Natural England Board

Meeting: 10
Date: 30 April 2008

Paper No: **NEB PU10 09**

Title: **Natural England's Draft Policy on the impacts of Climate Change on Biodiversity**

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1. Purpose

1.1. The purpose of this paper is to present the Board with a draft policy on the impacts of climate change on biodiversity.

2. Recommendations

2.1. It is recommended that the Board consider and agree the draft policy and, subject to any amendments proposed by the Board, that the final policy is signed off by the Chair.

3. Context

3.1. Natural England seeks to conserve biodiversity for its intrinsic value, because it enriches our lives, and for the services healthy ecosystems provide. The impact of climate change on biodiversity is now well evidenced[1] and includes changes to timing of seasonal events, species distributions, species abundance, rates of growth and, possibly, rates of decomposition. Recent analyses suggest that by 2050 up to 37% of terrestrial plants and animals worldwide could be 'committed to extinction' due to climate change[2].

3.2 In England, habitat loss has already occurred in coastal areas due to sea level rise[3] and there are likely to be adverse impacts on habitats as a result of changed rainfall patterns and increased extreme weather events[4] that are not yet quantified. We also, however, expect gains for biodiversity as many English species are at the northern end of their range, and these may increase in abundance and extend their range as our climate warms.

3.3 A high level of uncertainty surrounds the impacts of climate change on biodiversity. This must not be used as an excuse for inaction. We need to base our policies and actions on best available evidence, but review regularly their effectiveness and amend them as necessary. In particular, we have little

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[1] Hopkins *et al* . 2007 Conserving biodiversity in a changing climate : guidance on building capacity to adapt. Defra, London.
[2] Thomas *et al*. (2004) Extinction risk from climate change. *Nature* 427, 145–148
[3] Royal Haskoning 2006 Coastal squeeze, saltmarsh loss and Special Protection Areas. English Nature Research Reports Number 710. English Nature, Peterborough.
[4] Hulme M. *et al.* 2002 *Climate Change Scenarios for the United Kingdom: The UKCIP02 Scientific report.* Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich

evidence about how socio-economic impacts of climate change, such as changed farming patterns and water utilisation, will impact upon biodiversity.

3.4 Natural England is Defra's lead delivery agent for the England Biodiversity Strategy and we are currently developing and consulting on a new delivery framework for the Strategy and UK Biodiversity Action Plan which seeks to embed an ecosystem approach. Through our Character Area Climate Change Major Project we are identifying practical actions that will deliver adaptation.

3.5 We will need to develop this policy in context of Natural England's Forthcoming draft policy on ecosystem services [5] and our ongoing collaborative work on Defra's Ecosystem Approach Project .

3.6 The Board has approved a Climate Change and Energy Policy, which has subsequently been signed off by Chair. Given the importance and detail of this policy it has been disaggregated into two separate policies, one entitled climate change and the other entitled sustainable energy. As these policies will have a key role in supporting many aspects of our advocacy they will be available as pamphlets at the meeting.

4. Summary of Natural England's Draft Policy on impacts of Climate Change on Biodiversity

4.1 Conservation of protected areas and other high quality habitats is important now and in the future. We will continue to conserve and enhance these sites, although we will accommodate changes where this is a natural response to climate change and seek to offset any losses through habitat creation.

4.2 Management objectives of protected areas in particular, and conservation actions in general, should take full account of climate change adaptation and mitigation requirements.

4.3 Identification of new protected areas should take account of the need to adapt to climate change.

4.4 The range and ecological variability of habitats and species should be maintained as an insurance against uncertainty, except where there is clear evidence this is inappropriate due to climate change.

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

4.6 Landscape diversity should be maintained and, where possible, enhanced to conserve biodiversity in the face of climate change.

4.7 We should promote the use of approaches that work with natural processes.

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[5] The 'ecosystem approach' is the umbrella term for the science that (re)considers scale, holistic delivery, socio economic integration, and economic valuation. It is an intellectual framework that is long on science and short on delivery. 'Ecosystem services' focus on the delivery of benefits to society. 'Ecosystem conservation' focuses on delivering species and habitat conservation through functioning ecosystems.

4.8 Ecological connectivity should be improved through promoting and enhancing ecological networks.

4.9 Biodiversity delivers important ecosystem services that should be properly valued and taken into account in the policies and decisions of all sectors of society.

Annex 1

Natural England's Draft Policy on impacts of Climate Change on Biodiversity

Our Policy Aim

We propose that our policy aims are to (i) ensure that the actions we take and the advice we give will conserve and enhance England's biodiversity in a changing climate; and (ii) place biodiversity conservation at the heart of the climate change adaptation and mitigation strategies and responses of others.

Rationale for a policy on biodiversity and climate change

Natural England's involvement in biodiversity and climate change is a direct consequence of our core purpose[6] and our position as Defra's lead delivery agent for the England Biodiversity Strategy. We seek to conserve biodiversity for its intrinsic value, because it enriches our lives, and for the services healthy ecosystems provide. It is our role to provide strong leadership and drive the delivery of biodiversity outcomes. In doing so, we must ensure that our actions, and wherever possible those of our partners, are resilient to climate change.

The impact of climate change on biodiversity is now well evidenced[7] and includes changes to timing of seasonal events, species distributions, species abundance, rates of growth and, possibly, rates of decomposition. Recent analyses suggest that by 2050 up to 37% of terrestrial plants and animals worldwide could be 'committed to extinction' due to climate change[8].

In England, habitat loss has already occurred in coastal areas due to sea level rise[9] and there are likely to be adverse impacts on habitats as a result of changed rainfall patterns and increased extreme weather events[10] that are not yet quantified. We also, however, expect gains for biodiversity as many English species are at the northern end of their range, and these may increase in abundance and extend their range as our climate warms.

What needs to happen

We propose nine draft policies that together promote approaches to the conservation and enhancement of terrestrial, freshwater and marine biodiversity that are resilient to the uncertainties of climate change. Although climate change poses a serious threat to England's habitats and species, their conservation can also provide climate change solutions. Consequently, our proposed draft policies advocate a proactive approach to maximise the opportunities for conserving and enhancing biodiversity that arise from climate change adaptation and mitigation strategies.

We will need to develop this policy in context of Natural England's Forthcoming draft policy on ecosystem services and our ongoing collaborative work on Defra's Ecosystem Approach Project .

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[6] "*to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development"* (NERC Act 2006).
[7] Hopkins *et al* . 2007 Conserving biodiversity in a changing climate : guidance on building capacity to adapt. Defra, London.
[8] Thomas *et al*. (2004) Extinction risk from climate change. *Nature* 427, 145–148
[9] Royal Haskoning 2006 Coastal squeeze, saltmarsh loss and Special Protection Areas. English Nature Research Reports Number 710. English Nature, Peterborough.
[10] Hulme M. *et al.* 2002 *Climate Change Scenarios for the United Kingdom: The UKCIP02 Scientific report.* Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich

1. Protected areas and other high quality wildlife habitats

Protected areas are the cornerstone of current biodiversity conservation and are a key adaptation resource, together with other high quality wildlife habitats, such as priority Biodiversity Action Plan habitats. These sites and habitats will inevitably change in ecological character but they are expected to retain greater biodiversity than the rest of our countryside, coast and sea.

Evidence

- High quality wildlife sites have a suite of features, such as low fertility soil, distinctive hydrology and habitat heterogeneity which make them inherently biodiverse even under changed climatic conditions[11].

- There is already some evidence that protected areas are disproportionately important as receptor sites for bird species naturally colonising the UK from continental Europe[12].

- The largest and most healthy populations of many species occur in high quality wildlife habitats and protected areas, making them the most important source of individuals and propagules necessary for species to disperse in response to climate change[13].

- In the long term these sites are also the places most likely to shelter relict populations of species in climate-induced decline[14].

Proposed policy 1

Natural England believes that the conservation of protected areas and other high quality habitats is important now and in the future. We will continue to conserve and enhance these sites, although we will accommodate changes where this is a natural response to climate change and seek to offset any losses through habitat creation.

2. Conservation management

Our approach to conservation management of protected areas and other high quality wildlife habitats has been developed over several decades, and is usually based on setting clear objectives for habitats and species. As our climate changes these conservation objectives will need to be re-assessed as we move away from management largely focussed on selected species and habitats, towards much greater emphasis on the underlying ecological processes that are essential to the maintenance of biodiversity on sites

A range of conservation management practices may need to be introduced or modified to respond to the physical effects of climate change. Increased summer

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[11] See for example: Begon M., Townsend C.A. & Harper J. L. 2005 *Ecology: From Individuals to Ecosystems*. Blackwell, Oxford; Grime P. Hodgson J.G. & Hunt R. 2007 *Comparative Plant Ecology*.
[12] RSPB 2007 Climate change and wildlife in the UK. RSPB, Sandy
[13] Holyoak M. *et al.* 2005 *Metacommunities; Spatial Dynamics and Ecological Communities*. Chicago University Press, Chicago.
[14] Thomas *et al.* (In preparation). Climate Change Adaptation Strategies for Biodiversity. Natural England Commissioned Research Report.

drought will increase fire risk, whilst grazing during more frequent summer droughts may be prevented by lack of drinking water for livestock and die back of vegetation.

We also need to adjust our management of peatlands, inter-tidal habitats, woods and other habitats to take opportunities to mitigate against climate change through carbon sequestration and reductions of other greenhouse gas emissions.

Evidence

- Evidence that the biodiversity of our sites and habitats will change has already been discussed above.

- The incidence of wildfire is greatest in the dry summer months of the year in the UK and is expected to increase[15].

- The drought of 2003 resulted in a 30 % reduction of plant production across Europe in 2003 and the incidence of summer drought is expected to increase in England, particularly in the South- East[16].

- The growing season in the UK has lengthened by up to 30 days since 1990 and future increases are projected[17].

Proposed policy 2

Natural England believes that management objectives of protected areas in particular, and conservation actions in general, should take full account of climate change adaptation and mitigation requirements.

3. New protected areas

Under Section 28 of the Wildlife and Countryside Act 1981, Natural England has the power to notify as protected areas those sites of special interest by reason of their flora, fauna, geological or physiographical features. The current SSSI selection guidelines[18] allow for the inclusion of land that can be expected to develop special interest as a result of predictable natural change, such as coastal processes, sea level rise or vegetation succession. The position regarding the inclusion of areas that will require direct intervention to develop special interest is less clear. In developing a future strategy for designations, Natural England will need to consider whether designation processes and/or legislation needs to change to better take account of climate change adaptation.

Climate change will have a major impact on the marine environment, and marine protected areas will play a critical role in enabling adaptation of marine biodiversity. Climate change will need to be taken into account when planning the location, scale and design of these marine protected areas.

Evidence

[15] Department of Communities and Local Government 2006 *Effects of Climate Change on Fire and Rescue Services in the UK.* Fire Research Technical Report 1/2006. DCLG, London
[16] Ciais Ph. *et al.* 2005 Europe wide reduction in primary productivity caused by heat and drought in 2003. Nature 437, 529-533; Hulme et al. 2002 ibid.
[17] UKCIP 2002 Headline messages. www.ukcip.org.uk/scenarios/ukcip02/ukcip02_head_message.asp accessed 14 March 2008.
[18] Nature Conservancy Council (1989) Guidelines for selection of biological SSSIs. Peterborough.

- SSSI boundaries may be drawn to include all land which holds the special interest features, and areas necessary to ensure their long-term sustainability. This has been applied to recent designations, such as Pakefield to Easton Bavents (Suffolk) where the SSSI includes sufficient land to accommodate the special interest over 50 years of predicted coastal erosion.

- Recent designations (e.g. the Humber Estuary) have taken a 'whole system' approach and included a mosaic of habitats that support a range of different species at varying spatial and temporal scales.

- Natural coastal processes have been a key feature of several recent designations, such as Dungeness, Romney Marsh and Rye Bay SSSIs.

- The evidence base for the distribution of marine habitats and species is poorly developed. Significant marine survey work and research is needed to improve our understanding of the marine environment and the likely impacts of climate change.

Proposed policy 3

Natural England believes that the identification of new protected areas should take account of the need to adapt to climate change

4. Conservation of range and ecological variability

It is currently impossible to predict precisely which localities will continue to have climatic conditions suitable for a given species or habitat. By conserving their current range and variability we will reduce the probability of all localities being lost. In some cases, however, climate induced losses of species and habitats at certain localities will become inevitable, and we will need to identify species populations and sites which are unsustainable in the medium to long term and where it consequently will not be appropriate to carry out intensive or highly artificial interventions.

<u>Evidence</u>

- There is currently a high degree of uncertainty in the models that predict the impacts of climate change on biodiversity[19].

- A high proportion of species occur in several habitats (e.g. Wood White and Marsh Fritillary butterflies[20]). These habitats are likely to respond differently to climate change, which in turn makes the overall response of species even harder to predict.

- It is even harder to predict how habitats will respond to climate change than it is for species. Field experiments in England and Germany indicate that ecological differences between examples of the same habitat result in significant variation in climate change response[21].

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[19] Botkin D.B. *et al.* 2007 Forecasting the effects of global warming on biodiversity. Bioscience 57, 227-236.
[20] Asher J. Warren M., Fox R., Harding P., Jeffcoate G. & Jeffcoate S. 2001 *The Millennium Atlas of Butterflies of Britain and Ireland.* Oxford University Press, Oxford.
[21] Grime J.P., Brown V.K., Thompson K. *et al.* (2000) The response of two contrasting limestone grasslands to simulated climate change. Science, 289, 762–765; Voigt W., Perner J. & Jones T. H. 2007 Using functional groups to investigate community response to environmental changes: two grassland case studies. Global Change Biology 13, 1710- 1721.

Proposed policy 4

Natural England believes that the range and ecological variability of habitats and species should be maintained as an insurance against uncertainty, except where there is clear evidence this is inappropriate due to climate change.

5. Other causes of biodiversity loss

Climate change is not yet the greatest cause of decline for many species and habitats. However, it will exacerbate many of the current causes of harm to biodiversity such as non-native invasive species and nutrient enrichment of soils and water. Unless these additional causes of harm continue to be addressed the effectiveness of climate change adaptation will be compromised.

Evidence

- There is extensive evidence of multiple drivers of biodiversity loss in England[22].

- For UK BAP priority habitats and species, the top drivers of decline are habitat loss (due to infrastructure development and agriculture), inadequate management, nutrient enrichment, and non-native species[23].

Proposed policy 5

Natural England believes that climate change is one of many threats to biodiversity and by reducing other sources of harm we will help natural systems maintain their biodiversity in the face of climate change.

6. Varied landscapes

Maintaining or enhancing diversity in the landscape in terms of features such as vegetation structure, slope, aspect and water regime will increase the chances that species whose current habitat becomes inhospitable will in future be able to spread into other habitats.

Evidence

- Studies of the European distribution of species reveal that many occupy cooler north-facing slopes in the south of their range, while in the northern parts of their range they occupy warmer south-facing slopes[24].

- A study of 329 animal species from 16 taxonomic groups that are at the northern edge of their range in the UK, have shown that they are generally moving onto higher ground with cooler climates. Similar uphill expansion of plant species has been recorded in the Alps[25].

- Remarkable differences in microclimate occur in nature, even at apparently small scales. For example, the summer day-time temperature range under plants of

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[22] Natural England (In preparation) State of the Natural Environment. Natural England, Sheffield.
[23] Defra (2006) The UK Biodiversity Action Plan: highlights of the 2005 reporting round. Defra, London.
[24] Perring F. 1960 Climatic gradients of chalk grassland. Journal of Ecology. 48, 415-442; Thomas J. A. *et al.* 1999 Intraspecific variation in habitat amongst ectothermic animals near their climatic limits and their centres of range. Functional Ecology 13(Suppl. 1) 55-64;
[25] Hickling, R. *et al.* 2006. The distributions of a wide range of taxonomic groups are expanding northwards. Global Change Biology 12, 450-455; Parolo 2007 – ref. to be provided.

Horseshoe Vetch which vary in height between 1cm and 10cm is 8˚C.[26] A response to microclimate variation has been shown in the Silver Spotted Skipper Butterfly which now breeds in longer cooler grasslands on more northerly slopes, due to recent warming[27].

Proposed policy 6

Natural England believes that landscape diversity should be maintained and, where possible, enhanced to conserve biodiversity in the face of climate change.

7. Rivers and coasts

Changing rainfall patterns will affect our rivers and make them susceptible to increased flood surges and periods of low flow. A range of options involving natural processes, as opposed to hard engineering, exists. This includes the restoration of more natural river courses and floodplains, flood storage in washlands managed for biodiversity objectives, and the restoration of wetlands and other habitats to ameliorate peak flow and low flow conditions.
Similarly, rising sea levels on the coast, coupled with a possible increase in the frequency of storm surges means that risk of coastal flooding is more likely. Coastal realignment offers the possibility of reducing flood risk at lower long term cost, whilst creating space for biodiversity and other societal benefits, although in places realignment could put internationally important freshwater habitats at risk.

<u>Evidence</u>

- A change toward heavier rainfall events and projected increases in drought and storm events is likely to result in increased incidence of both inland flooding and low flows in rivers[28].

- Sea levels are expected to rise between 26cm and 86cm in southeast England by 2080[29].

- Areas of saltmarsh have already been lost from 12 Special Protection Areas in Eastern England and the risk of major coastal flooding is widespread in England[30].

- In England, Europe and North America, ecological restoration of river systems is a rapidly developing management approach, including the restoration of floodplains and multi-functional washlands[31].

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[26] Thomas J A 1990 The conservation of Adonis Blue and Lulworth Skipper: Two sides of the same coin. In Hillier S. H. Walton D. W. H. and Wells D. A. (eds) *Calcareous Grasslands Ecology and Management*. Bluntisham Books, Huntingdon. pp.112-117.
[27] Davies Z. G. Wilson, R. J., Coles S. & Thomas C. D. 2006 Changing habitat associations of a thermally constrained species, the silver spotted skipper butterfly, in response to climate warming. Journal of Animal Ecology 75, 247-256.
[28] Hulme M, et al. 2002 *Climate Change Scenarios for the United Kingdom: The UKCIP02 Scientific report.* Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich ; Environment Agency- PRINCE Report.
[29] Hulme et al. 2002 ibid.
[30] ABP Marine Environmental 2003 The implications of a major coastal flood on nature conservation interests in England. English Nature Research Report Number 695. English Nature, Peterborough; Royal Haskoning 2006 Coastal squeeze, saltmarsh loss and Special Protection Areas. English Nature Research Reports Number 710. English Nature, Peterborough.
[31] Buijse A. D. *et al*. 2002 Restoration strategies for river floodplains along large lowland rivers in Europe. Freshwater Biology 47, 889-907; Morris J. *et al.* 2004 Integrated washland management for flood defence and biodiversity.

- 22 coastal realignment projects have been carried out in England and many of the design principles are now understood[32].

- Natural England, in partnership with RSPB, the Wildlife Trusts, English Heritage and the Environment Agency, is about to publish a 'Wetland Vision' for England which identifies opportunities for wetland creation.

Proposed policy 7

Natural England believes that we should promote the use of approaches that work with natural processes.

8. Functional Ecological Networks

Some species will need to move significant distances from their current locality if they are to survive as our climate changes. Although many species have already expanded their range in response to climate change the fragmented nature of the landscape is impeding this process and some species have been unable to spread. Enhancing biodiversity across whole landscapes by creating new habitat, restoring degraded habitat, or reducing the intensity of management of areas between existing habitat will increase connectivity and facilitate dispersal.

Evidence

- A study of 329 animal species at the northern edge of their range in Britain demonstrated that 54 have not extended their range northwards as expected from observed climate change due to constraints on dispersal from habitat fragmentation[33].

- More detailed studies of butterflies and dragonflies and damselflies suggest the species which are not dispersing are often rare, habitat specialists[34].

- There is an extensive literature upon the role of landscape connectivity in species dispersal and the design and implementation of ecological networks[35].

Proposed policy 8

Natural England believes that ecological connectivity should be improved through promoting and enhancing ecological networks.

9. Valuing ecosystem services

English Nature Research Report 598. English Nature, Peterborough; and Palmer M.A. *et al.* 2005 Standards for ecologically successful river restoration. Journal of Applied Ecology 42, 208-217.

[32] Dixon M *et al.* (submitted) Managed realignment in England: some lessons learned form Wallasea Island. Marine Engineering.

[33] Hickling R. 2006 ibid.

[34] Hickling et al. 2005 A northwards shift in range margins of British Odonata. Global Change Biology 11, 502-506; Menendez R. *et al.* 2007 Direct and indirect effects of climate and habitat factors on butterfly diversity. Ecology 88, 605-611.
Warren, M. S. *et al.* 2001 Rapid response of British butterflies to opposing forces of climate and habitat change. Nature 414, 65- 68.

[35] See for example- Crooks K.R. & Sanjayan M. 2006 *Connectivity Conservation*. Cambridge University Press, Cambridge; Hilty J.A. *et al.* 2006 *Corridor Ecology.* Island Press, Washington; and Jongman R. and Pungetti G. 2004 *Ecological Networks and Greenways: Concept, Design and Implementation.* Cambridge University Press, Cambridge.

The pressures on biodiversity and the scale of the adaptation challenge, particularly the need for working at landscape scales, means that even the combined efforts of Natural England and our conservation partners will not be enough to achieve all the actions required to adapt biodiversity to climate change.

Failing to view ecosystems as valuable economic assets is undermining efforts towards conserving biodiversity and achieving sustainable development because there are few incentives for investing in or protecting our natural environment.

Through working with other sectors, including business, planners, other public sector bodies, and land managers we will seek creative solutions, and recognition of the benefits to be derived from biodiversity conservation in the face of climate change.

Evidence

- The annual shortfall in funding to meet England's biodiversity action plan targets is estimated to be up to £265 million[36].

- New approaches to valuing biodiversity are available that incorporate direct, indirect and non-use values[37].

- Global carbon trading and the UK government's introduction of a 'shadow price for carbon' provide precedents and models for developing new fiscal instruments that could lead to a substantial increase in the resources available for biodiversity conservation.

Proposed policy 9

Natural England believes biodiversity delivers important ecosystem services that should be properly valued and taken into account in the policies and decisions of all sectors of society.

Summary

Natural England is charged with leading the delivery of the England Biodiversity Strategy and it is our responsibility to adopt and promote approaches to conserving biodiversity that are robust to climate change and make the most of the opportunities available. England's future diversity of habitats and species, will largely depend on our success in conserving the biodiversity that we have today and in achieving landscape-scale enhancements to enable adaptation.

[36] GHK Consulting ltd. (2006). UK Biodiversity Action Plans: Preparing costings for species and habitat action plans. Report to Defra. www.ukbap.org.uk/library/BRIG/TargetsReview06/PreparingCostingsForSAPsAndHAPs.pdf accessed 14 March 2008

[37] Defra (2007) Valuing the Benefits of Biodiversity. www.defra.gov.uk/wildlife-countryside/pdfs/biodiversity/econ-bene-biodiversity.pdf accessed 14 March 2008