

# England Biodiversity Strategy Climate Change Adaptation Principles

Conserving biodiversity in a changing climate



Department for Environment, Food and Rural Affairs  
Nobel House  
17 Smith Square  
London SW1P 3JR  
Telephone 020 7238 6000  
Website: [www.defra.gov.uk](http://www.defra.gov.uk)

© Crown copyright 2008

Copyright in the typographical arrangement and design rests with the Crown.

This publication (excluding the royal arms and departmental logos) may be reused free of charge in any format or medium provided that it is reused accurately and not used in a misleading context. The material must be acknowledged as crown copyright and the title of the publication specified.

Information about this publication and further copies are available at:

**The England Biodiversity Strategy Climate Change Adaptation Workstream Secretariat  
Zone 1/08  
Temple Quay House  
2 The Square  
Temple Quay  
Bristol BS1 6EB**

**Tel: 01117 372 8322**

Email: [CentralAdmin.SupportTeam@defra.gsi.gov.uk](mailto:CentralAdmin.SupportTeam@defra.gsi.gov.uk)

Published by the Department for Environment, Food and Rural Affairs

Cover photograph – Andy Hay ([rspb-images.com](http://rspb-images.com))

# England Biodiversity Strategy

## Climate Change Adaptation

### Principles

Conserving biodiversity in a changing climate

<b>R. J. Smithers</b>	Woodland Trust
<b>C. Cowan</b>	Natural England
<b>M. Harley</b>	AEA
<b>J. J. Hopkins</b>	Natural England
<b>H. Pontier</b>	Department for Environment, Food and Rural Affairs
<b>O. Watts</b>	Royal Society for the Protection of Birds

## Foreword

This document sets out principles to guide adaptation to climate change. It is aimed at people responsible for planning and delivering actions across all sectors identified in the England Biodiversity Strategy:

- Agriculture
- Water and wetlands
- Woodland and forestry
- Towns, cities and development
- Coasts and seas.

Building on guidance for conservation practitioners published by Defra on behalf of the UK Biodiversity Partnership (Hopkins et al, 2007), it draws extensively on peer-reviewed and grey literature, as well as relevant ideas from individuals and organisations in the UK and elsewhere.<sup>1</sup>



Changes in phenology may lead to loss of synchrony between species

Photo © WTPL/Richard Becker

Adaptation requires “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (Intergovernmental Panel on Climate Change, 2007). Significant impacts of climate change on biodiversity in England have already been observed (Mitchell et al, 2007). Whatever action is taken now to reduce levels of greenhouse gas emissions, further impacts are inevitable because climate change will continue due to inertia in the climate system. Climate change, therefore, poses serious

<sup>1</sup> Appendices are available listing people approached for information and relevant excerpts from all items included in the bibliography.

## Foreword

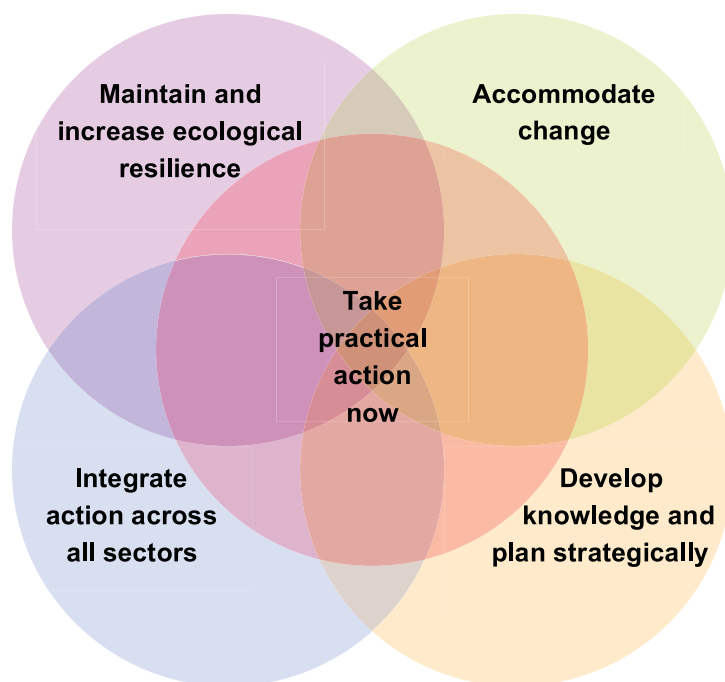
threats to biodiversity this century. The direct impacts of climate change on biodiversity (Mitchell et al, 2007) include:

- Changes in phenology, which may lead to loss of synchrony between species
- Changes in species abundance and distribution (including arrival and loss of species)
- Changes in community composition
- Changes in ecosystem processes
- Loss of space, eg. due to sea level rise.

Climate change will bring indirect impacts to biodiversity through changes in socio-economic drivers, working practices, cultural values, policies and use of land and other resources. Due to their scale, scope and speed, many could be more damaging than the direct impacts, especially those that affect our highly modified landscapes, coasts and seas. There will be opportunities as well as threats for biodiversity and adaptation needs to address both.

# Adaptation principles

Five main adaptation principles are fundamental to conserving biodiversity in a time of rapid climate change:



The precautionary principle<sup>2</sup> should underpin all of these.

Many elements of these principles are neither new nor specific to climate change adaptation; they underpin existing policy and practice in nature conservation. However, climate change creates a new imperative to understand and work with the dynamics of natural systems. The complex interactions between people and their natural environment must be managed to maintain the services and benefits that society derives from biodiversity and ecosystems. These will be increasingly important and threatened as the climate changes.

The principles are presented in a logical order but have not been prioritised, as the relative weight that each should be given is dependent on such factors as:

- A sector's potential indirect impacts
- Synergies with other sectors, and scope to deliver biodiversity benefits
- The scale of activity (eg. national, regional, local)
- The remit of organisations and individuals
- The particular issues or circumstances being addressed.

Key deliverables should be reviewed individually with regard to **all** of the principles, identifying:

- The extent to which each principle is relevant
- What is already being addressed
- What more needs to be done
- Cultural considerations, which may have an important influence on people's behaviour.

<sup>2</sup> "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." (United Nations General Assembly, 1992).

## Principle: Take practical action now



Future biodiversity will depend upon the biodiversity we conserve today

Photo © Natural England

The speed and scale of climate change require action now. We cannot know exactly how the climate will change or how it will impact directly or indirectly on species, habitats and ecosystems, particularly at a local scale. We cannot wait until the evidence demonstrates greater certainty, as delay will result in more severe impacts, fewer available options for action and increased costs of damage and intervention (Stern, 2006). This is because of the length of time it will take to implement adaptation action and for biodiversity to respond. Existing conservation efforts are insufficient and there is a need to act now with greater vigour to:

- **Conserve existing biodiversity**

The richness of future biodiversity, even in a changing world, will depend largely upon the biodiversity we conserve today.

- **Conserve protected areas and all other high quality habitats**

These areas will remain important because they have characteristics that will continue to favour high levels of biodiversity. They are key ecological components of wider terrestrial, freshwater and marine ecosystems.

- **Reduce sources of harm not linked to climate**

Climate change is one of many threats to biodiversity. By reducing other sources of harm we will help natural systems maintain their biodiversity in the face of climate change.

- **Use existing biodiversity legislation and international agreements**

Existing legal and policy frameworks should be used to enable effective action now while working with policy-makers to remedy any potential shortcomings.

## Principle: Maintain and increase ecological resilience



Create buffer zones around high quality habitat

Photo © Natural England/Morwenna Christian

Increasing the resilience<sup>3</sup> of ecosystems to the impacts of climate change, will help the widest range of biodiversity to survive and adapt. Ecological resilience 'depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment' (Convention on Biological Diversity, 2000). It is vital to continue and extend current efforts to:

- **Conserve range and ecological variability of habitats and species**

It is impossible to predict which localities will continue to have climatic conditions suitable for a given species or habitat. Diversity of terrestrial, freshwater and marine ecosystems, in terms of physical features and habitats, should be maintained. This will increase the chances that species whose current habitat becomes inhospitable will be able to spread locally into newly favourable habitat.

- **Maintain existing ecological networks**

Further habitat fragmentation and isolation should be avoided by maintaining sympathetic management of terrestrial, freshwater and marine ecosystems and implementing appropriate spatial planning.

- **Create buffer zones around high quality habitats**

High quality habitats can be buffered from potential negative edge effects by reducing the occurrence of damaging activities in their immediate vicinity. For example, this may be achieved on land by creating the same or complementary habitats adjacent to them.

- **Take prompt action to control spread of invasive species**

The establishment of invasive species known to cause significant habitat degradation or loss of other species should be prevented where action can be sustained.

<sup>3</sup>Resilience can be defined as: "The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change." (Intergovernmental Panel on Climate Change, 2007).



## Principle: Accommodate change



Make space for the natural development of rivers and coasts

Photo © Environment Agency

Climate change brings into sharp focus the need to manage for the future and adopt an increasingly dynamic approach to conservation. Both gradual change and extreme weather events will shape the places where species occur. Species populations will change and move, affecting other species and habitats. The past will not provide a guide to the future due to the rate and magnitude of change expected. There is a need to:

- **Understand change is inevitable**

The structure and composition of habitats has never been static. Species will respond individually to climate change and we should seek to work with the grain of change and natural processes.

- **Make space for the natural development of rivers and coasts**

Changing rainfall patterns and rising sea levels will affect our rivers and coasts. By recognising the role of erosion and deposition in shaping the environment, we can increase the potential for species and habitats to adapt naturally to these changes.

## Principle: Accommodate change

- **Establish ecological networks through habitat restoration and creation**

Some species will need to move some distance from their current locality if they are to survive climate change. The success of species dispersal can be promoted by enhancing protected areas and creating new habitat, restoring degraded habitat, and sympathetically managing areas between existing habitats in the wider environment.

- **Aid gene flow**

The ability of a species to adapt to change is correlated with genetic diversity and population size, so conservation should seek to maintain or create large populations. Gene flow between populations is desirable but care may be required where small populations have been isolated for a long period and local genetic variation may be swamped.

- **Consider the role of species translocation and ex-situ conservation**

Translocation (introduction, reintroduction and restocking) and captive-breeding programmes may be used to conserve some species. Large-scale translocations may be impractical.

- **Develop the capacity of institutions and administrative arrangements to cope with change and learn from experience**

We must learn to be effective in a changing and uncertain world. This will require a cultural shift to work positively towards a future of potentially different circumstances, learning from experience, and sharing information more widely within and between organisations, whilst retaining consistent objectives.

- **Respond to changing conservation priorities**

Conservation targets need to be regularly reviewed to ensure resources are directed towards conservation priorities as some species increase, others decline and habitats change in character.

## Principle: Integrate action across partners and sectors



Build and strengthen partnerships

Photo Andy Hay (rspb-images.com)

Adaptation policy across all sectors needs to be built on a foundation of healthy and resilient ecosystems. Different sectors of society view biodiversity and ecosystems in terms of their own economic, cultural and societal needs. Biodiversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. Yet competing economic uses of land, water resources and the marine environment usually undervalue biodiversity and natural systems, sometimes with widespread incentives and subsidies that lead to damage to the environment. The scale of adaptation required demands that biodiversity conservation is integrated with economic activities on land and at sea. There is a need to:

- **Integrate adaptation and mitigation measures**

Biodiversity conservation can contribute to carbon management; for example, as a result of peatland restoration or native woodland creation. Mitigation should not harm biodiversity and should recognise opportunities for biodiversity, thereby contributing to adaptation.

- **Integrate policy and practice across relevant economic sectors**

Adaptation measures for biodiversity should be explicitly linked with the wider benefits that they bring. Conservation organisations alone cannot deliver the scale of change required but they can demonstrate and catalyse action for biodiversity across all relevant economic sectors. In this way, conservation can be interwoven with other activities for effective delivery of ecosystem goods and services.

- **Build and strengthen partnerships**

Partnerships between the public and private sectors should form a fundamental part of the process of developing climate change adaptation strategies from the outset. Engagement with stakeholders and local communities is crucial to developing adaptation actions that will work best on the ground.

- **Raise awareness of benefits of the natural environment to society**

Wider appreciation that adaptation for biodiversity is in the interests of individuals, communities and businesses will lead to demand and support for implementation. This should build on recognition of environmental services provided by biodiversity and ecosystems.

## Principle: Develop knowledge and plan strategically



Undertake vulnerability assessments without delay

Photo David Tipling (rspb-images.com)

We cannot know exactly how the climate will change or its precise impacts on biodiversity but we do know the general trends and some specific species responses. We have to plan for the future with available information, developing techniques that will enable us to move forward with actions that we will not regret whatever the future may bring. Simultaneously, we must strive to learn more about the impacts of climate change on biodiversity and ecosystems and to monitor the effectiveness of adaptation.

- **Undertake vulnerability assessments of biodiversity and associated ecosystem goods and services without delay**

Vulnerability to climate change is 'the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes' (Intergovernmental Panel on Climate Change, 2007). Assessing vulnerability will help to identify priorities and develop appropriate actions.

## Principle: Develop knowledge and plan strategically

- **Undertake scenario planning and implement no regrets actions**

There is a need to make strategic decisions by embracing uncertainty and addressing the full range of likely variation in projected changes and their impacts. It is important to avoid selection of one preferred future in the hope that it will become true.

- **Pilot new approaches and monitor**

New approaches to conservation management need to be piloted and monitored at a large scale and within a time period commensurate with the challenge.

- **Identify potential win-win solutions and ensure cross-sectoral knowledge transfer**

Win-win solutions are policies and measures that deliver several adaptation measures at once or that also bring other social and economic benefits.

- **Monitor actual impacts and research likely future impacts**

Gaining knowledge of actual and projected impacts of climate change on biodiversity is essential to help shape and adapt conservation action.

- **Improve understanding of the role of biodiversity in ecosystem services**

Implementing an ecosystems approach requires a better understanding of the benefits provided by biodiversity and ways in which ecosystem services will be affected by climate change.

- **Research knowledge gaps with stakeholder participation**

Climate change adaptation has cross-sectoral implications. Ensuring stakeholders have common understanding of and commitment to new evidence is essential to develop policy and practice.

# Bibliography and acknowledgements

## Bibliography

- BRANCH partnership – Biodiversity Requires Adaptation in Northwest Europe under a Changing climate (2007) Planning for biodiversity in a changing climate – BRANCH project final report. Natural England, UK.
- Catchpole, R. (pers. comm. 2007) Adapting to climate change practical steps in assisting the natural environment to cope with climate change using Agri-Environment Schemes
- Convention on Biological Diversity (2000) Ecosystem approach principles
- European Environment and Sustainable Development Advisory Councils (2005) Biodiversity conservation and adaptation to the impacts of climate change. EEAC Statement
- European Platform for Biodiversity Research Strategy (2005) Recommendations of the meeting of the EPBRS on “Climate change and biodiversity conservation: knowledge needed to support development of integrated adaptation strategies”
- Eurosite (2006) Biodiversity sites and climate change: Eurosite statement of Orléans, 27th October 2006
- Few, R., Brown K., & Tompkins, E.L. (2004) Scaling adaptation: climate change response and coastal management in the UK. Tyndall Centre for Climate Change Research Working Paper 60
- Gregory, A., Burke, T., Ferris, R., Robson, J., Smithers, R.J. & Whitlock, R. (2006) The conservation of genetic diversity: science and policy needs in a changing world. Joint Nature Conservation Committee Report No. 383
- Hannah, L., Midgley, G. F. & Millar, D. (2002) Climate change-integrated conservation strategies. *Global Ecology & Biogeography* 11, 485–495
- Hopkins, J.J.; Allison, H.M.; Walmsley, C.A.; Gaywood, M.; Thurgate, G. (2007) Conserving biodiversity in a changing climate: guidance on building capacity to adapt. Defra on behalf of the UK Biodiversity Partnership
- Huntley, B. (2007) Climatic change and the conservation of European biodiversity: towards the development of adaptation strategies. A discussion paper prepared for the 27th meeting of the Standing Committee, Convention on the Conservation of European Wildlife and Natural Habitats, Strasbourg, 26-29 November 2007. Council of Europe
- Institute for Environment and Sustainability (2006). Marine and coastal dimensions of climate change in Europe: a report to the European Water Directors. IFES report to the European Commission Directorate General Joint Research Centre. EUR 2254 EN.
- Institute of Ecology and Environmental Management (2007) Position Statement – Climate Change. <http://www.ieem.net/IEEM%20-%20Climate%20Change%20Position%20Statement.pdf>
- Intergovernmental Panel on Climate Change (2007) Climate Change 2007 – Impacts, adaptation and vulnerability, contribution of Working Group II to the Fourth Assessment Report of the IPCC. Cambridge University Press
- IUCN-The World Conservation Union (2004) Global action for nature in a changing climate. Conclusions of a meeting of IUCN’s Climate Change Adaptation Working Group convened by Conservation International, English Nature, IUCN, The Nature Conservancy, RSPB, Woodland Trust, WWF.
- Joint Nature Conservation Committee (2003) A policy for conservation translocations of species in Britain. Drafted by I.F.G. McLean, JNCC on behalf of the Inter-agency Translocations Working Group
- LeRoy Poff, N., Brinson, M.M. & Day, J.W., Jr (2002) Aquatic ecosystems and global climate change: potential impacts on inland freshwater and coastal wetland ecosystems in the United States. Pew Center on Global Climate Change
- Midgley, G.F., Hannah, L., Millar, D., Rutherford, M.C., & Powrie, L.W. (2002) Assessing the vulnerability of species richness to anthropogenic climate change in a biodiversity hotspot. *Global Ecology & Biogeography* 11, 445–451

## Bibliography and acknowledgements

Mitchell, R.J.; Morecroft, M.D.; Acreman, M.; Crick, H.Q.P.; Frost, M.; Harley, M.; Maclean, I.M.D.; Mountford, O.; Piper, J.; Pontier, H.; Rehfisch, M.M.; Ross, L.C.; Smithers, R.J.; Stott, A.; Walmsley, C.A.; Watts, O.; Wilson, E. (2007) England biodiversity strategy – towards adaptation to climate change. Final report to Defra for contract CRO327

Natural England (2007) Draft Climate Change Policy

Nicholls, R.J. & Klein, R.J.T. Adaptation frameworks for sea-level rise impacts. <http://www.survas.mdx.ac.uk/content.htm>

Nicholls, R.J., P.P. Wong, V.R. Burkett, J.O. Codignotto, J.E. Hay, R.F. McLean, S. Ragoonaden & C.D. Woodroffe (2007): Coastal systems and low-lying areas. In: Intergovernmental Panel on Climate Change (2007) Climate Change 2007 – Impacts, adaptation and vulnerability, contribution of Working Group II to the Fourth Assessment Report of the IPCC. Cambridge University Press pp 315-356.

RSPB (2007) Climate change: wildlife and adaptation; 20 tough questions, 20 rough answers

Shaw, R., Colley, M. & Connell, R. (2007) Climate change adaptation by design: a guide for sustainable communities. Town & Country Planning Association, London

Spittlehouse, D.L. & Stewart, R.B. (2003) Adaptation to climate change in forest management. *Journal of Ecosystems and Management*. <http://www.forrex.org/jem/2003/vol4/no1/art1.pdf>

Stern, N. (2006) The economics of climate change. The Stern review. Cabinet Office - HM Treasury

UK Biodiversity Partnership (2007) Conserving biodiversity – the UK approach. Defra

United Nations General Assembly (1992) Report of the United Nations Conference on Environment and Development: Annex I, Rio Declaration On Environment And Development (Principle 15). Rio de Janeiro, 3-14 June 1992

Usher, M.B. (2005) Conserving European biodiversity in the context of climate change. Committee for the activities of the Council of Europe in the field of biological and landscape diversity. Council of Europe

Walmsley, C.A. & Harley, M. (2007) Conclusions and the implications for policy and practice. In: Walmsley, C.A.; Smithers, R.J.; Berry, P.M.; Harley, M.; Stevenson, M.J.; Catchpole, R. (Eds.) MONARCH – Modelling Natural Resource Responses to Climate Change – a synthesis for biodiversity conservation. UK Climate Impacts Programme

Watts, O. (pers. comm. 2007) Draft adaptation principles. RSPB

Web-based guidance on the integration of biodiversity considerations within climate change adaptation planning - <http://adaptation.cbd.int>

Woodland Trust (2005) Position statement: climate change

Woodland Trust (2004) Landscape-scale principles

WWF, English Nature, RSPB & IUCN (2003) Climate change and nature: adapting for the future.

### Acknowledgements

Thanks are extended to all those individuals and organisations from across the UK and elsewhere who provided information and ideas on which this document is based. The authors are grateful for comments received on draft versions of this paper from members of: the England Biodiversity Strategy Climate Change Adaptation Strategy Implementation Group (SIG), particularly Andrew Stott and Elaine Kendall; the UK Inter-Agency Climate Change Forum; the Woodlands & Forestry SIG and the Water & Wetlands SIG who attended a workshop to trial the principles; and the England Biodiversity Group.

Published by the Department for Environment, Food and Rural Affairs.  
© Crown Copyright 2008.

Printed on material that contains a minimum of 100% recycled fibre  
for uncoated paper and 75% recycled fibre for coated paper.

Nobel House, 17 Smith Square  
London SW1P 3JR

[www.defra.gov.uk](http://www.defra.gov.uk)

PB13168 December 2008