Submission of formal evidence from the RSPB to the Royal Commission on Environmental Pollution for their study on adapting the UK to climate change.

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Summary of key points:

1. Climate change is the greatest long-term threat to global biodiversity and a potential catastrophe for millions of people. Whilst some climate change is inevitable, temperature rises greater than 2 degrees above pre-industrial levels risk irreversible impacts, which are likely to stretch human society and ecosystems well beyond their adaptive capacity. These include the extinction of millions of species and the collapse systems as diverse as the Arctic and the world’s coral reefs. We must therefore mitigate climate change, whilst preparing to adapt to its impacts.

2. Without urgent action to help them adapt to even modest levels of climate change, many millions forms of non-human life will become the victims of human-induced climate change. Evidence from the fossil and pollen records shows that previous episodes of climate change resulted in mass extinctions. Today’s changes are also taking place against a background of other human impacts on the environment, which are placing an intolerable strain on biodiversity. There is a clear moral imperative to protect wildlife from the affects of human actions, which are altering the global climate.

3. The natural world is already degraded and the UK Government has an obligation to halt biodiversity loss by 2010. Progress has been made but statistics still suggest we have much more work to do. Species are still being lost; for example, the St Helena Olive, *Nesiota elliptica*, became globally extinct in 2003. Species declines continue, e.g. 331 species were listed on the UK priority list, as a result of severe declines in their populations. Two birds found on UK Overseas Territories, the Gough bunting and the Tristan Albatross, are now considered ‘critically endangered’. Priority habitats and protected sites are impoverished: e.g. 54% of English and 68% of Welsh SSSIs remain in ‘unfavourable’ condition and 38% of UK priority habitats are declining.
4. In this context, the RSPB strongly believes, that we should renew our commitment to halt and reverse declines in global biodiversity in the face of climate change, and redouble our practical efforts to do so. This means that whilst we understand and accept that species’ movement and habitat disruption are inevitable, we must manage these changes to prevent extinctions and protect populations on global scale. In the context of the UK, this will require us to understand our role in conserving those species which are currently present in the UK, but also those which might arrive as a result of responses to a changing climate.

5. Human beings have only recently begun to understand the value of the services provided to them by ecosystems, including carbon storage, flood risk management, water purification and many others. Protecting ecosystems from the impacts of climate change, and helping them adapt, is essential to secure these services, and is essential, in turn to enable human beings to adapt cost-effectively to a changing climate.

6. Successful adaptation for the natural environment will depend on two concurrent approaches. Firstly, direct action must be taken to enable biodiversity to survive climate change, both building resilience and accommodating change. Secondly, adaptation in other sectors must not result in collateral damage to the natural environment. All adaptation must be sustainable adaptation, built on the principles of sustainable development.

7. There is a need for further research to understand the likely impacts of climate change on wildlife and ecosystems, in particular, to understand what sort of landscapes facilitate the successful colonisation of new, suitable climate space by species as their preferred range shifts over time. However, we already enough about the likely impacts of climate change to take some positive action to help wildlife adapt. This includes action to address existing threats to biodiversity; to extend and buffer areas of semi-natural habitat; and to make the countryside more wildlife-friendly.

8. Existing pressures on the natural environment will make it harder for species to respond to climate change successfully. We must redouble our efforts to address habitat destruction and degradation, to reduce pollution, ease water stress and prevent persecution. We must also maintain protected areas in good condition, whilst recognising that over time their management objectives may need to be adapted to reflect changes in species distributions and habitat assemblages.

9. More land for nature conservation is essential to help wildlife adapt to climate change. We will need to extend and buffer the areas of semi-natural habitat, which already exist and create new areas of habitat in places of strategic importance to wildlife. This will ensure that suitable habitat is available within the new ranges of species’ on the move. It will also provide heterogeneity of conditions within sites, making it more likely that at least some areas will be micro-climatically suitable for species under threat from climate change.
10. **The wider landscape must become less hostile and more permeable to biodiversity.** More research is needed to understand exactly how different taxon groups and different species within them move around the landscape and locate and colonise new territory. However, it is likely that the provision on habitat features which provide food, shelter and water in the landscape are likely to assist in making the environment more, rather than less, permeable to wildlife. Such features include hedges, ditches, small ponds, areas of farm or urban woodland, winter food sources in field margins, and other elements which can be delivered at relatively low-cost in large numbers and on a wide scale.

11. **We will not be able to predict the exact response of every species in every site to the impacts of climate change,** and will need to learn to monitor change more closely and to adapt our management practices over time to reflect new realities. Such adaptation should, however, be set against the overall goal of preserving and enhancing biodiversity within an appropriate geographical scale.

12. **All sectors of our economy will need to adapt to climate change to secure a safe, healthy society in future.** Successful adaptation should be based on sustainable development principles, and hence ensure an equitable distribution of scarce resources and embody respect for environmental limits. Such an approach will encompass the needs of biodiversity and protect essential ecosystem services. Major changes are likely in all sectors that affect or depend on land-use, in particular, agriculture, forestry, water management and planning. These could be positive or negative for the natural environment. The Government must take the lead in developing land use policies for the future, which enable sustainable adaptation.

13. **Sustainable adaptation will require appropriate institutional arrangements and governance.** These should enable integration of different sectoral plans at the UK, national and regional level. In doing so, they should provide opportunities to identify co-benefits and to resolve potential conflicts. Resources must be provided specifically to promote actions which deliver co-benefits, and which are not being delivered through existing sectoral or cross-sectoral programmes of action. Large-scale habitat creation and restoration to help biodiversity adapt to climate change and deliver ecosystem services is one area requiring immediate attention.

**Introduction**

The Royal Society for the Protection of Birds (the RSPB) is the charity that takes action for wild birds and the environment. We are the largest wildlife conservation organisation in Europe with over one million members. We own or manage 140,444 hectares of land for nature conservation on 203 reserves throughout the UK.

The RSPB has a powerful presence across the UK, running nature reserves and people-focused projects in many places. Our professional staff engage in planning and wider development policy, strategy and delivery, at the international, UK, devolved administration, regional and national levels.
The RSPB are responding to this consultation as champions of the natural environment and of biodiversity in particular. Climate change is already affecting wildlife and is anticipated to have dramatic impacts in the future. Without our intervention, climate change is likely to lead to substantial extinctions. As current climate change is a human-induced problem, we have a moral duty to intervene to facilitate the adaptation of the natural environment and prevent these extinctions. In the UK, nature conservation has been trying to reverse historical human-induced losses of important habitats and species for decades by tackling the factors that threaten the natural environment. Climate change adds a new sense of urgency to achieve these goals, as set out in our response below.

Assisting in the natural environment’s adaptation to climate change is not only a moral duty; it is central to the success of our own adaptation and essential for our quality of life. The natural environment provides us with many ecosystem services from clean air to healthy soils and clean water, which are now at risk from our changing climate. Our understanding of the ecological mechanisms that provide these services is far from complete, and it is therefore difficult to predict the impact that a changing climate is likely to have. Given the importance and scale of the ecosystem services provided, it is therefore essential that we adopt a precautionary approach and protect ecosystems to the best of our ability.

**Adaptation – General Questions**

**Definitions and terminology**

Q1) The RCEP needs to have a clear view of the terms it should use for the study – is the IPCC1 view of adaptation adequate (see below)? Are there alternative views of adaptation to climate change that the RCEP should be considering?

(The IPCC definition is “Adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” – for a fuller definition, including anticipatory, autonomous and planned adaptation, see Annex B).

The RSPB is concerned that this definition presumes that all adaptation is beneficial. Some proposed adaptation responses might reduce harm for people, but increase harm to the natural environment, as set out below. The definition used by the RCEP should therefore recognise the possibility of maladaptive responses.

**Range of climate change**

Q2) There are several important factors when discussing climate change, which the RCEP needs to understand for this study:

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1 IPCC: Intergovernmental Panel on Climate Change
a) Over what time period should climate change be considered for the RCEP study – 2020, 2050, 2100, or some other time period?

The RSPB believes it is important that the study consider our planning for adaptation to climate change over all of these time periods. However, it is also important to consider adaptation responses under a variety of temperature scenarios (e.g. under 2°C, 4°C and 6°C), as these will define the impacts we encounter. The speed with which we encounter different temperature scenarios, and therefore impacts, depend on the efforts made in mitigating future climate change.

If the study must be limited to just one time period, we would recommend this be to 2050. Significant climate change will have occurred by 2050, and it is essential we are able to understand the adaptation required. Beyond 2050, predictions of further climatic change are significantly less certain, with substantial variation between different scenarios.

b) What are the magnitude, rate and kinds of climate change impacts in the UK that the RCEP study should be considering?

The RSPB recommend that the RCEP use the forthcoming UKCIP08 work, the previous UKCIP02 work, and the Fourth IPCC Assessment Reports as the basis for the magnitude, rate and kinds of climate change impacts for this study. We recommend that we plan our adaptation for all stages up to a 4°C rise in temperature, but that our mitigation efforts should continue to aim for a no more than a 2°C rise in temperature. The RCEP should also plan adaptation for the worst projected rates in temperature rise and other climate impacts, taking account of the interim stages.

The RSPB also recommend that the RCEP explicitly consider the impacts of climate change on the natural environment, such as outlined below.

Evidence of change already happening in the UK.
Climate change is already affecting UK biodiversity. In an analysis of 1600 northern hemisphere species, from a range of taxa, it was found that ranges had changed on average 6.1km northward and 6.1m upward².

Changes are becoming very clear among insects in the UK. First observed in the UK as recently as 1999, the small red-eyed damselfly is now breeding throughout much of East Anglia and southeast England. The southern oak bush cricket (Meconema meridionale) was first seen in Surrey in 2001 and has since become established in parts of Surrey and Middlesex.

The climate also influences the migratory behaviour of birds. Milder winters are already enabling wading birds and wildfowl to winter more on the east coast of the UK, reducing dependence on the milder west coast and saving birds the travel costs

of getting there. This might eventually affect the population size as well as the distribution of these species.

Warmer spring weather in recent decades has caused advancement in the timing of spring events, such as egg laying or invertebrate emergence. For example, earlier egg laying threatens bird populations if the emergence of vital invertebrate prey is not in synchrony.

Models of future bird distributions
With collaborators from Durham University, RSPB recently conducted an analysis to predict the potential change in distribution of all European breeding bird species by the end of the 21st century, by showing where suitable climate conditions (climate space) are likely to be present. Similar projects, (eg ‘Monarch’), have produced similar results. In brief, it was found that:

- The centre of the potential range of the average species is predicted to shift nearly 550km north-east and is only 4/5 the size of the current range.
- For some species, the potential future range does not overlap with the current range at all. The average overlap is 40%.
- Projected changes for some species found only in Europe, or with only small populations elsewhere, suggest that climate change is likely to increase their risk of extinction.

Such models assume that species will be able to respond at the rates required. In reality, however, poor dispersal ability may limit the potential of species to occupy future suitable range. Predictions of the future will therefore always be subject to a degree of uncertainty. Confidence in predictions from climate envelope models has been bolstered by recent work that shows that such models are able to successfully model species’ recent population trends.

Awareness of adaptation to climate change
Q3) The Royal Commission is interested in understanding the general level of awareness about adapting to climate change. How would you describe:

a) The level of awareness that either you or your organisation has about the need to adapt to climate change?

The RSPB is increasingly aware of the impacts of climate change on wildlife and on its own conservation business. The natural world is already adapting to a changing climate, and will need to do so even more in the future. Biodiversity is unlikely to adapt successfully to the increasing impact of climate change without human intervention. The RSPB recognises this and has produced the ‘Climate Change, Wildlife and Adaptation: 20 Tough Questions, 20 Rough Answers’ report, identifying some of the key questions around wildlife’s adaptation to climate change, and using its own expertise to answer these. The report aimed to increase awareness and promote discussion about the adaptation needs of biodiversity and nature conservation, both within and outside the organisation, and develop from this a unified approach to biodiversity conservation across all relevant organisations and interests.

There is still a need for better dissemination of information about impacts, and a more rigorous and concerted programme of action across the organisation. As a large organisation, adaptation actions will take many forms, from large scale land investments for both managed realignment of the coast (e.g. Freiston Shore, Lincolnshire) and replacement habitat for coastal freshwater habitat at risk from saline flooding (e.g. reedbed creation at Lakenheath, Suffolk), to a range of management planning, policy and science activities.

We are working to put this programme into place. Our planning for adaptation activities include:

- Reviewing nature reserve management to ensure that by 2015, site management is working towards optimising biodiversity for the 2050s.
- Developing climate risk assessments and compensatory actions in species management planning.
- Assessing reserve objectives and the risks to these from climate change as part of the standard five year planning cycle and developing measures to manage these risks at a site level, and to increase resilience.
- Seeking to develop our landholding in line with climate change requirements, including more land both to increase the size of individual sites (to increase resilience, strengthen populations and accommodate new species) and to add more sites in strategically important areas (to provide replacement habitat and enhance the site network).
- Undertaking climate-related scientific studies for some species, e.g. golden plover and ring ouzel. Future work will investigate both the leading and trailing edges of shifting distribution.
- Refining monitoring and review, to determine at what point management objectives need to be revised to reflect observed changes.
- Seeking to understand the multiple contributions of our land holdings to climate change mitigation (e.g. through carbon sequestration and storage) and adaptation (e.g. through flood risk mitigation), alongside nature conservation.

The RSPB is also aware of the potential impact of adaptive action by other sectors on wildlife and nature conservation. We are therefore seeking to influence other
sectors to adapt in a sustainable way that takes into account the needs of wildlife. The RSPB believe that UK Government must play a key role to ensure the necessary cross-sectoral assessment of interactions between adaptation activities and development of plans for sustainable adaptation in all sectors (see response to question nine).

b) Your awareness of what could or should be done to enable the natural environment to adapt to climate change;

There is considerable consensus in the nature conservation sector on how activities can support the adaptation of the natural environment. The RSPB’s outline adaptation principles for biodiversity were published in 2007 and these are now well-accepted. These principles are similar to the guidance and principles on helping to conserve biodiversity in a changing climate produced by Defra (on behalf of the UK Biodiversity Partnership) and the England Biodiversity Strategy.

Overarching adaptation should be a twin track approach of increasing both resilience and accommodation. Resilience actions seek to make species, habitats and ecosystems more robust against the impacts of climate change, strengthening populations where they are today, to put species in a strong position to adapt to climate change. Accommodation actions seek to facilitate the inevitable movement of species, to track the shifting location of their required climatic conditions.

We have recommended the following actions to help biodiversity adapt:

- **Conserve existing biodiversity**
  The richness of future biodiversity, in a changing world, will depend upon the diversity we conserve today. Protected areas are continuously under threat from development. We must continue to resist pressure on protected areas and other sites of high biodiversity interest, and build resilience through site management and species conservation.

- **Reduce non-climate sources of harm to the natural environment**
  Climate change is one of many threats to biodiversity and by reducing other sources of harm we will help to build resilience in the face of climate change. This will require response from across a range of sectors, coordinated and lead by Government, as many of the threats to the natural environment are complex and interconnected.

- **Create or restore habitat to reduce fragmentation and accommodate future range shifts**
  Creating and restoring habitat is essential for the adaptation of biodiversity to climate change. However, it is difficult to achieve without appropriate incentives or resourcing, and the UK BAP which aims to deliver this is

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already underfunded by some £300 million annually. New resources and mechanisms for delivery are needed urgently.

- **Manage the wider landscape to make it less hostile to wildlife**
  Whilst our knowledge of how to achieve this is currently incomplete, there are many actions that are widely accepted to be beneficial and could be taken immediately. For example, sensitive management of hedgerows or growing buffer strips alongside crops, is already supported through agri-environment schemes. However, uptake of such schemes is not as widespread as hoped, and resources need to be provided in order to redress this.

- **Continue to research the impacts of climate change and the response of wildlife.**
  There is an urgent need for more research to understand what is required by species for their adaptation, and how necessary changes can be implemented. A greater understanding is required about the actual impacts of climate change on species, on dispersal abilities of many species, and about how can we improve ecological connectivity on the ground to make it easier for less mobile taxa to adapt to climate change.

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**Case study: Helping bitterns adapt to climate change**

An example of the RSPB’s approach to adaptation is its work toward the future conservation of bitterns, published jointly with Natural England. Much of the UK bittern population is focussed on reedbeds at threat from sea level rise in East Anglia. Detailed research identified one site as the source of almost all surplus population, and hence the powerhouse of bittern expansion. Scientific research has provided the detailed knowledge required for the extent and location of reedbed creation necessary to sustain the fragile bittern population, and given a time frame for maintaining sea defence at the core breeding site. A booming bird appeared at Lakenheath Fen, one of the new sites, in 2008, some 13 years after work began to create a new reedbed in a Suffolk carrot field.

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1. Boom or Bust – a sustainable future for reedbeds and bitterns? RSPB and Natural England 2008

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**c) Your awareness of any actions (by the government or others) already planned or underway, to adapt the natural environment to climate change.**

The RSPB is aware that several institutions are starting to plan for adaptation to climate change. To date, we have been involved in the following initiatives:

- **Adaptation in the Climate Change Bill**
  The Climate Change Bill commits the UK Government to a number of measures to help the UK adapt to climate change. This includes a risk assessment, an adaptation programme and the power to require various authorities to report on their own adaptation measures (including the provision of guidance for authorities asked to do so). The RSPB is working with Defra to ensure the adaptation programme supports sustainable adaptation.
• **Habitat Action Plans and England Biodiversity work streams**

Defra, on behalf of the UK Biodiversity Partnership)\(^\text{14}\), and the England Biodiversity Strategy (EBS)\(^\text{15}\), have produced key principles and guidance for nature conservation to help biodiversity adapt to climate change. These key principles are being applied to existing Habitat Action Plans (HAPs) and the work carried out by England Biodiversity work streams. However, meeting the targets of the HAPs remains an essential goal to ensure biodiversity is robust in the face of climate change, and progress has been slow. The RSPB believe that urgent assessment of the blocks preventing delivery of HAPs, and ensuring the targets are met within the agreed timescales, is an essential step in assisting the adaptation of the natural environment.

• **The UK Climate Impacts Programme (UKCIP)**

UKCIP, and in particular it’s UKCIP02 and forthcoming UKCIP09 future climate scenarios, provides an essential resource towards understanding likely future impacts of climate change, and allowing these to be built into adaptation planning for the natural environment.

_Q4) The UK is committed to significant actions to mitigate climate change – what should be the relationship between adaptation and mitigation actions for climate change?_

**Both mitigation and adaptation are essential.** Past emissions mean we are already committed to substantial climate change, making adaptation vital if we are to maintain the function of human and natural systems (including biodiversity). Without sufficient timely mitigation, future climatic change will be so great as to make adaptation extremely difficult and costly, or in many areas, simply impossible.

**Balancing the need to support adaptation with the need to mitigate further climate change in specific cases is, however, an inevitable challenge.** A hierarchy of decision-making is therefore required. Central to this should be a non-negotiable commitment to meeting our mitigation goals across the UK economy, through the development of greenhouse gas budgets. Choices within this, however, should be made according to the principles of sustainable development; should seek to protect the natural environment; and wherever possible should provide co-benefits for adaptation.

**There are clear examples of actions which can provide mitigation and adaptation co-benefits in the land-use sector.** For example, the UK’s peatlands represent an enormous store of carbon. Many of these habitats are currently degraded and are losing carbon, both as gaseous carbon dioxide and as dissolved organic carbon in water. One cause of this degradation is drainage, facilitated by moorland grips. The

\(^\text{14}\) Hopkins JJ et al (2007) _Conserving biodiversity in a changing climate: guidance on building capacity to adapt_. Defra, on behalf of the UK Biodiversity Partnership

\(^\text{15}\) Smithers, RJ et al (2008 in press) _Climate Change Adaptation Principles: Conserving biodiversity in a changing climate_. Defra, on behalf of the England Biodiversity Strategy
lowering of the water table that is leading to loss of carbon also appears to be detrimental to several upland bird species of conservation concern, such as golden plover. Further drying out of the habitat, mediated by climate change, brings further threats to these upland bird populations. It is likely that measures to block the drains and restore the water levels will be beneficial for both making upland biodiversity more resilient to the pressures of climate change and for mitigating greenhouse gas flux. However, further research is required to increase confidence in such a strategy.

**In other cases the benefits of achieving rather small greenhouse gas savings (when set against the total UK budget) need to be weighed against potential conflicts with biodiversity protection**, and may not be sustainable in the broadest sense. For example, the adaptation of lowland heathland, and the species which use it, will depend in the UK on our ability to reduce historical fragmentation. In many cases, lowland heathland was fragmented by the planting of plantation forests, much of which now lie within the National Forest Estate, particularly in England. Felling trees and disturbing soil to re-create lowland heathland in these areas would temporarily contribute to carbon emissions, but is essential for wildlife. We would recommend that in these circumstances, any very limited tree-loss is accommodated within a wider programme of native woodland recreation, which will have carbon and biodiversity benefits.

**Climate change in the broader context**

Q5) Climate change is not the only major change that will take place over the coming years, or the only issue of importance for the environment, and yet it is being used as a justification for many decisions and actions.

a) In broad terms, what are the important non-climate changes (e.g. social, economic, demographic, technological, cultural or other) that will interact with climate change to facilitate or inhibit adaptation? *(It may be useful to cross reference your answer with your response to question 2a).*

All factors currently causing harm to the natural environment will inhibit its ability to adapt to climate change, unless we intervene to prevent them. These factors, and some associated potential non-climate changes, are as follows:

1. **Pollution**
   Air, soil and water pollution have been causing harm to the natural environment for centuries, and continue to do so. Non-climate changes could act to increase or reduce this pressure. For example, economic (e.g. the increasing costs of agricultural inputs), technological (e.g. the introduction of genetically modified organisms that require fewer inputs) and cultural (e.g. a move toward more sustainable farming) changes could reduce pollution in the future.

2. **Habitat loss and degradation through land-use change**
   Pressure from a variety of land-uses has led to the historical loss of habitats and species. Today, land-use pressures threaten the protection of existing biodiversity sites, inhibit the re-creation of habitats, and make the wider landscape
inhospitable through unsustainable land management. Non-climate changes could act to increase or reduce this pressure in future. For example, demographic and cultural changes (e.g. a continued increase in the number of households) could further increase the need for built development. Alternatively, cultural changes such as increased investment in co-benefit adaptation responses could alleviate some land-use pressures.

3. **Persecution**

For certain species, particularly birds of prey, persecution is an ongoing major threat. Non-climate changes could act to directly increase or reduce this pressure, and changes in other factors are also likely to have a significant impact. For example, persecution may be the final straw for a species once other factors such as unsustainable land management and habitat destruction have reduced a population to vulnerable levels. Cultural changes leading to the enforcement of wildlife protection laws could remove this pressure.

4. **Invasive species**

In many areas of the UK, invasive species are a major problem for ecosystems, habitats and species. Non-climate changes could act to directly increase or reduce this pressure. For example, increasing globalisation facilitates the transport of invasive species by human activity.

Many of the factors already affecting the natural environment listed above are likely to be further exacerbated by climate change, unless we act to prevent them. For example, the impacts of diffuse pollution are increased under drought conditions, which will be more common as the climate changes, due to the increased concentration of pollutants. Some species arriving in the UK or to new locations within the UK, as a result of climate change, could behave invasively. Human actions to adapt to or mitigate climate change could also drive land-use pressures, such as the growth of first-generation biofuel crops.

Almost all these drivers of biodiversity loss are driven by currently unsustainable patterns of production and consumption. Underpinning all our efforts to adapt sustainably to climate change should, therefore, be an attempt to address this issue.

Possible future cultural changes could facilitate sustainable adaptation in the natural environment. Cultural changes in institutions, driven by the internalisation of sustainable development principles, could lead to policy shifts that would benefit adaptation of the natural environment. For example, a cultural shift within an organisation could lead to making better use of soft flood defences that would benefit biodiversity. Using the need for adaptation to imbed the principles of sustainable development within institutions offers an interesting opportunity for the future.

b) When considering wider environmental priorities, what environmental goals may suffer if a stronger climate change adaptation agenda is introduced? How can the priority of adapting to climate change be...
increased as part of the sustainable development agenda without detracting from other important issues?

We have a moral imperative to protect other life on earth from the impacts of our actions. It would not be acceptable to abandon our goals for global biodiversity in the light of climate change. Instead, we need to pursue all other environmental goals more strongly and with consideration of future change, alongside our actions to mitigate further climate change.

Sustainable adaptation means seeking wherever possible to identify and support action that delivers co-benefits between environmental goals, and preventing action that unintentionally threatens the natural environment. For example, supporting projects that encourage sustainable land management practices in a catchment that provide valuable habitat for important species, alongside reducing diffuse pollution, thereby providing water quality benefits for water supply companies and for the natural environment.

There is a clear need to tackle existing environmental problems in order to help the natural environment, and specifically biodiversity, to adapt. Our changing climate makes it more important than ever to have clean freshwater, robust coastal zones and resilient biodiversity, as well as all other elements of the natural environment (such as healthy soils, clean air etc).

Adapting the natural environment to climate change is not an activity on its own, but a way of approaching all other environmental goals with a new sense of urgency and direction. If we allow ourselves to consider climate change adaptation in isolation, and detract attention from the other environmental goals it is inextricably linked to, we will not adapt. For example, protected areas are our major assets in enabling biodiversity to adapt to climate change, and yet some parties are now calling the legislation that underpins their protection into question.

Conflicts may arise, and we need institutional and governance arrangements to help resolve these in a transparent way according to sustainable development principles. The RSPB believe this will be a key role of the institutional arrangements being established through the Climate Change Bill, including the bodies preparing adaptation programmes and the Adaptation Sub-Committee.

The Natural Environment

Throughout these questions, where the term ‘natural environment’ is used, answers should refer to the three exemplars (biodiversity, nature conservation and protected areas; sea-level and coastal zones; freshwater).

Resilience of the natural environment

Q3) When planning what adaptive actions should be taken in order to increase the resilience of the natural environment in the UK, the RCEP is interested to know:
a) What form will this resilience take?
The RSPB believe that adaptation should be a twin track approach of increasing both resilience and accommodation. Resilience actions seek to make species, habitats and ecosystems more robust against the impacts of climate change, strengthening populations where they are today, to put species in a strong position to adapt to climate change. We give a definition for each exemplar below:

Exemplar 1 (biodiversity, nature conservation and protected areas):
‘Sustainable populations of species within a resilient ecological network that accommodates shifting climate envelopes.’

The cornerstone of action to secure resilient populations of species will be larger, adequately buffered protected areas and other important sites of high biodiversity in excellent condition.

Exemplar 2 (sea-level and coastal zones):
‘Coastal zones that can accommodate change, specifically in sea-level, and initially support net gain, and later maintenance, of the extent of important coastal habitats such as saltmarsh and mudflats.’

Exemplar 3 (freshwater):
‘Freshwater that is sufficient in quality and quantity to meet the needs of the natural environment, alongside human requirements, in a changing climate. Sustainable flood risk management that allows rivers and floodplains to accommodate increasingly frequent flooding events.’

b) How resilient to climate change does the UK want the natural environment to be? How resilient does it need to be to continue providing the services upon which society depends?

The resilience of the natural environment to climate change is essential for two main reasons. Firstly, as current climate change is human-induced, we have a moral duty to intervene to ensure the natural environment is resilient enough to adapt to a changing climate. This will ensure, for example, that action is taken to prevent extinctions, and gives future generations the best possible chance of inheriting a country at least as rich in biodiversity as it is today.

Secondly, we must ensure it is resilient enough to go on providing the services we depend on. Although we know that the natural environment provides a wealth of ecosystem services, such as carbon storage, flood risk mitigation and clean water provision, our knowledge of the ways in which land-use decisions affect the supply of these services is still in its infancy. Adopting a precautionary approach, we must assume that it in order to continue providing the services we depend on, ecological systems must be able to perform at least as well as at present. They will therefore need to be resilient enough to maintain at least current performance in the face of climate change induced disturbance.
We list below, in broad terms, the level of resilience we believe is required for each of the three exemplars:

**Exemplar 1 (biodiversity, nature conservation and protected areas):**

‘Resilient enough to ensure the UK plays its full role in protecting global biodiversity from the impacts of climate change, and contributes to the wider goal of halting and reversing global biodiversity declines.’

This level of resilience is essential if we are to uphold our moral duty to conserve biodiversity in the face of human-induced threats (see above). This would also be in keeping with the precautionary approach to ensuring the provision of a range of ecosystem services as outlined above.

**Exemplar 2 (sea-level and coastal zones):**

‘Resilient enough in the face of climate change and associated, sea-level rise and extreme events to ensure net gain of important coastal habitats initially, and then no net loss once historical losses have been redressed and habitat extent is sufficient to support sustainable populations of key species.’

This level of resilience is essential if coastal habitats are to go on providing essential services such as buffering the impact of wave energy and providing tidal storage to alleviate pressure on other sea defences. Coastal habitats are also economically-important nurseries for fisheries and shellfisheries and provide valuable public amenity benefits.

**Exemplar 3 (freshwater):**

‘Resilient enough to continue to provide sufficient clean water for human uses and the natural environment in the face of climate change and associated extreme events.’

This level of resilience is essential if freshwater is to continue to provide vital services including amenity, fisheries, and biodiversity into the long term in a changing climate, and will require considerable improvement from the current state.

We should, however, acknowledge that over time the needs of the natural environment in particular areas of the UK will change under a changed climate. We must be prepared to accommodate this change, so long as it takes place within the context of a wider framework to ensure the UK’s contribution to global and biogeographical goals for biodiversity conservation.

For example, it may not be possible over time to maintain historical river flows in rivers in some parts of Southern England. A sustainable approach to this would involve a hierarchy of actions to improve resilience first, and then to act to accommodate change:
1) Identify and reduce existing pressures on river flows through more sustainable approaches to water management within the catchment and groundwater area.

2) Ensure that species supported by threatened river systems are able to colonise new habitat in suitable climate space.

3) Monitor change in riverine systems and if necessary adapt conservation and management objectives to reflect changing water regime arising from unavoidable climate impacts.

c) To what extent is it possible to build in levels of resilience sufficient to deal with potentially catastrophic events induced by climate change?

Current mitigation activity aims to limit future global temperature rises to below 2°C. It is widely accepted that temperature rises above this level would result in ‘dangerous climate change’. By definition ‘dangerous climate change’ could lead to ‘catastrophic events’ of a scale to which it would be difficult or impossible to adapt. These include melting of the polar ice-caps and mass extinctions.

In addition, ‘discontinuities’ (as defined by the IPCC, but not included in their central estimates of temperate rise) such as melt down of the Greenland or West Antarctic Ice Sheets or a southern shift in the North Atlantic Thermohaline Circulation, would further increase the likelihood of ‘catastrophic events’ on a similar scale, and these become more likely with increased warming.

Given the uncertainty about the nature, scale and frequency of potentially ‘catastrophic events’, we have assumed for the purposes of this question, that these are local enough in scale for the natural environment to recover, such as more frequent or violent flood events and more frequent and extended droughts.

**Exemplar 1 (biodiversity, nature conservation and protected areas):**
The RSPB believe it is possible to build resilience to some of the extreme events likely to be induced by climate change, if sufficient investment in biodiversity is made now and in the future.

For example, we could build resilience against summer drought into freshwater biodiversity by planning for managed abstraction during these periods, making provision to store water during winter, improving channel profiles to manage low flows and implementing sustainable catchment management to reduce diffuse pollution.

**Exemplar 2 (sea-level and coastal zones):**
The RSPB believes it is possible to build resilience to some of the extreme events likely to be induced by climate change into coastal zones, through strategic planning of coastal change.

For example, we can build resilience against increased storm-surges into vulnerable coastal freshwater habitats through short-term protection complemented by inland
habitat creation to support populations longer-term. This would be best supported by managed re-alignment in other areas to increase the area of inter-tidal habitats, which then buffer the coast against storm surges.

Exemplar 3 (freshwater):
The RSPB believes it is possible to build resilience to some of the extreme events likely to be induced by climate change into freshwater systems, through strategic planning of catchment management, freshwater systems and abstraction.

For example, we can build resilience against extreme flooding events into freshwater systems, through strategically planned appropriate land management within vulnerable catchments. Many appropriate forms of land management will also benefit biodiversity, and so schemes can be designed to maximise o-benefits.

Natural responses and thresholds

Q7) The natural environment will respond to climate change in the absence of any human interventions. When considering the adaptation of the natural environment, when might a “do nothing” option be appropriate, whereby natural systems are left to respond without intervention?

Less extreme changes in climate in the past have resulted in mass extinctions. The fossil record shows that during past incidences of climate change exposed species have either moved with their shifting climate envelope, adapted in situ (behaviourally or evolutionarily) to the changed conditions, or often simply gone extinct. Predictions suggest that the climate change we face today will occur more quickly, and change to a greater extent, than at any time during the period over which most species on this planet have evolved.

Current change taking place against already damaged natural environment. The ability of species to move or adapt in situ has been dramatically impacted by human activity in the UK. For example, historical habitat loss and fragmentation have made it difficult for species to follow the movement of suitable climate space across a landscape, and reduced population size and thereby genetic diversity have made it difficult to adapt in situ.

Doing nothing will therefore risk dramatic loss of biodiversity. The combination of the factors above mean that today, without human intervention, the response of the natural environment to the challenge of climate change will not always be positive, and adaptation in many cases will be difficult or impossible, risking extensive species extinctions.

We have a moral duty to protect the natural environment from the impact of our actions. The climate change we face today differs from these past incidences in one crucial way; it has been caused by human activity. In addition, the difficulties the natural environment faces in adapting to climate change are also the result of human
activity. We therefore have a moral responsibility to intervene to protect the natural environment through assisting in its adaptation.

**In acting to assist the adaptation of the natural environment, we can help humans mitigate and adapt.** The natural environment provides us with a range of ecosystem services that we are only recently beginning to fully understand. ‘Doing nothing’ to support the adaptation of the natural environment to climate change puts these essential services at risk.

**Adaptation for the natural environment is therefore essential.** For example, ‘doing nothing’ to support the adaptation of biodiversity in agricultural systems would mean simply that the majority of species would be unable to survive in such areas, as could be argued would currently be the case in the absence of agri-environment schemes. Given that approximately 70% of land in the UK is under agricultural production, the impact of such a decision would be disastrous for biodiversity in the UK.

Q8) In the natural world, there will be thresholds of response to climate change, which are defined by the IPCC as “the point where stress on an exposed system or activity, if exceeded, results in a non-linear response in that system or activity”16.

a) Should thresholds of response to climate change be identified for the natural environment and, if so, how should this be done and by whom?

**Thresholds are difficult to predict in non-linear systems with complex inter-linkages such as the natural environment.** Ecosystems, as a rule, are not linear systems, which makes early identification of thresholds almost impossible. In addition, they are linked in countless complex ways, making the likely impact of exceeding a threshold in any one system much more complicated. Protecting the natural environment from exceeding thresholds of response, underpins our own ability to adapt as a species, because of the huge number of ecosystem services it provides, and the way in which it contributes to our quality of life in the UK.

**Given our dependence on services provided by the natural environment and our moral duty to protect it, it is imperative that we adopt a precautionary approach to living within environmental limits and increase our efforts to understand natural systems and monitor change.** Academic research, co-ordinated by an independent body, and funded by Government should strive to increase our understanding of environmental limits, and how best to adopt the precautionary approach. The Living With Environmental Change (LWEC) programme aims to provide decision makers with the best information to effectively manage and protect vital ecosystem services. However, LWEC is only able to administer existing funds of the research councils, and progress would be much faster with new ring-fenced resources.

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16 Taken from IPCC WGII AR4 Section 2.3.1
b) What would be an ‘unacceptable’ level of change to the natural environment? What are the key criteria which should underpin judgments of acceptability in this context?

Biodiversity loss due to human impact is morally unacceptable. Given that current climate change is a human-induced threat, we have a responsibility to intervene to protect the natural environment wherever possible, both for its own right, and for the vital ecosystem services that it delivers. Within our current understanding of future climate change below 2°C, the RSPB would consider that the extinction from the UK of any current UK species would be unacceptable. If our mitigation activities are sufficient to keep us below this level, as intended, current models suggest that, for example, there will be no breeding species of bird without suitable climate space in the UK.

However, change in distributions will result from climate change, and we must plan to accommodate this. We need to understand change in distributions whilst retaining the overall goal of halting and reversing global biodiversity declines. In the UK we need to understand where species are likely to lose and gain in range, protecting them at the trailing edge to help build resilience, and accommodating them at the leading edge of their range. We will need to monitor the responses of biodiversity with great care to understand when to withdraw investment for some species in some sites, in order to contribute to the wider overall goal of halting and reversing losses. Whilst change is inevitable and must be accommodated, climate change must not be used as an excuse to abandon efforts to look after the natural environment and secure a future for biodiversity.

Institutional arrangements for environmental conservation

Q9) How will adaptation of the natural environment interact with (either negatively or positively) adaptation responses in the major land uses (such as agriculture, water resource management, energy production, forestry, urban development, infrastructure) and what institutional arrangements, if any, are needed to facilitate changes in land use to support adaptation to climate change?

The adaptation of major land uses offers the potential for both substantial wins and substantial losses for the natural environment. We must avoid a situation where the adaptation actions of one sector compromise sustainable adaptation in another, or threaten our ability to protect the innocent victims of climate change – including vulnerable species and ecosystems. Instead, we should identify and prioritise the many co-benefits that exist for adaptation.

The RSPB believes that consideration of the natural environment in a changing climate should be built into adaptation in other sectors, with institutional arrangements for adaptation contributing to sustainable development principles. We must prevent the natural environment suffering collateral damage as an unintended consequence of adaptation in other sectors. Climate change adaptation is not the only factor that will drive future changes in land use, and other factors (e.g. climate change mitigation, economic and technological) will interact. To encourage
sustainable outcomes, the Government must take an overview of adaptation actions in different sectors, and ensure that they help, rather than hinder, adaptation in the natural world.

Alongside this, strong commitment is urgently needed to deliver the direct interventions that the natural environment needs in order to adapt. There is common agreement on a set of guiding principles that will help biodiversity to adapt (see responses to Q3). The principles are relatively straightforward, but putting them into practice is more difficult. In many cases, the policies required to deliver against the guiding principles, are already in place (e.g. the UK BAP), but their delivery is inhibited by lack of resources and leadership.

**Impacts, adaptation and institutional mechanisms in different sectors**

**AGRICULTURE**
Interaction between adaptation in agriculture and in the natural environment will be complex, positive and negative, and interwoven with changes caused by other drivers (e.g. climate change mitigation, economic and technological).

**Impacts of climate change on agriculture**
Climate change will present threats and opportunities for UK agriculture. These could include:

- Shifting climate envelopes leading to:
  - Potential for new crops and combinations of crops
  - New pests and diseases
  - New potential pollinators and other beneficial insects
  - A greater prominence in terms of world food production potential (as the UK becomes more central to the climate envelope suitable for key crops and other areas less so).
- Increased risks of water shortages and drought
- Increased risks of flooding and storms
- Pressure to reduce livestock numbers to tackle emissions
- New uses for conventional crops in biofuels and for biomass
- Markets for dedicated energy crops

**Potential adaptive responses and their impact on the natural environment**
A range of potential adaptive responses in the agricultural sector is possible, and the potential impact on the natural environment varies:

- Increased production in response to new markets and reduced global food production. *The impact on the natural environment would depend on how this is achieved, but could pose considerable risks for the natural environment.*
- Pressure for further land conversion to accommodate bioenergy demands and increased pressure for ‘food security’. *This could threaten areas of high biodiversity interest unless carefully managed.*
• Pressure to protect and even reclaim land in coastal areas threatened with sea-level rise. *This could further threaten inter-tidal and coastal freshwater habitats.*

• Use of genetically modified crops to increase productivity and overcome factors such as drought and disease. *The impacts for the natural environment would need to be assessed on a case-by-case basis.*

• Adopting novel crops and combinations of crops, including mass planting of bioenergy crops. *The impacts on the natural environment could be positive or negative, depending on where novel crops are planted and how they are managed.*

• Shifts in livestock production, as some livestock areas become more or less suitable for arable production. *The impacts on the natural environment could be positive or negative, depending on what changes occur and where.*

• Action to protect and restore stores of soil carbon to mitigate further climate change. *This could benefit the natural environment, for example if permanent pasture is maintained.*

• Action to protect and restore floodplains and river catchments to manage impacts of diffuse pollution and reduce flood risk. *This could have substantial benefits for the natural environment.*

• Changes in cropping patterns and the timings of tilling, sowing and harvesting with the changing weather patterns. *These could have considerable positive or negative impacts on farmland species and the wider natural environment.*

**Sustainable adaptation options**

Some adaptive responses in agriculture have the potential to benefit the natural environment. Identifying these co-benefits, and ensuring that they are delivered through appropriate policy interventions and by providing incentives for farmers, will be a major role for Government in ensuring sustainable adaptation. Three examples are discussed below.

• **Contributing to sustainable catchment management through minimising use of petro-chemical based inputs** may be one of the most significant contributions that the agricultural sector can make to enable the natural environment’s adaptation to climate change. The diffuse pollution these inputs cause substantially decreases the resilience of the natural environment, and freshwater systems in particular. Reducing the use of these could be an essential component of sustainable adaptation in the agricultural sector.

• **Increasing productivity within environmental limits would allow agriculture to adapt sustainably.** For example, production need not be sacrificed in order to enhance farmland biodiversity, as the RSPB has shown at Hope farm, but this message needs to be spread more widely. Informed and resourced use of agri-environment measures can substantially increase the permeability of the farmed environment to wildlife, many of which a low- or no-cost options.
• Action to encourage sustainable livestock management could help both agriculture and the natural environment adapt to climate change. For example, changing climate envelopes could make formerly abandoned livestock areas economically-viable again. Where this occurs in areas of former high nature value farming, it could prove to be a win-win outcome for agriculture and the natural environment.

Institutional arrangements to support sustainable adaptation in agriculture
• Government arrangements through policy or legislation are the key institutional opportunity to influence changes in agriculture. For example, regulation of petro-chemical based inputs would protect freshwater systems and biodiversity from diffuse pollution, thereby increasing resilience to climate change. Adoption of agri-environment measures would make the agricultural landscape more permeable and less hostile to biodiversity.

• Agricultural levy boards, such as EBLEX (the English Beef and Lamb Executive), could encourage sustainable adaptation. These groups are funded by statutory levy and facilitate technology and information transfer, coordinate research, and carry out marketing and promotional activities on behalf of product supply chains. They therefore have the potential to investigate the impacts of, and recommend and support adaptation practices, which are compatible with the adaptation of the natural world.

• Those at the end of the supply chain, including vendors like supermarkets, and ultimately the consumer, have the potential to encourage and support adaptation practices that are compatible with the adaptation of the natural world. The Sustainable Development Commission are currently working with some of the larger supermarkets on consumer requirements and supplier practices, and this work could be extended to consider adaptation.

WATER RESOURCE MANAGEMENT.
Managing the water cycle is inextricably linked to the natural environment. Options for adaptive activities by the industry at every stage in the cycle have the potential either to substantially benefit the natural environment and support its adaptation, or to work against it.

Impacts of climate change on water resource management
Climate change will present threats and opportunities for water resource management. These could include:
• Increased frequency and intensity of drought
• Increased frequency and intensity of flooding
• Increased concentration of pollutants during periods of low flow
• Lower water availability overall in certain areas
Potential adaptive responses and their impact on the natural environment

A range of potential adaptive responses in the water resource management sector is possible, and the potential impact on the natural environment varies:

- Improving water quality by managing diffuse pollution through sustainable land management. *This benefits the natural environment by increasing the resilience of freshwater systems.*
- Improving water quality by investing in water treatment works. *This could have negative impacts for biodiversity if it encouraged companies not to invest in reducing diffuse pollution.*
- Land management to improve recharge of shallow groundwater aquifers. *This has the potential to benefit the natural environment.*
- Making use of soft engineering, rather than hard engineering, for flood defences in rural areas. *This can have huge benefits for the natural environment – from creating new habitats to buffering rivers from diffuse pollution.*
- Using Sustainable Urban Drainage Systems (SUDS) in urban areas as a cost effective means of reducing urban flooding. *This can have huge benefits for the natural environment if appropriately designed.*

Sustainable adaptation options

Many adaptive responses in water resource management have the potential to benefit the natural environment. Identifying these co-benefits, and ensuring that they are delivered through appropriate policy interventions and by providing incentives for water resource companies, will be a major role for Government in ensuring sustainable adaptation. Two examples are discussed below.

- **Reducing abstraction by reducing human use** would help both the natural environment and water resource management industries to adapt to climate change. This could be achieved through widespread adoption of building regulations and the higher levels of the Code for Sustainable Homes (which would see a substantial reduction in per capita consumption of water) and through the retrofitting of water efficient devices into the existing housing stock.

- **Investing in sustainable catchment management could have huge benefits for both the natural environment and the water resource management industry,** helping both to adapt to climate change. Sustainable land management, including the reduction of diffuse pollution, would improve water quality, increasing the resilience of freshwater systems and reducing costs for water treatment. Many forms of sustainable land management in catchments could also contribute to groundwater recharge and flood risk management.
Institutional arrangements to support sustainable adaptation in water resource management

A number of institutional arrangements either already do, or have the potential to assist adaptation in the water resource management sector whilst also facilitating adaptation in the natural environment.

- **The Water Framework Directive** sets targets for the ecological status of freshwater bodies that require many of the sustainable adaptation actions described above in order to meet them.

- **The broad role of the Environment Agency** lends itself to an approach that encourages sustainable land management as a solution to adaptation, but requires the powers, resource and political will to put this into practice.

- **The new Floods and Water Bill being drafted provides an opportunity to address many of the institutional barriers to sustainable management of the water sector.** The RSPB has identified a number of key institutional arrangements essential to support adaptation in this sector that assists adaptation in the natural environment. These include:
  
  - Replacing the traditional ‘flood defence’ and ‘land drainage’ functions of flood risk management operating authorities with an explicit sustainable water management remit, underpinned by new powers beyond simple flood defence.
  
  - Encouraging the wider uptake of sustainable urban drainage by removing the automatic right of new developments to connect to the public sewer, requiring planning permission to increase hard surfacing over urban greenspace, giving local authorities governance of surface water management and increasing their technical capacity to manage ‘intra-urban’ flooding.
  
  - Time-limiting all abstraction licences (currently these are only a small percentage of total abstraction).
  
  - Introducing ‘General Binding Rules’ for agriculture that would ensure a continuation of sustainable farming practices benefiting both water quality and local flooding. The loss of set aside under CAP, the poor implementation of Nitrate Vulnerable Zones and the low impact of Catchment Sensitive Farming makes such safeguards essential.

**Energy Production**

With the urgent need to mitigate future climate change through reducing emissions of green house gases, energy production is diversifying. In land-use terms, energy production can be split up into crops grown for energy production (bioenergy crops) and built developments that either generate electricity directly (e.g. wind and tidal power) or convert feedstocks (renewable sources, waste or fossil fuels) into heat and power.
**Bioenergy Crop Production**

Bioenergy crops include biomass crops such as *Miscanthus* spp. and short rotation coppice, and biofuel crops such as wheat and maize for bioethanol and oil seed rape for biodiesel.

**Impacts of climate change on bioenergy industry**

The growth of the bioenergy industry has been driven, in large part, by the need to shift from fossil fuels to renewable energy sources in an effort to curb emissions of greenhouse gases. Possible future impacts of climate change on this new industry in the UK include:

- Increased demand for bioenergy crops to further curb emissions
- Impact of shifting climate envelopes, meaning that different crops are suitable in different locations, and new crops can be grown in the UK.
- Impact of changes to wider agriculture (see above), notably the impact of increased demand for food production in the UK.

**Potential adaptive responses in bioenergy and their impact on the natural environment**

A number of adaptive responses are possible in the bioenergy industry, and the potential impacts on the natural environment varies:

- Efforts to increase productivity per hectare due to increased demand for bioenergy and food crops. The impacts on the natural environment would depend on how this was achieved.
- Direct or indirect land-take from non- or minimal cultivated areas where increased demand for both food and fuel from crops pushes bioenergy and food crops onto new land. If this resulted in the cultivation of areas of biodiversity interest (e.g. set-aside or permanent pasture), there would be considerable negative impacts for the natural environment.
- Re-location of crops in response to shifting climate envelopes could move the impacts outlined above around. This has the potential to exacerbate effects on the natural environment, unless well managed (see below).

**Sustainable adaptation options for bioenergy**

Many of the potential adaptation actions for the bioenergy industry in response to climate change can could have a positive or neutral impact on the natural environment, and thereby contribute to sustainable adaptation.

- Producing biomass feedstock by coppicing existing woodland sites could provide huge benefits for the natural environment, if approached in a way that also seeks to maximise benefits for wildlife. Site management through coppicing could thereby build resilience of woodland species by increasing appropriate structural heterogeneity (e.g. rides and glades) and increasing the areas of habitat in suitable condition.

- Dynamic positive management of land use change associated with direct or indirect land take could manage impacts on the natural environment as demand and climate envelopes change. Sustainable land use change would...
direct cultivation away from areas of biodiversity interest. It would aim to improve the value of the cultivated land for biodiversity through mechanisms such as agri-environment schemes. If shifting climate envelopes, or other impacts of climate change such as increased flooding or drought, resulted in certain areas being unsuitable for cultivation, sustainable land use change could encouraging the management of land for biodiversity.

Institutional arrangements to support sustainable adaptation in the bioenergy industry
A number of institutional arrangements are available that could be used to help to manage the land use change impacts of the bioenergy industry in the UK.

These include obligations such as the Renewable Transport Fuel Obligation (RTFO), support schemes like the English Energy Crop Scheme (ECS), as well as tools aimed specifically at safeguarding the natural environment, such as Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA) (see below). Currently the RTFO does not require compliance with any environmental or social sustainability standards, but this could and should be introduced at the earliest opportunity. Screening of applications to country support schemes for biomass planting and infrastructure (such as the ECS) is being set up in some cases but these systems need to be robust, fit for purpose and regularly reviewed to ensure that they are delivering.

Built development for energy production
Impacts of climate change on built developments for energy production
How built development for energy production might adapt to climate change is difficult to foresee, other than through improvements in building standards such as increased insulation and water recycling. For example, whether or not patterns of wind will alter due to climate change sufficiently to require the location of wind farms to respond is not clear.

Potential adaptive responses in built developments for energy production and their impact on the natural environment
- Changes in optimal locations for built developments for energy production are possible. For example, if wind patterns were substantially altered, wind farms may have to be re-located, or power plants may have to move with feedstock sources (possibly impacted by climate envelopes). If this were to occur, the impact on the natural environment would depend on how re-location was managed.
- New tidal power installations may need to accommodate future sea-level rise and increased frequency of storm surges. This could lead to additional loss of important inter-tidal habitats, which given future land use pressures, could be difficult to compensate.
Sustainable adaptation options for built developments for energy production
At present, it seems that the most likely adaptation response for built development for energy production is their re-location. The location of new built development for energy production would need to be subject to the same strategic planning as other developments to avoid conflict with areas of high biodiversity interest, in order to ensure sustainable adaptation.

Institutional arrangements to support sustainable adaptation in built development for energy production

- The new Infrastructure Planning Committee (IPC) offers an opportunity to facilitate changes in land use to support the natural environment’s adaptation to climate change for any energy development that would generate over 50MW. The RSPB believes that the IPC should have a sustainable development duty, and that the Terms of Reference for the IPC should clearly refer to climate change including the need to facilitate the adaptation of the natural environment.

- National Policy Statement (NPS) will establish the national case for infrastructure development and set the policy framework for infrastructure planning commission decisions. Guidance for their ‘appraisal of sustainability’ is currently under preparation by CLG. The RSPB believe this should include strong guidelines on how to take into account adaptation to climate change, when preparing NPSs. The cumulative effects of large infrastructure projects on land use could potentially have serious implications for climate change adaptation in the UK. The RSPB therefore believe that any ‘appraisal of sustainability’ should incorporate the requirements of the SEA Directive, which already requires consideration of a plan or programme’s significant effects on climatic factors, including adaptation to climate change.

FORESTRY

The management and planting of plantation forests, native woods and wood pasture can have direct positive and negative impacts on priority species, priority habitats and designated nature conservation sites. How forestry policy and practice responds to climate change adaptation is therefore of great importance to the UK’s biodiversity.

Impacts of climate change on forestry

Political desire to limit emissions and mitigate future climate change is starting to have a powerful impact on forestry in the UK. Possible future impacts of climate change include:

- Increased demand for forestry products as biomass feedstock for heat and power generation.
- Changes in forestry practices and timings with changing weather patterns induced by climate change.
- Changes in tree species suitable for forestry use and the possible location for planting of different tree species with shifting climate envelopes.
Potential adaptive responses in forestry and their impact on the natural environment

It is essential that the forestry sector consider the needs of the natural environment when establishing its adaptation policies.

- Planting of new forests to provide biomass feedstocks or other benefits. This could include adaptation by tracking suitable climate space. This could be positive or negative for the natural environment depending on how the site is located and managed.
- Changes in management practices to build forest resilience to climate change, or in response to changing weather patterns. This could have positive or negative impacts for the natural environment depending on whether management takes the needs of woodland species into account.
- Planting of tree species novel to the UK, or novel to an area of the UK. This could have positive or negative impacts depending on the species involved, their management, and the previous land use of any new locations.

Sustainable adaptation options for forestry

The forestry sector, both public and private, has a particular opportunity to contribute to the natural environment’s adaptation to climate change through its own adaptation actions.

- Positive management of existing wooded areas, could build substantial resilience to climate change into sites, benefiting both the natural environment and site owners. It is likely that a considerable portion of the biomass for future UK renewable heating needs will come from better woodland management, which will be a vital win-win for wildlife given that lack of management appears to be one of the drivers of current loss of woodland biodiversity.

- Planting new forests could contribute to the UK BAP target for native woodland expansion, buffer existing biodiversity-rich woodlands, reduce fragmentation and thereby greatly assist the adaptation of biodiversity to climate change. In order to achieve these positive outcomes, new forests must be well located, well designed (containing appropriate native species) and well managed. Strategic planning for new forests will help to locate sites positively – they should avoid areas of existing biodiversity interest (species and habitats), buffer existing biodiverse woodlands where possible and reduce fragmentation. Adaptation strategies must consider native woodland species as a priority rather than focussing solely on productive commercial tree species.

Institutional arrangements to support sustainable adaptation in forestry

- All woodland planting and management, must be required to meet the government’s UK Forestry Standard and its associated guidelines. This must include biomass forestry funded through all parts of the country Rural 28
Development Plans, and management of the state forests. UK Forestry Standard compliance is part of the UK government and devolved administrations’ international commitments to sustainable forest management.

- Forestry policies across the UK must continue to promote sustainable multi-benefit forest management. This means that all new woodland planting must be appropriately located, designed and managed to enhance, not damage, important biodiversity, such as wetland sites, semi-natural grassland, wader areas, raised and blanket bogs, heather moorland and coastal dune systems. Existing woodlands - native woods, forestry plantations, wood pasture, scrub and ffridd - must also be managed to protect and enhance priority biodiversity.

**Urban Development and Infrastructure**

Urban development and infrastructure will adapt to climate change at a number of scales, and have the potential to benefit adaptation in the natural environment, both directly and indirectly.

**Impacts of climate change on urban development and infrastructure**

Climate change will have a wide variety of impacts on our built environment, including:

- Higher summer temperatures that will impact building materials and living conditions
- Reduced water availability during periods of drought
- Increased frequency and severity of flooding events

**Potential adaptive responses in urban development and infrastructure and their impact on the natural environment**

A range of responses are likely, and could include:

- Building design and development planning to cope with high summer temperatures, such as through providing shade, improving insulation and using materials resistant to higher temperatures. *This could have positive or negative impacts on the natural environment, depending on the mechanisms used.*
- Improving flood risk management in built developments and infrastructure planning. *This could have positive or negative impacts on the natural environment, depending on whether ‘soft’ or ‘hard’ engineering solutions are used.*
- Improved water efficiency in new building and developments. *This could have a positive impact on the natural environment, by reducing demand for abstraction, resulting in more water available for wildlife.*

**Sustainable adaptation options for urban development and infrastructure**

- Firstly, at an individual building scale, working to high building standards for efficient water and energy use will assist households in adapting to climate change and benefit the natural environment. For example, good
insulation will help households cope with higher summer temperatures, and will also reduce heating requirements in winter. Reducing energy demand will assist with climate mitigation, but in the longer term could reduce pressure on renewable energy sources and the consequent pressure on land. High water efficiency will help households and wider society cope with periods of drought, and benefit the wider natural environment by reducing demand for abstraction.

- **At an individual development scale, the integration of important adaptation features can provide direct benefits for the natural environment.** For example, Sustainable Urban Drainage Systems (to reduce the risk of flooding) and trees (which provide natural air conditioning and help alleviate the effect of the heat island impact in urban areas). These features contribute to the Green Infrastructure of a development, which has the potential to considerably assist the adaptation of biodiversity to climate change by increasing the permeability of built developments and expanding certain habitats.

- **At an infrastructure development scale, providers should consider ‘soft’ options over ‘hard’ options, as these will better help the natural environment to adapt.** One example would be using ‘soft’ flood management rather than ‘hard’ flood defences wherever possible. This can provide important habitats to assist the adaptation of the natural environment (all three exemplars). Another example would be providing ‘soft’ drainage for roads and rail to protect against extreme rainfall events induced by climate change, which again could help the natural environment to adapt. Infrastructure providers therefore need to consider adaptation both for their own needs, and that of the natural environment, making the most of these win-wins.

**Institutional arrangements to support sustainable adaptation in urban development and infrastructure**

- **Greater measures should be encouraged to increase take up of the Code for Sustainable Homes.** A full and considered review of the Buildings Regulations, as already proposed, should allow more consideration of the impact that housing can have on adapting to climate change.

- **More emphasis needs to be placed on the ability to provide green infrastructure (GI) alongside development.** Often the reason for a lack of GI in developments is down to a lack of resources and expertise on the part of key bodies such as local authorities. More should be made of the forthcoming Community Infrastructure Levy to lever increased resources for the provision of green infrastructure in development.

- **Finally, frameworks for adaptation in infrastructure are becoming more common, but much more momentum is required**, and the consideration of
adaptation of the natural environment must be an intrinsic part of the process.

*Cross-sectoral institutional mechanisms to support sustainable adaptation*

Some existing institutional mechanisms cut across sectors and have the potential to assist in balancing adaptation needs across the board.

**INSTITUTIONAL MECHANISMS FOR ADAPTATION ESTABLISHED IN CLIMATE CHANGE LEGISLATION**

The integration of different adaptation measures is essential if our adaptation response is to be sustainable. This will require a thorough understanding of land-use policy and its cumulative impacts on the natural environment. The principles of sustainable development must be at the core of developing sustainable adaptation, and strong leadership is essential to work through the difficult decisions that lie ahead, and champion ‘win-wins’. Sustainable adaptation to climate change will require specific resources, with timely action likely to be particularly cost-effective.

UK and devolved Governments should ensure that the institutional arrangements for adapting the UK to climate change being established under climate change legislation can deliver the following functions:

- **Analysing and advising on the interaction** between different adaptation measures and proposals from devolved authorities, Defra and reporting authorities, with a view to identifying conflicts and co-benefits, and sharing understanding of the cumulative impacts of proposals on the natural environment. This could involve horizon-scanning at an early stage. *The Adaptation Sub-Committee (ASC) may be the most appropriate body for this function.*

- **Identifying policies and programmes** (including those affecting land-use) which will help to resolve potential conflicts and deliver co-benefits. *The bodies preparing national adaptation programmes and with reporting powers may be the most appropriate bodies for these functions (i.e. Defra/ DECC, and devolved authorities).*

- **Adding value by identifying and resourcing programmes and projects to deliver co-benefits between sectors.** For example, sustainable catchment management would have huge benefits for adaptation in the water resource management sector, in the natural environment, and would contribute to achieving the default targets of the Water Framework Directive. However, responsibility lies between numerous policy areas and there currently limited action on the ground at a meaningful scale to deliver these outcomes. A cross-sectoral body would be best placed to set out how this could be achieved.
Leadership, action and resources could be provided by the bodies preparing national adaptation programmes and with reporting powers (i.e. Defra/DECC, and devolved authorities). Projects could be identified and proposed for support by partnerships of regional stakeholders, including statutory nature conservation bodies, regional and local Government, businesses and NGOs.

To assist in meeting these responsibilities, the UK Government should develop indicators of sustainable adaptation that can be used to test adaptation strategies. These should include indicators, which focus on the sustainable use of scarce natural resources (for example, water). They should also include output indicators of actions clearly identified to deliver co-benefits across sectors, for example the area of land restored or created with the purpose of delivering ecosystem services and supporting the adaptation of biodiversity.

The diagram below outlines the current institutional structures for adapting the UK to climate change being established under the Climate Change Bill, and the functions we believe each body should have in order to deliver sustainable adaptation. The same set of functions should also be reflected at other decision-making levels – for example, at a regional and local level.

Fig. 1: Current institutional structure for adapting the UK to climate change and proposed functions
Any institutional mechanism for dealing with adaptation must be well informed of the most recent scientific estimates of future climate change and its impacts. Review of current and emerging evidence should be at the heart of the Risk Assessment prepared by the UK Government every five years, but must also be built in to adaptation planning during interim periods. The RSPB recommend that the Adaptation Sub-Committee and the bodies preparing national adaptation programmes and with reporting powers (i.e. Defra/DECC, and devolved authorities) regularly review emerging evidence on the magnitude, rates and kinds of impacts of climate change. In response to an improving scientific basis, adaptation planning and activities must themselves be reviewed to ensure they are as appropriate to the challenge ahead as possible.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) are major tools to support sustainable land use change, and hence sustainable adaptation. Almost all sectors affecting land use (including forestry, agriculture, industry, fisheries, energy, transport, waste management, water management, telecommunications, tourism, and town and country planning) are required to assess the environmental effects of their plans, programmes and projects through SEA or EIA prior to adopting or starting these.

Two Directives cover most of the sectors affecting land use patterns (except defence):
- Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (the “SEA Directive”)

Both the SEA and EIA Directives state that adaptation to climate change must be considered when preparing a plan, programme or project, and any negative effects mitigated if necessary. This included within the list of significant effects for consideration under the directives, as ‘climatic factors’, ‘biodiversity’ and the ‘interrelationship’ between these two (see Annex 1 of the SEA Directive and Annex 4 of the EIA Directive). These two directives, therefore, have the potential as institutional arrangements to build the needs of the natural environment in adapting to climate change into decisions about land use. However, clear and regularly updated best-practice guidance on how to appropriately consider climate change adaptation within SEAs and EIAs is needed.

Q10) As the climate changes, so the land, aquatic and coastal environments will change, including those areas protected for biodiversity and conservation. The RCEP is interested to understand what this means for conservation policies and whether the current arrangements enable or inhibit adaptation of the natural environment.
a) If the nature of existing protected areas changes as the climate changes, what does this mean for current conservation policy?

Land managed specifically for nature conservation provides strongholds for wildlife in a changing environment, offering protection from human impacts such as pollution, persecution and development. There is sadly no evidence that these pressures will lessen as a result of climate change; indeed, many of them are likely to intensify as climate impacts compound existing problems and put more pressure on resources such as water and productive land. For this reason alone, climate change will increase the importance of protected areas for wildlife: criticisms that protected areas are static anachronisms in a newly dynamic world are ill-founded. We can also adapt these strongholds for wildlife to take account of the impacts of climate change, along the principles of resilience and accommodation. By 2015, site management should be working towards optimising biodiversity for the 2050s.

The RSPB therefore believes that protected areas are a vital component of adaptation strategies for wildlife. Yet some change in the species interest of particular sites is inevitable, and may in some places be significant. Some newly-arriving species may become new interest features and integrated into site management objectives. Where an interest feature has been irreversibly lost, removal from the designation and management objectives may be appropriate. Our initial analysis of both EU and UK protected area laws suggests that they are already capable of allowing these adjustments, which must of course only happen as a result of the real-life situation and not ahead of time, based on the uncertainties of predictive models.

The Birds and Habitats Directives both also include Articles which can provide a legal framework for the creation of a more ‘permeable’ wider countryside. Longstanding they may be, yet these Directives still provide the litmus test for sustainable living and the framework for assessing development proposals. They just need the political will to plan and fund their full and imaginative implementation.

b) With regards to site-specific conservation policies, what should be protected now and in the future, especially if the present site is bound to change? How can a range of resilient habitats be provided to conserve biodiversity?

We need to look after biodiversity now in order to secure resilient populations of wildlife which can colonise new sites in the future. Resolving the problems that threaten biodiversity today is essential, making our current conservation work a vital start to adaptation to climate change.

Protected areas are essential to achieving this goal. Studies show that protected areas are the powerhouses of species recovery and strongholds of productive

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17 Sutherland, R, Watts, O and Williams, G 2005: Climate change and the Birds and Habitats Directives: can they work together? ECOS 26 (3/4)
populations. Furthermore, stronger recovery is associated with larger areas of protected sites, especially for the rare and vulnerable species. Our current network of important wildlife sites is covered by a suite of legislation, that together provide strong protection. This is illustrated by the fact that since 1994 (when the EU Habitats Directive was implemented in the UK), less than 20 cases have resulted in damage requiring provision for habitat compensation under Article 6(4) of the Habitats Directive. The Nature Directives have had a positive effect in encouraging developers either to avoid such sites or to fully mitigate potentially damaging effects.

**Even when features of interest on a site change in response to climate change, we will still need to protect areas of semi-natural habitat.** This is because they offer protection from non-climate changes such as pollution, persecution and land-use pressures. They also offer a suite of environmental conditions preferred by a range of specialist species, notably low nutrient status, high water quality, and diversity of soil types and hydrological regimes.

**Accommodating shifts in species distribution will require both a network of sites and complementary habitat conservation across the countryside.** Articles in both the Birds Directive and the Habitats Directive require Member States to improve the ecological coherence of the Natura 2000 network and meet the ecological needs of habitats and species. These Articles provide the requirement to build stronger conservation measures into the economic fabric of countryside activities, such as farming, forestry, water management and mineral extraction. Climate change will increase the need for habitat creation and restoration alongside other measures to develop ecological connectivity across landscapes, encompassing Natura 2000 sites and the intervening countryside.

**Habitats and assemblages of species are likely to change under climate change, but creative use of our protected area network could accommodate these changes.** Identifying key elements of structural diversity, which we can protect in networks of semi-natural habitat, could offer species an opportunity to find suitable niches within a changed environment. So, for example, in protecting and restoring floodplain wetlands we might look for varied topography providing a range of water levels and creating different successional regimes, without necessarily being able to predict or dictate the species which will make up new vegetation communities.

**The UK’s aim should be to play its part in halting and reversing declines in global biodiversity.** The UK is committed, under the Convention on Biological Diversity and the Gothenburg target of halting biodiversity loss by 2010, to ensuring the survival and recovery of species that are declining because of human activities. Objectives for sites and networks of sites should make a specific contribution to this

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overall aim, incorporating the potential increase or decrease in the UK’s responsibility for different species as their ranges shift with moving climate envelopes.

At present, however, many sites are not large enough to support sustainable populations of vulnerable species and make a real contribution to international networks. Sites in the UK urgently require buffering and extension to play this role effectively. The Nature directives make provision for such activity and this should be prioritised in the UK, for example through resources to support delivery of the UK Biodiversity Action Plan targets for habitat expansion.

Case study: coastal Natura 2000 habitats and sea-level rise

The response to predicted losses of intertidal and freshwater habitats on the coast is a good example of where the two elements, protected areas and habitat creation, interact. A high level study for Defra and the Environment Agency assesses the potential scale of habitat compensation arising from flood risk management in England to deal with the effects of sea level rise and coastal squeeze. The report suggests that over the next 100 years, significant areas of fresh and brackish water habitats (32,300ha) and saltmarsh (4,000ha) will be lost from Natura 2000 sites. Under the Habitats Directive, this should be compensated for in advance of the damage occurring. Sustainable solutions will need to be found that are compatible with climate change. For some freshwater habitats, this will probably mean migrating those elements of the protected area network inland through the creation of new habitats. These new areas will eventually be brought within the Natura 2000 network.

c) How should current arrangements (such as protected areas or wildlife law) for the protection of species and habitats be adapted to ensure that the natural environment can adapt to climate change?

We consider the current legal and policy framework (in particular the Nature Directives) can lead to flexible and dynamic conservation programmes if they are implemented in a purposive and creative way. Legal advice to the RSPB, supported by its own analysis, demonstrates clearly that the Directives provide a workable framework to address climate change and act as a driver to deliver adaptive measures to sustain biodiversity into the 21st century. Therefore, while some adjustments will be needed in the way in which this framework is implemented, the

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20 Risk & Policy Analysts Ltd., Royal Haskoning UK Ltd. and ABPMer Ltd. (2006) National evaluation of the costs of meeting coastal environmental requirements. DEFRA.
underlying system is fit for purpose and can ensure species and habitats can adapt to climate change.

Guidelines on implementation could aim to adapt these strongholds for wildlife to take account of the impacts of climate change, along the principles of resilience and accommodation. By 2015, site management should be working towards optimising biodiversity for the 2050s.

Given the uncertainties associated with climate change predictions, we will need to subject site objectives and implementation to periodic monitoring and review, as our understanding of the effects of climate change improves. This will be essential to help determine at what point management objectives need to be revised to reflect observed changes. Any adjustments must be grounded in monitoring of actual changes. At a European level, monitoring and surveillance requirements already assess how well Member States are doing in attaining favourable status for their species and habitats. Importantly, this regular reporting cycle provides the knowledge to re-assess site conservation objectives and species conservation measures in light of changing circumstances, for example as climate change may require.

Individual sites should also be seen as part of an expanded and strengthened network that can accommodate shifts in species’ distributions. This network should reduce the fragmentation of semi-natural habitat and improve the opportunities for dispersal of species. Habitat creation, in particular, should focus on areas that are likely to be of strategic importance with regard to climate change. The RSPB and Durham University have developed a methodology to identify the potential locations of future Important Bird Areas with climate change, in our work with African partners, which will be extended in the future to cover IBAs in Europe.

Values relating to the natural environment

Q11) How society perceives and interacts with the environment is different in each country, and within the different regions and sectors of that country. The values and attitudes of society will ultimately underpin its response to climate change. a) How will climate change affect how society perceives and values the natural environment?

Climate change could affect how people feel about the natural world. When damaging events are increasingly understood to be the result of climate change, there is no reason to believe that attitudes towards the natural world per se will change. This may be positive or negative for the natural environment. For example, the extensive flooding in central Europe in 2002 and the heatwaves of 2003, may have convinced many of the need to address climate change but may not have altered perceptions of the natural environment.
If climate change does not change public perceptions of the natural environment, it could encourage maladaptive responses to climate impacts. For example, demands for more, hard engineered, flood protection rather than environmentally sympathetic, managed realignment. It could also lead to a piecemeal approach to adaptation. Addressing problems, like water stress, agricultural production or flood protection in an ad hoc fashion, rather than strategically, increases the likelihood of inefficient and ecologically damaging responses.

However, climate change could have a profound impact on how the public perceive the natural environment. For example:

- Observable changes to the timing of seasonal events could have a positive impact on societal perceptions of the natural world.
- Climate change will bring increasing numbers of potentially charismatic species to our shores. For birds, this includes little bustards, spoonbills, cattle egrets and hoopoes, and these could bring a new audience to appreciate wildlife.
- Climate change may alter the populations and distribution of much-loved flora and fauna, due to weather patterns affecting migration, a lack of synchrony between hatching and food sources or because of competition from newcomers.

Events such as these could lead to an increased understanding of the vulnerability of the natural environment and our dependence on it, as well as encouraging a new audience to appreciate wildlife.

Government and NGOs have a role to play in explaining the underlying science of climate change, describing its impacts on the natural environment, and explaining how these will affect people, stressing our dependence on healthy ecosystems. As we increase our understanding of the range of ‘ecosystem services’ that the natural environment provides, we should share this with the general public. In doing so, the natural environment may come to be valued more broadly for the instrumental values associated with such services, in addition to its intrinsic value. With coastal flooding, managed realignment yields ecological benefits in terms of the intertidal habitats it facilitates. It can also, in certain circumstances yield cost effective flood protection benefits as well. From bees pollinating fruit and vegetables to forests sequestering carbon, understanding the broad benefits of nature may lead society to attach another set of explicitly economic values to its conservation.

We can also help by ensuring that children in particular have the opportunity to experience the natural world. The RSPB already works closely with schools through its outdoor learning programme, and the story of climate change could be woven into lessons in more detail.

Contact with nature could be threatened if we fail to act soon to help wildlife adapt to climate change. If our actions to assist the adaptation of the natural environment are not sufficiently timely or on a large-enough scale, remaining areas of biodiversity interest could become extremely vulnerable to disturbance, and
public access may have to be restricted, or even prohibited. This would deny huge numbers of people important opportunities to engage with wildlife.

We must recognise and communicate that climate change is symptomatic of unsustainable patterns of production and consumption across all aspects of human life. In this way, we can seek to learn lessons which can be extended into how we manage other environmental problems in the future.

b) As the climate changes, it is likely that non-native (or alien – see definitions at Annex B) species will migrate into the UK. When and how do previously non-native species come to be regarded as part of the UK’s native biodiversity, and what will this mean for the UK?

Climate change will complicate our approach to non-native species. Many species will arrive in the UK, or to new areas within the UK, of their own accord, as their climate envelope shifts. This has already begun to occur, and the frequency of new arrivals will only increase.

Our approach of species extending their natural range in this way will need to be carefully considered on a case-by-case basis. Our consideration should be set within our overall aim of halting and reversing global biodiversity declines, taking into account the role of the UK within the expansion or protection of a species range.

Newly arrived species can behave in an invasive fashion in their new location, whether they arrive through natural range expansion or by human intervention. The behaviour of species new to an area requires careful monitoring on a case-by-case basis to ensure there are no substantial negative impacts on existing biodiversity.

c) Is the legal framework for species and habitat protection adequate for dealing with invasive non-native species under climate change?

As climate change presents a new challenge to legislation dealing with invasive non-native species, it will most likely require review. Any such review should consider the full range of mechanisms by which species new to an area arrive, and should probably consider arrivals as a result of climate change on a case-by-case basis, taking note of the points outlined above.

**Opportunities presented by the changing natural environment**

Q12) Whilst much of the debate is focussed on how humans can help protect the natural environment as it responds to climate change, how can the changes to the natural environment be used to help UK society adapt to climate change?

The natural environment provides humankind with a vast range of services that underpin our existence, and our quality of life. As this question specifically refers to the changes in the natural environment as it responds to climate change, we will not
consider the wider services provided by the natural environment here, other than where changes in these due to climate change can be used to help UK society adapt to climate change.

The natural environment provides an essential role as an early indicator of climate change through its response. For example, the way that populations of species are altering their distribution gives us a very clear indication of how and how quickly the climate is changing. By giving a clear indication of the impact our activities on environmental limits, the adaptation of the natural environment could encourage UK society to live and to adapt in a sustainable way. For instance, it could encourage us not to waste resources where this would be impractical as the climate changes, e.g. increased development in South East England, or at the coast.

Many of the vital ecosystem services provided by the natural environment may change with our changing climate and help us to adapt to climate change. For example, pollinators and other beneficial invertebrates will respond to changing climate envelopes (e.g. further north and at higher altitudes), which could enable different types of agriculture at different altitudes. As the natural environment changes in response to climate change, this could engage public interest in it (e.g. through charismatic new native species arriving). If these changes were embraced and encouraged more people to make use of the natural environment, it could have knock on benefits for public health, spirituality, recreation and tourism.

The effects of climate change on the natural environment may also enable economic activities to adapt. A warmer climate should mean many more domestic holidaymakers and potentially, visitors from warmer climes. The UK coastal regions contain an array of natural attractions and beauty spots. Protecting them, together with the marine environment, will provide opportunities for economic diversification in regions many of which are economically deprived.

Institutional Arrangements and Capacities

When considering institutional capacities and arrangements, the Commission would be particularly grateful if the answers are framed in terms of the three exemplar issues discussed above: biodiversity, nature conservation and protected areas; sea-level and coastal zones, and; freshwater.

Institutional adaptive capacity

Q13) To what extent do UK institutions and organisations recognise and understand their dependence on the natural environment, and how this affects their capacity and capability to adapt? Are there examples of organisations in the UK that have quantified their level of dependence?

Our understanding of ecosystems services is at an early stage. Whilst work is increasing in this area, we have yet to fully understand the mechanisms by which these services are provided.
There is no organisational or institutional culture of valuing these in most sectors in the UK. A sustainable relationship with the natural environment would be greatly facilitated if the value of the ecosystem services which different organisations depend on were assessed and internalised within decision making. Taking account of the benefits that the natural environment provides, and the impact of actions on it, would then become part of day-to-day life, as are other types of costs and benefits. Decision making like this would be better able to work to the principles of sustainable development, particularly the need to live within environmental means, and encourage sustainable adaptation.

Land-using sectors have the most obvious dependence on the natural environment. For example, the agricultural sector depends on the natural environment for healthy soils, clean and abundant freshwater, and beneficial invertebrates, and these services are only recently starting to be recognised. Extensive farming systems such as organic, play an important role in maintaining and enhancing all elements of the natural environment for the longer term. This ‘valuing’ of the ecosystem services provided to organic farming by the natural environment is reflected through the increased price paid for organic goods by consumers. All farming systems are dependent on the natural environment, but this is less well recognised in conventional farming.

Even in land-using sectors, little or no work has been done by the companies themselves to assess and value their dependence. For example, the water industry is unusual in that their product is almost entirely dependent on the natural environment. There is relatively little recognition of this, and solutions have generally been ‘end of pipe’. Water companies in poor quality environment areas have to spend more money on cleaning water – where catchments are in high quality environments managed for their high nature value then water companies and their customers benefit from reduced risk to their supplies and through greatly reduced treatment costs.

Other organisations, however, are making more progress toward valuing these essential services. For example, the value of the services provided by the natural environment have always been implicit in the work of nature conservation organisations. More recently, many organisations have started to look more closely at how these services can be better quantified and expressed explicitly to the rest of society. Amongst commercial organisations, insurance companies appear to be the most advanced in quantifying their dependence on the natural environment and costing this into their decision-making. This mostly relates to the impact of extreme events, rather than the services provided by the natural environment. Internalising these costs will help insurance companies to adapt to climate change by protecting them against the costs of extreme events, and the lessons learnt

Internalising the costs associated with the services of the natural environment would encourage decision–making that contributed to sustainable adaptation. For example, internalising these costs would help farmers to make more sustainable
decisions that took into account the impact of their action on the natural environment, and the consequent impacts on them. Defra’s ecosystem services work has begun to examine the value of the services the natural environment provides and this could feed into future internalisation of costs for agriculture. This would facilitate sustainable adaptation of the agricultural sector.

**Government should take the lead in valuing ecosystem services and promoting these values across public and private sector.** There is increasing awareness of the importance of valuing ecosystem services within Defra but a systematic means of incorporating an ecosystems approach must be developed and embedded in all policy formulation and decision making processes. Encouragingly, Defra have begun work developing the needed methodologies that must, rapidly, become a central aspect of, amongst others, Strategic Environmental Assessments, and Environmental Impact Assessments.

Q14) Does the UK have the right capacities and institutional arrangements to be able to identify the changes to which it should be adapting?

The UK Climate Impacts Programme (UKCIP), and in particular it’s UKCIP02 and forthcoming UKCIP09 future climate scenarios, provides an essential resource towards understanding biological change and biodiversity conservation needs across the UK. It is important nonetheless not to lose sight that any projections are simply future potential scenarios, and cannot be used for precise spatial planning for the future. Accommodating the uncertainty and variability about future climate is a key part of successful adaptation – and lack of precision about the future must not be used to delay the urgent action required. The UKCIP reports also provide detailed indicators of current climate impacts, and through their website, support for developing adaptation frameworks.

It is essential that we better understand the impacts (current and future) of climatic change on the natural environment, in order to build this evidence-base into institutional arrangements for adaptation. Research in this area is increasing slowly, but with ring-fenced resources directed at key questions our evidence base could far better support our adaptation planning.

The findings of UKCIP, the reports of IPCC and ongoing review of other emerging evidence must be built into institutional structure for adapting to climate change in the UK. We have outlined in our response to question nine, the institutional arrangements being established through the climate change Bill that we believe should have specific functions to enable sustainable adaptation. The Adaptation Sub-Committee, with their remit for analysis of information, are probably the most appropriate body to incorporate regular review of emerging evidence on climate changes into their advice. Any changes to the evidence base should then cascade into a review of adaptation plans and actions, to make sure these are still the most appropriate.
Q15) What are the relative roles of government, communities, individuals, civil society, and/or companies with regards adapting to climate change for the three exemplar issues? For example, is there too much of a focus on institutional responses and needs versus understanding of individual concerns and needs?

Government have a vital leadership role in identifying the impacts of climate change and ensuring the UK adapts in accordance with the principles of sustainable development. The role must be to coordinate and enable other levels of UK society to adapt as necessary, for example as outlined in our response to question nine. Regional responses should be promoted by Government, and identify specific programmes and projects to deliver co-benefits.

Leadership from Government is in many ways a pre-requisite for individuals to feel informed and empowered to take action to adapt to climate change. Communities will have an important role in understanding changes at the local level and responding to these with locally tailored solutions, and Government should ensure that lessons learnt at this level feedback to improve their own planning.

Q16) As society adapts to climate change, decisions will need to be made as to what is an appropriate range of adaptation objectives and responses.

a) What should be the key objectives of climate change adaptation strategies for the three exemplars?

All adaptation objectives should contribute to sustainable development, that is, contribute to the creation of a just and health society living within environmental limits. This should include protecting biodiversity from the impacts of human-induced climate change, and from human response to climate change.

Exemplar 1 (biodiversity, nature conservation and protected areas):
The overall objective should to be ensure that global biodiversity is protected from the negative impacts of human-induced climate change; and that adaptation strategies contribute to the goal of halting and reversing declines in global biodiversity.

Within this, activity should increase the resilience of existing populations of wildlife, and manage the landscape to accommodate inevitable changes in distribution and habitat composition. This will require the following tools/approaches:

- **Protecting existing populations from the impacts of non-climate pressures**, including persecution, pollution, habitat destruction and degradation, through investment in meeting current objectives for protected area networks and conservation frameworks, such as the UK BAP.
- **Monitoring change and assessing the need to modify conservation and site objectives** to reflect changes in the composition of habitat communities and the distribution of species. Such modifications should reflect an understanding of the role any particular population, site or network plays in
the protection of global biodiversity, and therefore may require an understanding of population change at a bioregional scale.

- **Buffering and extending existing areas of semi-natural habitat, and creating new areas of habitat.** This will help to ensure a greater level of heterogeneity within landscapes, increasing the likelihood of survival for populations at the edge of a shifting range, for example, and providing a varied ‘substrate’ for new colonisers.

- **Making the wider countryside more ‘permeable’ for wildlife,** through the provision of habitat features such as ponds, ditches, hedges and small woodlands.

- **Studying the dispersal responses of species impacted by climate change** to ensure optimum strategies for aiding their adaptation can be identified and put into practice over time.

**Exemplar 2 (sea-level and coastal zones):**

**The objective should be to ensure a sustainable future for the UK’s coastal assets, (environmental, cultural and social) through the managed and equitable realignment of coastal defences.**

This will require coastal management systems, which identify vulnerable assets, assess their sustainability in their current locations and put in plans to migrate them where appropriate and/or necessary. This applies equally to natural assets such as freshwater habitats, to cultural assets, and to communities. Such plans should aim to maximise the flood risk management benefits of sustainable coastal management, and to create coastal habitats to offset losses currently occurring through sea-level rise and coastal squeeze.

**Exemplar 3 (freshwater):**

**The objective should be to maximise the freshwater resource available and to ensure its sustainable and equitable distribution.** The sustainable use of freshwater resources must include living within environmental limits, which will require water management to contribute towards, rather than undermine, adaptation plans for biodiversity.

Sustainable catchment management, focussing on land management practices which restore water quality, and on the efficient use of scarce water resources, must underpin sustainable adaptation to climate change. Patterns of land-use and human settlement in water-stressed areas must be able to take into account the water needs of the natural environment. However, nature conservation may also need to adapt conservation objectives for rivers and other water bodies over time, to reflect changes in absolute water availability which come about as a consequence of climate change.

b) What should be the criteria for determining appropriate adaptation objectives and the responses that would meet these objectives for the three exemplars?
All adaptation objectives should be assessed against their potential contribution to sustainable development, and therefore sustainable adaptation. The UK Government’s definition of sustainable development is living within environmental limits and achieving a just society, by means of a sustainable economy, good governance, and sound science.

Applied to adaptation, this might mean, for example:

- **Living within environmental limits** – adaptation strategies should seek to protect and restore rather than further deplete finite natural resources (including biodiversity).
- **A just society** – adaptation strategies should recognise and protect the needs of vulnerable communities and individuals at home and abroad; should seek to deliver inter-generational justice; and should recognise a moral duty towards other species on earth impacted by human activity.
- **A sustainable economy** – adaptation strategies should seek to promote patterns of economic activity, which contribute towards social justice and do not breach environmental limits.
- **Good governance** – sustainable adaptation requires institutional arrangements and governance structures which will help resolve inter-sectoral conflicts and identify and deliver co-benefits.
- **Sound science** – sustainable adaptation should be founded on an ever increasing understanding of the impacts of climate change on the natural world and on human societies; and adopt the precautionary principle with respect to the protection of ecosystems and the services they provide.

c) **How should different adaptation objectives and responses be prioritised for the three exemplars?**

The principles of sustainable development provide a framework within which to integrate the needs of society, environment and economy. They should be used systematically in prioritising actions within an adaptation strategy. In every case, actions should be prioritised which can deliver co-benefits. Where conflicts do arise, resolutions must be found which do not breach environmental limits – on the understanding that to do so risks serious and potentially irreversible harm to our own and future generations.

d) **Some adaptation responses could disadvantage some individuals or groups (e.g. coastal realignment could lead to individuals or communities having to move). How should the “fairness” of different adaptation responses be considered?**

Sustainable development principles are the best means we have available, to achieve equity in decision making. Such principles should be put into practice in an open and transparent manner, which encourages local ownership and participation, without sacrificing wider interests or inter-generational fairness.
For example, involving the public and specifically affected communities in decisions around coastal management is an important part of managing fairness. Appraising the impacts and minimising disadvantage in such a managed way will encourage fairness and reduce the backlash associated with ‘unfair’ decisions – the ‘outrage factor’ identified in the Foresight ‘Flood and Coastal Defence’ project report.

European, national and regional approaches

Q17) What is the appropriate level (e.g. European, UK, regional, local) at which decisions should be made for climate change adaptation?

Adaptation decisions will need to be made at all of these levels if we are to successfully adapt to climate change in accordance with sustainable development. Different decisions will be appropriate at different levels, and best-practice and ideas should be shared in both directions – both ‘bottom up’ and ‘top down’.

Q19) Which existing EU mechanisms (e.g. the Common Agriculture Policy or the Water Framework Directive) could play a role in delivering adaptation to climate change in the UK? What are the aspects of such mechanisms that enable or hinder adaptation?

The RSPB believes that both the Common Agricultural Policy and the Water Framework Directive need to contribute to the natural environment’s adaptation to climate change, both through building resilience and supporting accommodation.

The Common Agricultural Policy

In Pillar I, support for agriculture is currently indifferent to climate change adaptation or mitigation. There are no standards or requirements within cross compliance that explicitly refer to climate change adaptation, however the system is well placed to oblige farmers to support the natural environment’s adaptation. Cross compliance, which farmers must respect to receive their Single Farm Payment (SFP), is made up of SMRs (Statutory Management Requirements, reflecting existing legislation) and GAEC (Good Agricultural and Environmental Condition). Together these cover habitat creation, protection, restoration and maintenance and soil management issues, all of which have the potential to benefit the natural environment’s adaptation to climate change if appropriately directed. The RSPB believes that while the SFP exists and farmers are receiving it, good practice with regard to explicitly facilitating the adaptation of the natural environment through sustainable land management should be fundamental to receiving payment.

In Pillar II, the CAP Health Check has introduced a number of ‘new challenges’ member states must address within their Rural Development Plans, including climate change adaptation. Whilst the RSPB supports these actions in principle, the operations will use Pillar II funds, which account for only about 25% of the total CAP resource. These functions need to permeate the whole CAP.
**The Water Framework Directive**

The Water Framework Directive has great potential to help adaptation in the natural environment, as its default objective is to have 100% of freshwater in good ecological status by 2027. Meeting such a target would confer substantial resilience both to freshwater systems and wider biodiversity dependent on high water quality and ecology. However, at present it seems likely that the UK will only make a fraction of this target, with an objective of under 30% to be in good ecological status by 2015 in the majority of river basin districts, due to the heavy use of derogations.

The Water Framework Directive contains planning cycles that encourage front-loading of activity towards the goal of good ecological status in freshwater systems. These have the potential to substantially benefit adaptation of the natural environment by building resilience early on. As the WFD does not allow deterioration of water quality, early action would build in long-term resilience. Early action toward adaptation is not only best for the natural environment, but can be cost effective too. At present, it seems the UK Government is viewing the phased approach that they have adopted as a reason to delay action, rather than an opportunity to save time and increase the adaptability of freshwater habitats through early action. The RSPB is calling for the Government to be more ambitious in their overall target of the proportion of freshwater systems in good ecological status by 2015, and to front-load their activity wherever possible in order to produce a more sustainable and adaptable freshwater environment.

**Q20)** As other countries in Europe experience climate change, they also will experience changes in the natural environment. What indirect impacts might this have on the natural environment of the UK?

Species could lose core parts of their range elsewhere in Europe, thereby making the UK more important for their overall conservation. For example, drought in southern Europe could lead to loss of wetlands in the Mediterranean basin, an important stop-off for migrating birds, and making our wetlands even more vital. This could happen more quickly than moving climate envelopes, and reinforces the need for us to maintain robust wetlands here.

The climate space suitable for the growing of cereals will move northwards with climate change, making southern parts of Europe less productive. This in turn could increase demand for productivity in the UK as it in turn becomes more central to the grain belt. This could have knock on impacts on land use pressures in the UK, and consequent pressures on the natural environment as laid out above (see response to question five).

There could be impacts on the UK through EU mechanisms influenced by changes in other European countries. As climate change worsens, certain countries will be particularly affected. Pressure from them, leading to changes in EU legislation, could result in changes across the EU which would exacerbate problems everywhere. For
example, Spain, Portugal and France have been trying to reduce the impact of the Water Framework Directive which, if effected, would reduce standards across the EU, with consequent impacts on the natural environment.

And finally…

Q21) Are there any other issues which should be included within the RCEP’s study?
The RSPB would like to recommend two further areas for investigation in the RCEP’s study on adapting the UK to Climate Change. Firstly, the need to establish the cost of adapting the natural environment to climate change in the UK, and secondly, the importance of marine conservation in a changing climate.

The cost of adapting the natural environment to climate change in the UK
Establishing what needs to be spent to facilitate nature to adapt optimally is an essential piece of work if the costs and benefits are to be brought into decision-making, and specifically into the UK Risk Assessment to climate change. To date research, such as that contained in the Stern review, has looked at the costs of human adaptation, for example, in terms of ‘climate proofing’ infrastructure, flood defence, health etc. No one has looked at the costs entailed in the planned aspect of wildlife/nature adaptation. This is an important oversight and the RCEP should be highlighting it in its study.

The importance of marine conservation in a changing climate
The changing climate will not only affect our terrestrial, aquatic and coastal environments, but also the UK’s marine environment. Rising sea temperatures and increases in ocean acidification are predicted to have significant impacts on our seas – some of these impacts are already becoming apparent. For example, seasonal cycles of productivity and reproduction throughout marine ecosystems are changing, upsetting traditional trophic relationships – leading to the recently observed breeding failures around UK coasts as seabirds struggle to find enough food at the right time to bring up their chicks.

Through centuries of overexploitation we have degraded our marine ecosystems, bringing many of our native species and habitats into decline, and reducing the capacity of our seas to adapt to and to mitigate the consequences of climate change. Our marine ecosystems are therefore already severely depleted, and current levels of protection are woefully inadequate to safeguard them against existing impacts let alone the future threat of continued climate change. We must act now to reduce the exploitation of our marine environment, and to increase its resilience to the future impacts of climate change. The RSPB therefore believe that the RCEP should consider adaptation in the UK marine environment. Establishing a comprehensive marine protected area network for the UK is one important action to build resilience in our marine ecosystems.