

BRITISH ECOLOGICAL SOCIETY WORKSHOP

ESTABLISHING AN EVIDENCE-BASED FRAMEWORK FOR MANAGING BIODIVERSITY IN A PERIOD OF RAPID CLIMATE CHANGE

Institute of Biology, London. 28th June 2005

Ecological questions underpinning policy questions

Preamble

The following list of policy questions was assembled from submissions by policy representatives at the workshop, together with questions submitted to a UKPopNet workshop held at UEA in February 2005. Some questions have been listed together where they appear to be covering broadly the same policy issue. The underpinning ecology questions (in blue) were developed through the two days, first by initial suggestions from policy representatives, followed by a full day of discussion with science representatives.

The ecological questions are certainly not exhaustive and often only examples of a type of question are given. Some ecological questions relate to more than one policy question and often cut across the effectiveness/impact divide that was used. Some policy questions generated no ecological questions and are listed at the end under 'policy rationale'.

In a few cases the policy question is essentially the same as the ecological question and this is reflected in it being repeated. The categories used to subdivide the policy questions are not mutually exclusive and have resulted in significant overlap. At this stage we have left this in as they are the products of two different groups.

We have not attempted to distinguish between those ecological questions that might be susceptible to systematic review of existing evidence and those that might need to be addressed through original research. Our view is that this process needs to be undertaken by further interaction between science and policy groups.

Categories of Question

Policy effectiveness

1. Is European invasive species policy sufficient to cope with the predicted increased effects of invasive species in a period of climate change?
 - Is there any evidence of increased invasion rates in the UK?
 - What is the ecological impact of existing invasive species in the UK?

- Which species are predicted to increase their range / abundance / invasiveness in a period of altered climate?
 - Do invasive species provide opportunities for other species?
 - Does the UK act as a potential reservoir of invasive species elsewhere?
 - What are the definitions/characteristics of invasive species?
 - Are current measures sufficient to deal with increased sources of invasive species?
 - What are the pathways of invasion and what are methods of control; will they change under climate change scenarios?
 - Are there any invasive pathogens that are likely to become a bigger risk?
 - How can invasive species be managed – eradicate / control / limit range?
2. Which current land management practices are most vulnerable to climate change (i.e., will cease to be beneficial to biodiversity)? Are relevant agri-environment schemes effective at adapting to climate change? What changes should be made to future agri-environment schemes in order to help wildlife adapt to climate change?
- What is the understanding of spatial planning relevant to climate change?
 - What are the vulnerabilities of ecosystems? (A specific example was soil erosion)
 - What are the characteristics of robust and resilient habitats (and why)?
 - What management practice will increase the resilience of habitat X?
 - Do we know what climate change impacts are likely to be for UK BAP priority habitats?
 - What management already exists and how applicable will it be to climate change?
 - Are current agri-environment schemes effective at adapting to climate change?
 - Which habitats are most vulnerable to what effects in what parts of the country?
 - Do future predicted species ranges as a result of climate change overlap with current / future coverage of suitable management under future climate scenarios?
 - Are current agri-environment schemes / managements viable / beneficial to wildlife under different climate change scenarios?
3. How well suited is the current protected area system for conserving biodiversity in the face of climate change, and how can it be enhanced in light of this? How will the management of protected areas need to change to adapt to climate change?
- Do protected areas increase biodiversity?
 - What are the current management options for conserving biodiversity?
 - How robust are habitats and species to climate change? (Prioritize Corrine biotypes)
 - How will movement of species be impacted by climate change?

- Is there a need to revise protected site selection criteria?
 - Are populations at the edge of their range more vulnerable to climate change than those at the centre?
 - Will colonization offset loss of habitat?
 - What species / habitats / managements are robust to extreme climate events?
 - Is management for a species at the core of a range differentially effective at the edge of the range?
 - What management interventions facilitate species movements?
 - How do species responses vary along environmental gradients, specifically climate related gradients e.g. soil moisture, temperature?
4. Where are the robust case studies to demonstrate that habitat creation and management can help protect lives, property and business threatened by extreme climate changes events such as flash flooding, drought, gales, and heatwaves?
- Using case study examples, what is evidence that woodland cover prevents flooding (and that semi-natural woodland is better than monoculture)?
 - What is the impact of grip drainage in the Pennines on flooding?
 - How much of a catchment needs to be flooded or forested to prevent flooding elsewhere?
 - What is impact on biodiversity of landuse change in response to climate change?
 - What method of increasing permeability to reduce flooding has the best impact on biodiversity?
 - What are the regional variations in appropriate management to optimise ecosystem goods and services? ie. Something on regional variation in adaptation strategies.
5. Given that we need to reduce fragmentation of habitats to allow species to respond to climate change, how connected do habitats need to be for "connectivity" measures to be worthwhile? And which habitats are the most vulnerable to fragmentation?
- Do wildlife corridors work?
 - What defines ecological connectivity?
 - What is the minimum core environment required to negate edge effects?
 - How much does connectivity facilitate the movement of invasive species?
 - What ecological characteristics make a habitat or species resilient or vulnerable to fragmentation?
6. At what spatial scales is it most important to address habitat fragmentation?
- For a representative range of species and habitats, is local habitat fragmentation mitigation effective or does it need to be national?
 - For taxonomic group (a) in vegetation type (b) a distance of (c) m/km is a significant barrier in terms dispersal, population stability, meta-population stability, gene-flow under climate scenario (d)?

- How will climate change affect community composition / habitat distribution?
 - How will climate change affect species ecology – particularly dispersal / patch preferences etc?
 - How small is too small in relation to patch size and connectivity?
 - Which species are most susceptible to habitat degradation / fragmentation, as an indicator of future susceptibility to fragmentation and climate change interactions?
7. What resource (e.g. fisheries) management strategies are robust to non-stationary dynamics and climatic forcing?
- Which species are going to move under climate change?
 - Is the composition of habitats changing?
 - How will communities change through the accumulation and loss of species?
 - How will competitive relationships between species change?
 - This question has strong linkages with 2 & 3, with additional components relating to fish-size classes.
8. Is there an optimal coastal management retreat strategy, in terms of biodiversity and sustainable development?
- Which characteristic species or habitats may be lost if there is a managed retreat?
 - Can saltmarsh creation protect property?
 - Are there different ways of managing retreat and which have greatest biodiversity benefit?
 - Will habitat change on managed retreat be rapid enough to cope with rising sea levels?

Mitigation effectiveness

9. What measures (e.g. agri-environment) can policy-makers encourage to enhance the ability of ecosystems to withstand the impacts of climate change? How can we increase the resilience of habitats and species to cope with climate change? How can we use adaptation to offset negative and take advantage of positive impacts of climate change on biodiversity?

[Need to have inter-disciplinary work (eg plant, invertebrate and bird ecologists, hydrologists, land use policy specialists, etc) to consider how different adaptation (techniques and final outcomes sought) can be used. It needs to be inter-disciplinary as adaptations have positive and negative consequences for different species and a mechanism for assessing best fit for purpose would need to be developed.]

- How can mitigation and adaptation be used to maintain the products and the wildlife they support?

- Case study example: adaptive management for coastal retreat involves a range of options e.g. sea wall creation, abandonment, saltmarsh creation. Which of these options has maximum biodiversity benefit?
- What characteristics of a habitat make it resilient?

10. How will ecosystem functions, goods and services be affected by climate change and what impact will mitigation and adaptation measures have on these products? How can mitigation and adaptation be used to maintain the products and the wildlife they support?

[This needs to be examined not only for the nature conservation viewpoint but also other sectors which will undertake mitigation and adaptation or pursue sustainable development such as transport, energy, industry, foreign investment, land use policies etc.]

- What services does biodiversity deliver, and how will that be affected under a changing climate?
- What are the biodiversity consequences of mitigation and adaptation management?

11. How can policies be structured to meet with uncertainty, and be capable of adapting to change within reasonable timescales? How can policy responses retain flexibility?

[Policies need to be sufficiently flexible to allow for adaptation - because, the degree of climate change and the impacts that will occur are uncertain, and the ways in which species/ecosystems/habitats will be affected and will behave ie. adapt, are unpredictable, so policy needs to be flexible enough to cope with this uncertainty - and needs to be able to react reasonably quickly ie - can policy adopt the scientific concept of "adaptive management" and develop a similar adaptive management policy approach?]

- Does adaptive management work?
- How do we combine different policy responses?
- Over what timescales do species/ecosystems/habitats track their climate envelope? i.e. can species assemblages currently out with the UK colonise to realise their future climate space?

12. In the face of climate change what is the suggested/recommended future direction of agriculture that would be both economically viable for land owners but also be beneficial for changing biodiversity?

- Case study examples: What is impact of production of biofuel or source materials for bio diesel or specialist fats, dyes, aromatherapy, or wine on biodiversity?
- Is inter-cropping more sustainable than mono-cropping from an economic / agricultural perspective?
- Are perennial based systems of greater benefit than annual systems under future climate change scenarios?

13. Are translocation of species effective in adapting to climate change?
- What kind of species will successfully translocate?
 - How much habitat (or how many species) needs to go with the translocated species?
 - Does translocation affect survivability?
 - Where should they be translocated to, in order to preserve the species?
- Case study examples: Red kites have been translocated to Scotland successfully. Their English sites might not be suitable under climate change. E.g.2. Natterjack toads have a disjunct and dynamic distribution.

Impact Prediction

Direct impacts

14. What time lags can be expected between climate change and ecological change?
- What time lags can be expected between climate change and ecological change?
15. Using an analysis of species and habitats most at risk from climate change, what are the likely trends to these habitats and species and what monitoring and surveillance could be used to assess the changes, taking into account potential unknown outcomes and reactions? What is the likely relationship between the extent of climate change and the pattern of species extinction? Which habitats and species might we lose completely because of climate change? Which species that are currently “at risk” are most vulnerable to climate/weather impacts?
- How is climate change expected to change the range and abundance of specific taxa in marine, terrestrial, freshwater environments? e.g. Birds, butterflies, plants, moths, marine inverts, salmonids, freshwater inverts, marine plankton, dragonflies, grasshoppers and bush crickets, beetles.
 - What species and habitats are likely to put at high risk of local or national extinction driven by climate change?
16. What are the effects of predicted climate change on marine populations, species and habitats, in terms of their distribution, production and standing biomass?
17. How will acidification of surface water from rising CO₂ concentrations affect planktonic productivity and other marine organisms?
- How will acidification of surface water from rising CO₂ concentrations affect planktonic productivity and other marine organisms?
18. Which species are expected to move into the UK as a result of climate change and what impacts will they have?
- Which species are expected to move into the UK as a result of climate change and what impacts will they have?

19. What case studies exist to show the impact of forest cover or lack of forest cover on hydrological systems which are likely to be susceptible to changing climate regimes?

Socio-economic impacts

20. How will predicted climate change impact upon the interactions among different natural resource use sectors, e.g. watershed management and equity between agriculture, forestry and riverine systems, and what are the net consequences for biodiversity?
- What is the minimum acceptable water flow that needs to be put in place for the existing ecosystem function?
21. What will be the ecological impacts of changing agricultural patterns in response to climate change? What will the future impacts on biodiversity be of the production of various renewable energy sources? Will this production be sustainable from a biodiversity point of view? How can we better integrate our understanding of the ecological effects of climate change on decisions over spatial planning and transport?
- How will potential land use change in the UK impact on the distribution of habitats and species? e.g. renewable energy sources, flood storage, water retention, changing cropping and grazing management, forestry, spatial planning, tourism
 - What are the potential future crops? What is the biodiversity value of these crops where they are currently grown?
 - What are the environmental consequences of carbon sequestration for marine and terrestrial ecosystems?
22. What are ecological, economic and social consequences of changing synchrony between species as shown by UKPN?
23. As a philosophical framework for biodiversity conservation evolves in the UK to become in line with that of other EU member states, what are the implications of climate change for the services that biodiversity/ecosystems provide to humankind?

Interactions

24. There are various types of impact of climate change on wildlife, ranging from species distribution change; direct impacts of climate change on species; phenological issues; impacts from community changes (including changes in competitive relations); invasions and diseases; and land use change. How do these rank in terms of scale of adverse impact on UK biodiversity

- How do the various impacts of climate change on wildlife rank in terms of scale of impacts on UK biodiversity?
25. Which multi-trophic system will be the first to desynchronise?
 26. How robust are the currently-used options for managing vulnerable communities/species in the face of predicted levels of climate change?
 - In the face of predicted levels of climate change how robust are options that are currently used to manage vulnerable communities/species?
 27. How does climate change interact with other ecological pressures (e.g. invasive species, habitat fragmentation) to create synergistic effects?
 - How are invasive species affecting ecosystem they have already arrived in?

Policy rationale

28. Does rapid climate change require a focus on biodiversity and landscape scale protection rather than a site protection approach?
29. What aspects (old, new, species, communities) of biodiversity are most valued and how are they valued by society?
30. The Sustainability Development Strategy refers to “environmental limits” and carbon emissions are often quoted. What are the ecological/environmental limits in the UK that should be set?
31. How do we allocate finite (water) resources between ecosystems and society under climate change?
32. How do we define good ecological status (GES) under climate change?
33. How can the climate change adaptation policies of other agencies/sectors be changed to incorporate conservation goals?
34. How should the way we assess the value of land/soil be amended to incorporate an assessment of its sensitivity/vulnerability to climate change?