a more sustainable future.

The C3S includes a toolbox which provides help to analyse changes in temperature, precipitation and for instance number of winter days. Currently the toolbox is not very user friendly and the EU is working hard to improve this. Having some basic knowledge about climate change models, uncertainties and biases might be an impediment for using the toolbox effectively.

5 Generic recommendations for climate change adaptation

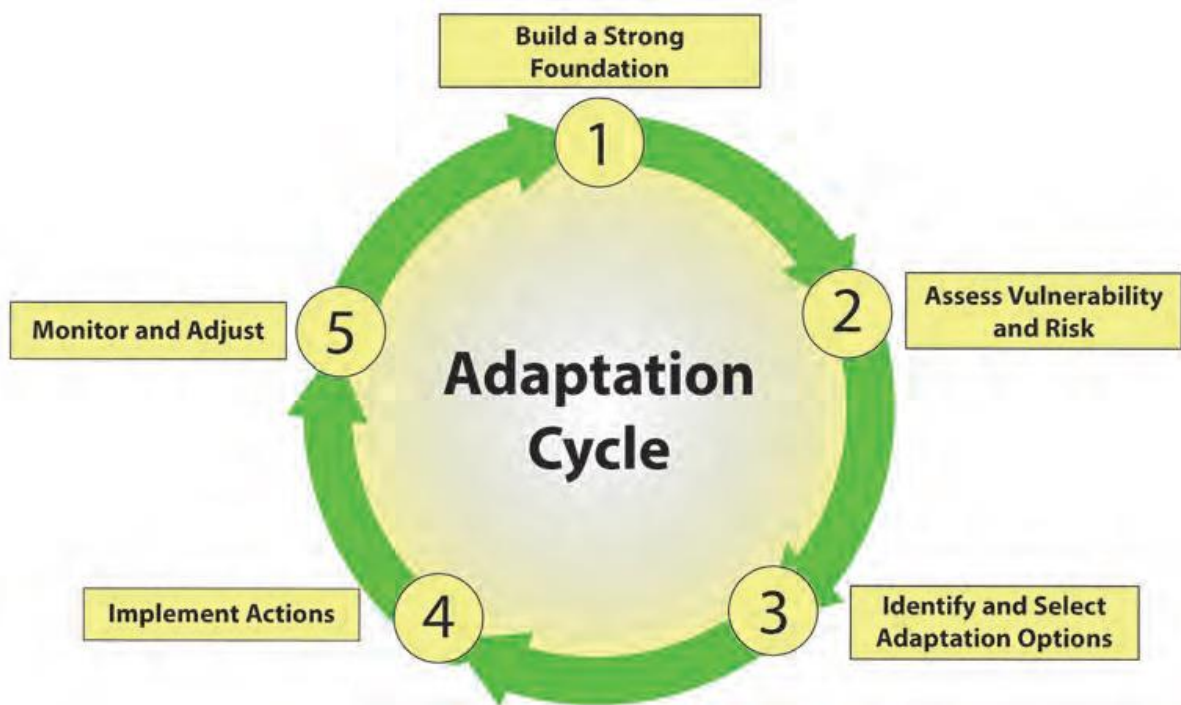
A major problem for designing adaptation measures to protect biodiversity from the impacts of climate change is that for many species and habitats, no or little information is available about the vulnerability and consequently about the impacts of climate change.

Several research projects supported by the Framework Programmes for Research and Technological Development or Horizon 2020 and other EU programmes (e.g. Interreg program) have increased knowledge on biodiversity vulnerability and adaptation (for example [MACIS](#), [BRANCH](#), [ATEAM](#), [Ecologic](#), [Habit-change](#), [MIRACLE](#), [BIO-C3](#), [BAMBI](#), [ATLAS](#), [GEOLAND](#) or [MPA-ADAPT](#)). The EU's Research and Innovation programme Horizon 2020 work plan for 2018-2020 for Climate action, environment, resource efficiency and raw materials includes actions on the Inter-relationships between climate change, biodiversity and ecosystem services ([LC-CLA-06.2019](#)). Research on biodiversity is

also supported through the [BiodivERsA ERA-Net](#), which works to coordinate national research programmes on biodiversity across Europe and to organize international funding for research projects in this field on a competitive basis.

6 Adaptation Planning

Valuable recommendations on adapting management of protected areas to climate change can be found <https://portals.iucn.org/library/sites/library/files/documents/PAG-024.pdf> (2016) ¹ This publication promotes the use of the adaptation cycle:



These guidelines articulate essential elements for adaptation planning and implementation, and it describes additional resources that site managers can use right away. The chapters and associated best practices generally follow the five steps presented below: .

Step 1: Build a Strong Foundation that involves assembling available knowledge and resources, planning for change, and developing a long-term capacity for informed, flexible management. Developing and adopting forward looking and climate-informed goals may mean protected areas need more active management rather than just protection for the persistence of existing systems. Adaptation planning is place-and habitat specific This should be supported by assembling baseline information from local, national, and international sources Important is also to increase staff literacy on climate change.

¹ Gross, John E., Woodley, Stephen, Welling, Leigh A., and Watson, James E.M. (eds.) (2016). *Adapting to Climate Change: Guidance for protected area managers and planners*. Best Practice Protected Area Guidelines Series No. 24, Gland, Switzerland: IUCN. xviii + 129 pp

Step 2: Assess Vulnerability and Risk means undertaking quantitative or qualitative analyses to determine which species, ecosystems, and other values are most vulnerable to changing conditions, and identifying the key vulnerabilities that pose the greatest risk to achieving conservation goals. Understanding the vulnerability of species, ecosystems, and ecological processes is an essential first step in effective adaptation planning.

A common approach to understanding vulnerability is to conduct species-based assessments, and many different methods are available.

Step 3: Identify and Select Adaptation Options emphasizes the need for structured approaches to recognize and prioritize strategic and tactical actions to achieve short and long term adaptation goals in protected areas.

A variety of tools are available to support adaptation planning, including scenario planning and various structured decision making techniques. Adaptation actions may be *reactive*, by responding to impacts already apparent, or they may be *anticipatory*, in that they prepare for future conditions.

Step 4: Implement Actions is where the protected area takes action based on all of the previous analysis and deliberation. As with all steps in the general adaptation cycle, implementing climate change adaptation actions is not a one-time decision but an ongoing process. Some actions may need to be implemented immediately while others can address long-term goals, and these will take more time and resources to put in place.

Step 5: Monitor and Adjust, the protected area managers and their staff measure indicators of success and failure and use that information to evaluate and recalibrate their decisions. “Learning by doing” is critical for climate adaptation because we will be successful only by specifically directing attention to what works and what does not.

Five best practices address climate change considerations for protected area planning, with a focus on how conservation goals need to be flexible to adjust to changing circumstances and conditions.

- Manage for change, not just persistence
- Reconsider conservation goals as well as management strategies
- Adopt forward-looking, climate informed goals
- Link adaptation actions to climate impacts

Valuable information can also be found on:

- <https://nerc.ukri.org/research/partnerships/ride/lwec/report-cards/> (Climate Change Impacts Report Cards)
- The following recommendations are from the Climate Adaptation Manual published by Natural England and the RSPB. (Natural England and RSPB, 2014. Climate Change Adaptation Manual) <http://publications.naturalengland.org.uk/publication/5629923804839936>
- Europarc Federation together with Réserves Naturelles de France and 8 other mainly French partners is implementing a project titled “NatureAdapt”. NaturAdapt aims at triggering a transition towards the adaptive management of protected areas while laying the foundations of a dynamic collective learning process. More information on: <https://www.europarc.org/about-us/europarc-projects/naturadapt/>.

Generic recommendations for climate change adaptation include:

- Building resilience against the added risk of climate change by acting on existing anthropogenic risk,

- Using a cyclic management approach to include increasing knowledge over time on climate change impacts, and incorporating this into a comprehensive information system for use in decision-making for adaptive management,
- Using the opportunity of implementation of existing initiatives to:
 - restore natural ecosystem function within catchments, in particular the ability of catchments to retain and slowly release water and to degrade pollutants,
 - reduce fragmentation and improve connectivity of habitats to allow species movements,
 - balance ecology and economic developments,
- Mainstreaming of climate concerns into other policy areas, programmes, processes and funding supports.

These elements constitute climate change adaptation, and their implementation rests upon certain fundamental principles against which possible measures should be formulated and judged, namely:

- Investing in the future, not the past
- Working with nature, not against it
- Inclusivity of stakeholders and increasing public awareness
- Building capacity for adaptive management
- Focussing on „no-regrets” and „win-win” measures and solutions
- Change management practices and infrastructure that add to long-term vulnerability.

Case studies on climate adaptation can be found on:

<https://climate-adapt.eea.europa.eu//eu-adaptation-policy/sector-policies/biodiversity>

Although not directly targetting adaptation to climate change impacts but more on ecosystem based solutions to climate change, the Panorama web site offers good cases for climate change adaptation as well:

<https://panorama.solutions/en/portal/ecosystem-based-adaptation>

7 Potential opportunities

The risk analysis also identified a number of possible opportunities and these are also embedded within Nature England’s Adaptation Plan. Most of these will need positive action to realise the potential benefits and this is an important element of adaptation. The most important potential opportunities include:

- Some priority species habitats might thrive under increasingly warmer and drier conditions, particularly those on drier heathland and grassland habitats.
- Some priority species and habitats may thrive through changes in interspecific interactions, for example increased competitive advantage.
- The opportunity to conserve rare and threatened species colonising new locations. These are likely to be those with southerly distributions.
- There is an opportunity to facilitate landscape change in ways that create valuable new landscapes that are more resilient to climate change and deliver improved benefits for society (sense of place, biodiversity and other ecosystem services).
- Increased opportunities to engage with society to help people understand that landscapes are inherently dynamic and to identify the best ways to accommodate future changes.

- Opportunity to develop advice and incentives for land managers to support sustainable management of the soils and water that underpin both ecosystem services and agricultural production.
- Opportunity to develop advice and support for farmers and marine stakeholders (e.g. fisheries, coastal tourism) seeking to adapt their business in a sustainable way. Climate change highlights the importance of a healthy natural environment and leads to a better understanding of ecosystem services by our partners and society. This means that measures to reduce current pressures on biodiversity, soil, water and the coast become higher priorities. This provides greater opportunity for Natural England to influence planning and agricultural land use and to deliver socio-economic adaptation and the development of better habitat networks and habitat creation, supporting a more joined approach.
- Opportunities for emissions mitigation through managing greenhouse gases and carbon stores within the natural environment, to increase the quality of these natural assets and their capacity for climate change adaptation.
- Opportunity to secure improved management of woodlands and other habitats providing inputs for energy crops or anaerobic digestion, to ensure that these mitigation initiatives are consistent with adaptation of the natural environment.
- The potential to bring forward innovative, environmentally beneficial development and a balance of land use appropriate to local climate adaptation requirements; providing a strong impetus for the delivery of multi-functional green infrastructure.
- Greater interest in using natural environmental solutions to help communities adapt to climate change. This may increase the provision of greenspace, street trees and water bodies increasing recreational opportunities.
- Increasing areas of land allocated for flood attenuation, particularly near settlements, could lead to the availability of greenspace near to where people live.
- Increased awareness and interest in the natural environment and in climate change impacts as a local, tangible issue may make it easier to engage people with the natural environment and to take action, for example, through volunteering.

Valuable information on how to deal with climate change impacts in management of N2000 sites can also be found in:

- [Guidelines on Climate Change and Natura 2000 – Dealing with the impact of climate change. On the management of the Natura 2000 Network of areas of high biodiversity value.](#)