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Delivering a healthy natural environment

An update to “Securing a healthy natural environment:
An action plan for embedding an ecosystems approach”



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The image on the front cover is an example of floodplain woodland creation

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Further information

Requests for further information can be sent to the Natural Environment Strategic Unit, which leads this work within Defra. Please email ecosystems@defra.gsi.gov.uk or write to the Natural Environment Strategic Unit, Area 3D, Nobel House, 17 Smith Square, London SW1P 3JR.

This update, along with further information on our research programme, is available online at <http://www.defra.gov.uk/environment/policy/natural-environ/ecosystems/index.htm>

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Foreword



We all depend on the natural environment. It provides the essentials of life, inspires us, and is central to our health and happiness.

We recognised over two years ago that the changing and growing pressures that the environment faces demanded a fresh approach to how we manage and use that environment. “Securing a healthy natural environment: An action plan for embedding an ecosystems approach” set out some key actions that Defra considered were necessary to encourage this new way of thinking about our environment across all levels of Government.

Since its publication, we have continued to learn ever more about just how much we as society get from our natural environment: whether that be resources and raw materials to use, services to support us or the many personal benefits we get from interacting with it. As these benefits become more apparent, it has also become clear that we need to value these benefits so that we can ensure a sustainable supply from which people can benefit now and in future.

The work of the last two years has also shown how, by considering how different aspects of the environment are related, we have the potential to make better plans and decisions that open up new opportunities for both protecting and enhancing our environment and our lives.

This update to the Action Plan is written to support and encourage the many people who are working with us to realise those opportunities. It shows some of the ways that taking an ecosystems approach is changing the way we work and provides links to the various new resources and documents that have been produced within the lifetime of the document.

However, changing the way we think and work is not always easy, and there is still much more to do to embed this approach in Government and beyond. This will require us to work together in new ways, strengthening the evidence on the value of the natural environment. We will need to develop new processes to incorporate that value into the decisions we make across all, not just the environmental, sectors and share experiences of what works and what doesn't so that we can respond to future challenges quickly and efficiently.

Most of all, we need to work together with the natural environment, investing in it and allowing it the space and resources it needs to function fully and continue to support our economy and society into the future.

A handwritten signature in black ink that reads "Huw Irranca-Davies". The signature is written in a cursive style and is underlined with a single horizontal line.

Huw Irranca-Davies

Minister for Marine and Natural Environment

1 Executive summary

“Securing a healthy natural environment: An action plan for embedding an ecosystems approach” (which has come to be known as the “Ecosystems Approach Action Plan” (EAAP)) was published at the end of 2007 as a result of two years’ work within Defra and with a range of stakeholders. The EAAP set out the concept and framework of ecosystem services, and described how this could be translated into “an ecosystems approach” to policy and decision making that could be applied at all levels of Government in this country. This focused on two main areas:

- Shifting the focus of policy making and delivery away from looking at natural environment policies in separate “silos” – e.g., air, water, soil, biodiversity – and towards a more holistic or integrated approach based on whole ecosystems
- Seeking to ensure that the value of ecosystem services is fully reflected in policy and decision making in Defra and across Government at all levels

It set out the national, international and regional situation at the time, to show where this approach and framework was already being embedded in policy that related to the natural environment. It also set out the most up to date thinking about the evidence base for this area, including methods for valuing the natural environment and for taking account of environmental limits. Lastly, it looked to the future challenges of climate change adaptation and mitigation to consider how we might need to take an adaptive approach to managing the environment in light of these and other pressures and challenges.

Taking all of this into consideration, it set out five priority areas where progress was needed in order to embed this thinking and approach more firmly into policy and decision making.

- Promoting joined-up working within Defra and the Defra Network to deliver environmental outcomes more effectively
- Identifying opportunities for mainstreaming an ecosystems approach
- Using case studies that demonstrate the benefits of taking an ecosystems approach
- Developing ways of valuing ecosystem services
- Developing a robust evidence base

To drive that progress, it also set out a range of over thirty actions for Defra, its Delivery Network, and other organisations and Government Departments. These actions are summarised in Annex 1.

Importantly, the EAAP highlighted the fact that taking an ecosystems approach is a means to an end: it is meant to help deliver our natural environment outcomes more effectively and efficiently and to help society make better informed decisions about how to balance economic, environmental and social objectives in pursuit of truly sustainable development. It can do this by helping people take better informed decisions that take full account of environmental impacts, by enabling better prioritisation and more efficient use of our resources, and by enabling more effective communication between diverse stakeholders, promoting greater awareness of the value of the natural environment and ecosystem services to a wide section of society.

To evaluate progress and to assess whether we are beginning to see some of the benefits of thinking and working in this new way, Defra committed to reporting back on the EAAP after two years. We have already produced and published on the Defra website two interim updates on the individual actions in December 2008 and July 2009. This document brings those updates together and provides an opportunity also to show where our partners in delivering the EAAP have gone further, exploring new and innovative ways of putting this thinking into their work.



It gives us an opportunity to reflect on the benefits of this new way of working and thinking. In just two years, and with so much continuing research and development work adding all the time to our knowledge and ability to apply this thinking to a diverse range of policies, plans and decisions, we recognise that this is very much still the start of the process. This document therefore also sets out the continuing challenges that we see and that stakeholder feedback has suggested to us, and highlights some of the initiatives in place to help to rise to those challenges. It does not replace the EAAP, and should be read alongside it to give the full picture of how this approach can be embedded across Government.

In summary, over the last two years we have seen this way of thinking and working appearing in increasing numbers of policy and strategy documents in this country and in Europe. We have worked with a wide range of people who have been turning to this way of thinking to better account for the value of the natural environment in their decisions, to look for new opportunities to address environmental issues, and to communicate with a new constituency of people who have not yet considered all that the natural environment could do for them where they live or work. Finally, we have seen a great and continuing expansion of the evidence base related to ecosystem services, in the resources available to policy and decision makers and in practical application of this approach to management of the natural environment on the ground. We are beginning to see the benefits of taking this approach and we will continue to monitor these closely so that we can encourage others to adopt the facets of an ecosystems approach that are most beneficial in different policy or decision making contexts.

Chapter 2 of this document sets out in general terms how our thinking on an ecosystems approach has matured over these two years. Chapter 3 then gives an overview of progress in each of the five priority areas, with conclusions arising from this activity set out in Chapter 4. Chapter 4 also provides a table of documents, resources and information that are linked to the EAAP, to enable the reader to access information quickly and easily as they consider how further they can embed this thinking into their own work.

2 Ecosystem services and an ecosystems approach – applying the framework in a national context

2.1 Ecosystem services provided by UK ecosystems

Ecosystem services can be defined as services provided by the natural environment that benefit people. These benefits include:

- Resources for basic survival, such as clean air and water
- A contribution to good physical and mental health, for example through access to green spaces, both urban and rural, and genetic resources for medicines
- Protection from hazards, through the regulation of our climate and water cycle
- Support for a strong and healthy economy, through raw materials for industry and agriculture, or through tourism and recreation
- Social, cultural and educational benefits, and wellbeing and inspiration from interaction with nature

While there is no single, agreed method of categorising all ecosystem services, the Millennium Ecosystem Assessment¹ (MA) framework is widely accepted and is seen as a useful starting point. The MA identifies four broad categories of ecosystem service which all lead to different benefits:

Provisioning Services

We obtain products from ecosystems such as food, fibre, medicines.

Regulating Services

We benefit from the results of ecosystem processes such as water purification, air quality maintenance and climate regulation.

Cultural Services

We gain non-material benefits from our interaction with the natural environment such as education and well-being.

Supporting Services

Functions that are necessary for the production of other ecosystem services from which we benefit, such as soil formation and nutrient cycling.

Through the Ecosystems Approach Action Plan (EAAP)², we have commissioned, supported and monitored an ever-growing body of research related to ecosystem services and their use as a framework for planning and decision making. Initiatives such as the National Ecosystem Assessment (NEA – see section 3.5) are providing us with a much better understanding of what UK ecosystems have the potential to deliver, and how we can continue to benefit from the services they can provide. The NEA is looking across all of the terrestrial, freshwater and marine habitats of the UK to discern the services they are providing to society. Part of this work has been to dissect the classification of ecosystem services presented in the MA and distil them into a form that is helpful for considering the value of UK ecosystems to society and the economy. A summary of this classification is presented in table 1, together with some of the goods and benefits that each service provides.

¹ Reports can be downloaded from www.millenniumassessment.org/

² <http://www.defra.gov.uk/environment/policy/natural-environ/documents/eco-actionplan.pdf>

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Table 1. Ecosystem services provided by UK ecosystems with examples of valuable benefits to society and the economy. Adapted from the framework being used in the National Ecosystem Assessment.

Ecosystem service type	Primary & Intermediate ecosystem services and processes	Final ecosystem services (example of goods)
Provisioning		Crops, plants, livestock, fish, etc. (wild & domesticated) (food, fertiliser) Water quantity (potable water, Industrial use of water) Trees (timber, avoidance of climate stress) Wild species diversity inc. microbes (natural medicine)
Cultural		Meaningful places (aesthetics, recreation, tourism) Socially valued landscapes, waterscapes and wildlife (aesthetics, recreation, tourism)
Regulating	Climate regulation Pollination	Climate regulation (avoidance of climate stress) Waste breakdown & detoxification (pollution control, waste removal) Hazard regulation – vegetation & other habitats (flood protection) Purification (clean air, clean water, clean soils) Wild species diversity inc. microbes (disease and pest control) Water quantity (flood protection)
Supporting	Weathering Primary production Decomposition Soil formation Nutrient cycling Water cycling Ecological interactions	

The NEA also sets out a framework for considering the role of UK biodiversity in the context of ecosystem service provision, recognising its importance for:

1. **Supporting ecosystem processes:** biodiversity may play a role in the dynamics of ecosystem services, e.g., in nutrient cycling or rates of decomposition.
2. **Providing genes and species:** some species and the genetic variability within them contribute directly to valuable goods, e.g., the use of genetic diversity in wild crop and livestock relatives contributing to breeding programmes, and this increase in genetic diversity can increase resistance to the spread of disease.
3. **Its value to people:** people gain direct personal benefits from the appreciation of wildlife and scenic places and biodiversity also has further spiritual, religious and education value.

The classification in the MA and its development in the NEA therefore provide a solid foundation for considering the ecosystem services that might be relevant to policy and decision makers in this country. Furthermore, our research programme over the last two years has also shown that frameworks such as these can be enhanced by tailoring them slightly to link them to existing structures present in different policy or decision making contexts.

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Defra's "Introductory guide to valuing ecosystem services (2007)"³ advocates a stepwise approach through which it is possible to reveal "priority" services for further consideration. Therefore, by revealing these priorities and linking them to the specific policy context, the policy or decision maker can make best use of the available evidence and present the result of their analysis in a way that is meaningful to their stakeholders. Examples of this are worked through in the case studies that have formed part of the EAAP, such as applying it to environmental stewardship policy, or planning for green infrastructure (see section 3.3).

2.2 Valuing ecosystem services

Understanding more fully the various services that our ecosystems are providing makes it feasible in a growing number of situations to use economic and non-economic methods to place a value on those ecosystem services flowing from any particular place or habitat.

Although this economic value will not capture the full value of any particular habitat or species, which necessarily includes different types of value systems, it does provide a clear guide to magnitude and direction of benefits that society is likely to enjoy if it makes the necessary investments in maintaining and enhancing the natural systems that provide these valuable services. It also helps to inform better decisions about how we use the natural environment and the trade-offs we face, enabling society to benefit more fully from those services now and also to avoid the costs of living without or replacing these services in future should natural systems become less effective at producing them.

New practical tools for valuation and a growing evidence base mean there is increasing scope to incorporate changes to the value of the environment in policy appraisal⁴. These are supported by practical projects (see section 3.4) which are demonstrating how markets for services such as water purification or recreation and tourism can make these values real for landowners, incentivising them to use and manage their land for multiple purposes. As we begin to incorporate these factors into decisions across different sectors of the economy, we are increasingly uncovering a solid economic case for actions which work with natural systems to deliver benefits to society.

2.3 Linking ecosystem structure and function to societal and economic benefits – using ecosystem services as a translation system

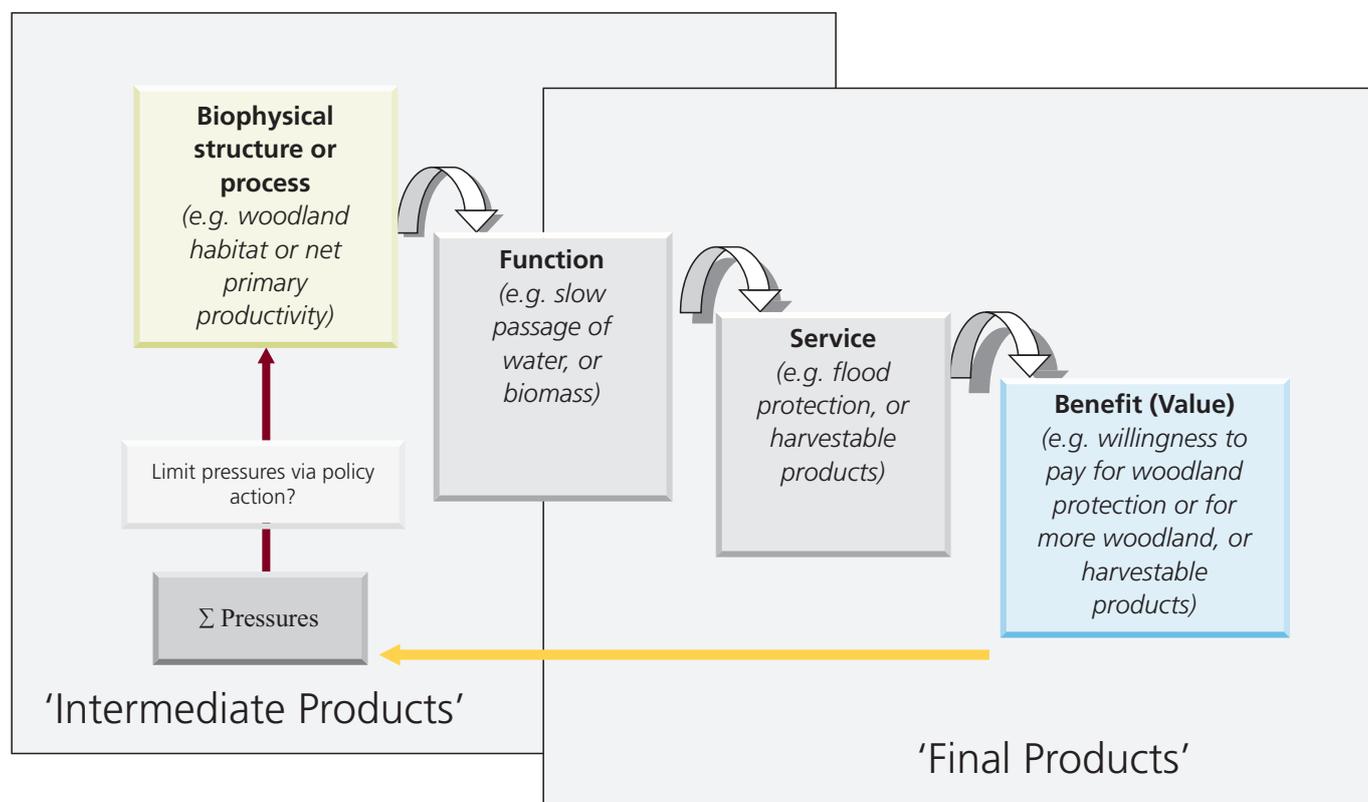
We are beginning to understand better in a number of areas how these services also relate to the structure and function of our ecosystems (Figure 1 provides a schematic view of this linkage). This is an area where more fundamental research is needed to assist in our ability to link the actions we take to protect or enhance various aspects of ecosystems and the various forms of benefits that derive from those actions. Indeed, ecosystem services has been recognised as one of the big overarching challenges for the Department in its new Evidence Investment Strategy (see section 3.2.1.1). Some of the work we have in place or planned to address these issues is further detailed in section 3.5.

3 <http://www.defra.gov.uk/environment/policy/natural-environ/documents/eco-valuing.pdf> – see chapter 3 for the "Impact Pathway" approach to the valuation of ecosystem services.

4 <http://www.defra.gov.uk/environment/policy/natural-environ/using/value.htm>

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Figure 1. The relationship between biodiversity, ecosystem function and human well being (taken from Haines-Young and Potschin, 2010⁵)



However, even without knowing the detailed linkages between structure, function, service and value for each system in which we have an interest, simply understanding the structure of these relationships can help significantly in embedding this approach into policy and decision making.

For example, consideration of the steps in Figure 1 enables different groups of experts to communicate with each other – ecologists and earth scientists looking at the first two steps need to put their work through the “translation” of ecosystem services, to help them explain issues of concern to them to the economists and social scientists who might be studying the last steps of the process.

Policy makers can use this understanding to help them consider how setting up markets for different ecosystem services might impact on the structure and function of ecosystems themselves, or conversely consider how action to preserve the structure of an ecosystem (e.g., steps to protect or enhance biodiversity) may have considerable economic and societal benefits above simply the conservation of that particular area. In both cases, such consideration could lead to policies that have a greater range of benefits for the natural environment.

This ability to translate across disciplines is one of the strengths of the ecosystem services framework. However, it is also one of its challenges, as it is “new” language to all, connecting different stakeholders who may formerly not have interacted. Therefore it needs to be carefully handled and explained to avoid confusion between different parties. We recognise that there is a continuing need to improve the way that we communicate this approach and the concepts that lie behind it to different audiences, aiming for consistency of meaning, but recognising that it will be necessary to adapt our approach depending upon which part of the “chain” in Figure 1 our audience is most familiar with.

⁵ Haines-Young, R. & M. Potschin (2010): The links between biodiversity, ecosystem services and human well-being. In: Raffaelli, D. & C. Frid (eds.): *Ecosystem Ecology: a new synthesis*. BES Ecological Reviews Series, CUP, Cambridge [in press] – also in Defra project report NR0107 – <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=14751#Description>

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2.4 Using the ecosystem services framework – taking an ecosystems approach in practice

The EAAP described an ecosystems approach as a generic framework for incorporating the holistic consideration of ecosystem services and their value into policy, plan and decision making at all levels of Government in this country. Progress with actions in the EAAP over the last two years and the expanding evidence base continues to support the five original principles behind an ecosystems approach:

- Taking a more holistic approach to policy-making and delivery, with the focus on maintaining healthy ecosystems and ecosystem services
- Ensuring that the value of ecosystem services is fully reflected in decision-making
- Ensuring environmental limits are respected in the context of sustainable development, taking into account ecosystem functioning
- Taking decisions at the appropriate spatial scale while recognising the cumulative impacts of decisions
- Applying adaptive management of the natural environment to respond to changing pressures, including climate change

We have seen different policy areas exemplifying each of these principles (and often several of them) over the last two years. Work feeding into Defra's forthcoming Climate Change Plan has highlighted the importance of taking a whole system approach to a set of policies that both will have impacts on many aspects of the natural environment, and where the natural environment has a strong role to play in delivering other important objectives for society. This work has also demonstrated the need for a policy framework that promotes adaptive management, allowing the environment and our management of it to change with time as pressures (and our knowledge of how to respond to those pressures) change.

Demonstrator studies addressing the challenges of water quality and fluvial or surface water flooding have been designed to show the possibilities that arise when decisions about management are taken at an appropriate scale and when cumulative impacts are taken into consideration across a whole catchment or river system. Further details of these are given in section 3.3. The Impact Assessment for the Marine and Coastal Access Act (see section 3.4) has demonstrated the feasibility and utility of using ecosystem service valuation to assist policy making, and work in the East of England has shown how the concept of environmental limits can be used to enhance decision making surrounding options for local development (see section 3.3).

However, various strands of the work of the last two years also point to the importance of involving people in taking an ecosystems approach (very much in line with the Convention on Biological Diversity definition of the ecosystem approach⁶). Although such stakeholder engagement is part of all good policy making, as we look forward to further implementation of an ecosystems approach in a wide range of policy contexts, it seems appropriate to stress that an important principle in taking an ecosystems approach in this country is:

- Identifying and involving all relevant stakeholders in the decision and plan making process

6 <http://www.cbd.int/decision/cop/?id=7148>

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Stressing this makes the point that taking an ecosystems approach requires careful thought about who the stakeholders affected by a decision really are. This is particularly relevant where ecosystem services are generated a point distant from where the majority of beneficiaries are, e.g., in issues surrounding water quality or provision across a large catchment. We are currently developing guidelines to enable people to do this effectively, as described in section 3.4.

Finally, stakeholders have suggested that we need to demonstrate the benefits of embedding these principles in practical policy and decision making. This document charts some of the areas where this has made a positive contribution to work across Government, and the Defra Network are also supporting further work that tests this approach out in a variety of practical situations (see section 3.3). Such studies will provide us with clear evidence of the benefits of different aspects of this approach and to enable us to pass on lessons learned from these projects to the growing number of people attempting to embed this thinking in their work.

The next chapter gives many more details of how and where this approach is being embedded in Defra, Defra's Delivery Network, other Government Departments and in different parts of the country. These examples illustrate many of the points above and point also to the continuing challenges that we face in using an ecosystems approach to enable more effective and efficient delivery of our natural environment goals.

3 Progress in embedding an ecosystems approach over the last two years

The EAAP identified a number of clear priority areas for action that it was felt would be fundamental to success in embedding this approach and to securing wider engagement at the national, regional and local levels. In the last two years, good progress has been made against these actions, with, in some cases, people and organisations going further than the original actions anticipated and embedding an ecosystems approach in additional areas or new ways. Highlights of progress are given below, together with links to specific outputs from the actions and ongoing challenges in these areas.

3.1 Promoting joined-up working within Defra and the Defra Network to deliver environmental outcomes more effectively

3.1.1 Progress

An ecosystems approach is now reflected in the plans and activities of Natural England, the Environment Agency and Forestry Commission, and each organisation is exploring a variety of ways to embed this thinking into their work, such as the Catchment Management work that the Environment Agency is undertaking with Defra, the ecosystem service pilots being run by Natural England, and Forestry Commission's Trees Woods and Forests implementation plan.

Government Offices, the Environment Agency, Forestry Commission and Natural England have also developed a framework which sets out the respective expectations and ambitions for working together at regional level. The collective aims are to:

- Align priorities at a regional and local level
- Promote environmental thinking as a core component of sustainable development
- Provide a clear evidence base to agree strategies for intervention and investment in places

Together, they have also begun work on identifying, via the use of evidence, key environmental priorities within each region. This may include expected changes to the region from climate change, key strategic sites, implications for water resources, as well as information on biodiversity and green infrastructure. They are also working on an enhanced evidence base, which will be an important means of ensuring that environmental considerations inform delivery of Public Service Agreement 28 on the natural environment (see section 3.2.1) and development of strategies at a regional level.

The Network is also doing targeted work at local level to support delivery of environmental objectives where their assistance is needed most. For example, Natural England has published nine regional statements of the regional strategies with which it will engage <http://www.naturalengland.org.uk/planning/regionalplanning.htm> These reflect the importance Natural England attach to their engagement with local authorities across the range of their responsibilities e.g. land use planning, highways authorities and land owners. Natural England, Government Offices, the Environment Agency and other partners are also working with 115 Local Area Agreement Authorities to deliver improvements relating to Defra's Local Area Agreement natural environment indicators.

From April 2008 Environment Agency Area teams have had a service level target to work with all upper tier Local Authorities and their local strategic partners to ensure that their Sustainable Community Strategies recognise the importance of the environment, and to work with them to deliver agreed Local Area Agreement targets. The Environment Agency is also targeting its work with Local Authorities, with priority given to Local Authorities with the 50 poorest environments in England. This targeting will be further assisted by the work underway to produce a baseline of environmental pressures in each area.

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The Environment Agency and Natural England are also working together through to their operational teams on the implementation of the new “duty to co-operate” with local authorities and the new Local Government Performance Framework.

3.1.2 Challenges ahead

As with all organisations involved in the EAAP, various policy and delivery areas in the Defra Network have gone further than others in embedding the principles of an ecosystems approach into their work. There is still work to be done centrally and in the regions to “translate” this approach into what it means for those delivering change on the ground and to provide the guidance and resources needed by different parts of the network to incorporate this thinking into their work.

It will also be important to continue to improve upon the new structures and ways of working that have emerged over the last two years to strengthen the links between policy goals in central Government and the implementation of change on the ground. An important part of this will be to share best practice and examples of where aspects of the approach have yielded significant benefits so that these benefits can be replicated in other places.

There also remains the challenge of how we measure success in the improvements that are being made to the natural environment. Research undertaken by Defra suggested that the Network already collects information on a wide range of environmental parameters that could yield information about changes to ecosystem service provision in different places⁷. The National Ecosystem Assessment (see section 3.5) will further elucidate the ability of the data we currently collect to provide this information.

3.2 Identifying opportunities for mainstreaming an ecosystems approach

3.2.1 Progress

The vision for the Defra-led Public Service Agreement to secure a healthy natural environment for today and the future (PSA 28⁸) states its vision as:

“To secure a diverse, healthy and resilient natural environment, which provides the basis for everyone’s well-being, health and prosperity now and in the future; and where the value of the services provided by the natural environment is reflected in decision-making.”

Therefore valuing the natural environment underpins the delivery of this PSA.

Several of the actions in the EAAP have helped make progress in delivery of the PSA’s vision, for example those that are increasing the incorporation of ecosystem service valuation into policy and decision making or providing examples of where proper consideration of the natural environment is helping deliver the objectives of other Departments.

Other actions have in turn been enabled by the cross governmental working that has been fostered by the PSA. It has, for example, helped in improving communication around the importance of the natural environment, in encouraging greater collaborative working between the Defra Delivery Network and local and regional Government and in disseminating techniques and guidance on valuing the environment to other Departments and their own delivery bodies.

⁷ <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=15699&FromSearch=Y&Publisher=1&SearchText=NR01&GridPage=1&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

⁸ The delivery agreement for this PSA can be found at: http://www.hm-treasury.gov.uk/d/pbr_csr07_psa28.pdf

3 Progress in embedding an ecosystems approach over the last two years

3.2.1.1 *Mainstreaming an ecosystems approach within Defra*

The Defra website relating to an ecosystems approach has been completely updated to provide step-by-step advice on all aspects of promoting and undertaking an ecosystems approach. It contains material that can be used for communication, by analysts, by policy makers and by scientists to enable a wide range of people to embed this thinking into their work.

These resources can be found at:

<http://www.defra.gov.uk/environment/policy/natural-environ/>

The value of our natural environment and the need to deliver environmental improvements in a more joined up way that considers how best to work with natural systems continues to be a core message in many communications from Defra.

Examples of these messages can be found at:

<http://www.defra.gov.uk/environment/policy/natural-environ/understand/index.htm>

Also, Defra's new **Evidence Investment Strategy** (EIS)⁹ highlights protecting ecosystems services as one of the three big interlinked evidence challenges for the Department. The strategy recommends that more evidence investment needs to be directed to these big enduring challenges.

For more information about the strategy and the role of ecosystems services within it see <http://www.defra.gov.uk/evidence/science/how/strategy.htm>.

Consideration of ecosystem services is now also embedded in a number of policy areas within Defra, for example in **"Future Water"**¹⁰. Looking ahead to 2030, Future Water sets out some of the practical steps society will need to take to ensure that good clean water is available for people, businesses and nature. Future Water recognises that, because water is essential to life, and because almost everything society does affects water in some way – from what is abstracted from the environment to what is put down the drain, treated in sewage works and then discharged back into the environment, to how houses are designed or land is managed – it needs to consider all of these aspects in a whole-system way. It notes the importance of diverse ecosystems in enhancing water quality, and outlines a strategic and integrated approach to the sustainable management of our water resources, for the public water supply as well as for the provision of healthy ecosystems and the services they provide.

Future Water also commits to building on the success that has been achieved through the England **Catchment Sensitive Farming Delivery Initiative** (ECSFDI). Catchment Sensitive Farming (CSF) is land management where stakeholders such as farmers, water companies, Natural England and the Environment Agency work in partnership to keep diffuse emissions of pollutants to levels consistent with the ecological sensitivity and uses of rivers, groundwaters and other aquatic habitats, both in the immediate catchment and further downstream. The ECSFDI currently delivers CSF advice to farmers in priority catchments which cover approximately 40% of England, and we are looking to build on this in the future to help deliver Water Framework Directive objectives, which include achieving good biological and chemical status in water bodies by 2015.

An ecosystems approach is also embedded within Defra's policy statement on the **"Appraisal of flood and coastal erosion risk management"**, published in June 2009¹¹. This policy statement sets out the principles of appraisal for public policy and investment in flood and erosion risk

⁹ <http://www.defra.gov.uk/evidence/science/how/strategy.htm>

¹⁰ <http://www.defra.gov.uk/environment/quality/water/strategy/pdf/future-water.pdf>

¹¹ <http://www.defra.gov.uk/environment/flooding/documents/policy/guidance/erosion-manage.pdf>

3 Progress in embedding an ecosystems approach over the last two years

management. It states that the impacts that different options under consideration have on the environment should be fully described and taken into account in appraisal and that opportunities to enhance the natural environment and improve its capacity to perform ecosystem services should be identified and the potential benefits valued. It also embeds the consideration of environmental limits, stating that legislation and policy to protect particular aspects of the environment, such as natural and historic features, should be followed to ensure that FCERM does not breach critical environmental thresholds.

The Environment Agency is also updating its **Flood Risk Management Environmental Valuation Handbook**. This update takes account of developments in the valuation literature, including ecosystem services. This guidance will be published during 2010 and will be used to guide investment decisions in flood risk management.

Different facets of an ecosystem approach also underpin many of the provisions of the **Marine and Coastal Access Act**. The Act sets out an integrated set of provisions for a new approach to the management of activities in the marine area. Each of the different elements of the Act will contribute significantly to the achievement of the objectives and benefits of the others. For example, in the case of the marine nature conservation provisions, the Marine Policy Statement (the first stage in the new marine planning system) will set out the UK Government's ambition and priorities for the policies that shape the use of our marine resources and how we will achieve sustainable seas. Marine plans (the second stage in the new planning system) will help to inform decisions on the location of Marine Conservation Zones and the setting of conservation objectives. The conservation objectives will be furthered through the new duties placed on public authorities which will have effect through the new marine licensing system and extended conservation powers of the new Inshore Fisheries and Conservation Authorities (which will replace Sea Fisheries Committees) and the Marine Management Organisation (the Government's strategic delivery body in the marine area to be vested in April 2010).

This approach is also important to work developing the Department's Climate Change Plan, due to be published shortly. This work recognises the interconnectedness of systems in responding to the dual challenges of mitigation and adaptation, and also highlights the importance of the natural environment in providing society and the economy with cost effective responses to the changing climate.

More specifically, as part of implementing the England Biodiversity Strategy, Defra has produced a set of **Climate Change Adaptation Principles**¹². These include the need to integrate action across all sectors and to take an approach that accommodates change in order to manage the complex interactions between people and their natural environment and so to maintain the services and benefits that society derives from biodiversity and ecosystems. These principles are supported by a range of research projects and case studies to examine the effects of and our response to climate change on biodiversity.

3.2.1.2 Mainstreaming an ecosystems approach within other Government Departments

Other Departments are also beginning to include this thinking into their work. For example, the Department for International Development (DfID) has committed £27 million to the Ecosystem services for Poverty Alleviation research programme, which, together with funding from the Natural Environment Research Council and the Economic and Social Research Council, will direct over £40 million to researching how better consideration and management of ecosystem services can meet

¹² <http://www.defra.gov.uk/environment/biodiversity/documents/ebs-ccap.pdf>

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DfID's goals for international poverty reduction <http://www.nerc.ac.uk/research/programmes/esp/>. This has been further supported by the announcement in DfID's recent White Paper "Building our common future" <http://www.dfid.gov.uk/About-DFID/Quick-guide-to-DFID/How-we-do-it/Building-our-common-future/> that the UK will invest in a new international initiative on valuing natural capital that builds on the existing project on The Economics of Ecosystems and Biodiversity (TEEB – which DfID are also supporting). This will develop and pilot a common tool to help countries incorporate environmental values into economic decisions. It will support wider efforts to build countries' capacity for environmental management, including climate adaptation and development plans.

The Department for Communities and Local Government (CLG) continues to work closely with the Defra Network in developing policy concerning eco-towns. This includes ambitious minimum requirements for biodiversity, green infrastructure and ecosystem management which CLG set out in the Eco-towns Planning Policy Statement in July 2009¹³.

The Department for Transport has committed to work with Defra to reflect the value of the natural environment in a more joined up way in their appraisal of plans and strategies. They have, for example, been conducting research with Natural England into the incorporation of the valuation of landscapes into their appraisal tools, and working with the Environment Agency to address diffuse pollution issues from major roads and junctions.

Working with economists from a number of Departments, Defra is also leading a review of the economics of sustainable development on behalf of the Government Economics Service (<http://www.defra.gov.uk/evidence/economics/susdev/index.htm>). The objective of this review is to establish a clear analytical framework for considering sustainable development in policy development, appraisal and evaluation.

An interim report was published in October 2009, which proposed a working definition of sustainable development. It also identifies considerations that policymakers need to understand when assessing whether an individual project or policy is consistent with the Government's position on sustainable development. The recommendations focused on putting this assessment into practice, including updating guidance for policymakers for the Impact Assessment process, and extending the coverage for valuation of environmental impacts.

The final report is expected later in the Spring of 2010, and will report back with the progress made on recommendations and further steps to make the analytical consideration of sustainable development more operational.

3.2.1.3 Mainstreaming an ecosystems approach in the Regions

Regionally, the Government Office Natural Environment Leads network have undertaken numerous initiatives in support of applying an ecosystems approach at a regional level, holding workshops, funding demonstration projects and producing communications materials which enable people in the regions to understand the importance of considering the natural environment and how it contributes to wider economic and social outcomes as part of their work. Now several regions are investigating implementing this approach in a variety of projects, many of which are not primarily environment-focused. Defra are also enabling this process, for example by assisting others to explore the concepts around regional growth within environmental limits, and through work to ensure the national indicator set better reflects the complete natural environment agenda.

¹³ <http://www.communities.gov.uk/publications/planningandbuilding/pps-ecotowns>

3 Progress in embedding an ecosystems approach over the last two years

3.2.2 Challenges ahead

The UK's first Climate Change Risk Assessment is due to be published in January 2012 and will assess the risks posed to the UK, including to those things that have economic, environmental and social value. The CCRA team are working with the National Ecosystem Assessment, and other experts, to make the best use of the most up to date evidence and methods when assessing the level of risk posed to the natural environment.

As part of the EAAP, Defra has assessed the challenges to and opportunities for incorporating ecosystem valuation into policy appraisal across Government. A summary of this work which demonstrated where there are further opportunities for working with other Departments to incorporate this thinking at local, regional and national levels where policy appraisal is taking place will be available next month¹⁴.

3.3 Using case studies that demonstrate the benefits of taking an ecosystems approach

3.3.1 Progress

Defra has supported a range of case studies over the last two years to examine how an ecosystems approach might be embedded in a number of policy areas, e.g., green infrastructure planning, catchment management, environmental appraisal, air quality and environmental stewardship. These projects have produced some useful findings that both show the benefits of taking an ecosystems approach and also the challenges of doing this in practice. The reports of all of these case studies can be found at <http://www.defra.gov.uk/environment/policy/natural-enviro/research/case-studies.htm>.

One project looking at a transport scheme highlighted the differences in project appraisal that would result from considering impacts at spatial scales which were appropriate to the ecosystem service in question, rather than only looking adjacent to the planned road route. It also showed how an ecosystems approach would have considered the value of the contribution of the ecosystems' services to human wellbeing and the economy, concluding that this would have enabled a clearer and more comprehensive assessment of value to feed into the decision making process.

However, several of the case studies reported that currently available information that is needed for accurate valuation of different ecosystem services still could benefit from improvement. They pointed to the need to be aware of the limits to such valuations, and use them pragmatically, investing extra effort where uncertainties that could have a major impact on the outcome of the decision or the implementation of the policy remain.

The case study looking at the management of the Parrett Catchment in Somerset showed the importance of considering the perspectives and needs of wider stakeholder groups when framing and initiating the decision making process. Language and the issues considered need to be carefully chosen so that they can be meaningful to everyone who needs to be involved in the decisions.

However, both the Otmoor study and the Thames Gateway Green Grid study showed that, with careful "translation", using an ecosystem services framework was an effective way to engage a wide range of stakeholders on the benefits they derived from "natural" areas. The strength of this approach was that it then enabled people with differing viewpoints and backgrounds to discuss management and planning issues related to these areas in a common language.

¹⁴ This will be made available on the Defra website.

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The case studies looking at applying an ecosystems approach to Environmental Stewardship and Air Quality policy both showed that this approach improves consideration of the multiple impacts and benefits that policy interventions can have on ecosystems and the services they provide to society. Both also highlighted the need for clear and careful communication of these benefits to enable all the relevant stakeholders to understand more fully the results of their actions. In both cases considerable knowledge gaps remain in defining precisely the value of the changes in benefits when different options are taken, and these are areas for further research work.

The Environment Agency and Natural England have also undertaken projects which demonstrate this approach in their areas of work.

The Environment Agency has strengthened the evidence base for its policy on strategic land use by researching how this impacts upon water quality and availability, flood risk management and carbon storage in soils within the context of an ecosystems approach¹⁵.

The Agency has also produced four case studies, addressing ecosystem service outputs and their economic values at different scales. The **River Tamar** (catchment scale management) case study analysis demonstrates significant net societal value stemming from the Tamar 2000 project, spread over a wide range of ecosystem service benefit categories. The intended benefits for provisioning services and cultural services are significant, but so too are incidental benefits including regulatory services (such as climate regulation) and supporting services (including habitat provision, nutrient cycling, etc.).

The **Alkborough Flats** case study (part of the Agency's wider work on the Humber Estuary), demonstrated that the ecosystem services analysis provides defensible evidence of how managed realignment can yield broader and more sustainable benefits to the population. Significantly, the case study found that an assumed 'trade-off' of provisioning services (loss of arable land) to provide beneficial regulatory, cultural and supporting services did not in fact materialise, with the replacement grazing regime more than offsetting the loss of cereal and straw production. This shows that innovative management for wider benefits need not result in a 'trade-off' of provisioning values. The site is being used as a demonstration project to help promote new approaches to the impacts of sea level rise across Europe.

The case study of the **River Glaven sea trout restoration** addresses a smaller, rural catchment in North Norfolk, demonstrating that the direct fish-related benefits are small compared to wider societal benefits ranging from reducing flood risk to improved local amenity and regional tourism. It also reinforces a conclusion from prior studies that ecosystem restoration tends to deliver positive benefits across all ecosystem service categories.

Finally, a local-scale case study exploring the ecosystem service benefits of a 'buffer zone' installed to address severe cattle poaching of the ground on the upper **Bristol Avon** in North Wiltshire demonstrates that carefully-targeted ecosystem protection can enable a river system to regenerate habitat delivering significant fisheries, wildlife and aesthetic values. Fishery interests drove this scheme, yet fishery-related benefits accounted for less than 10% of the total benefits most of which accrued to the wider public and the vitality of the river reach.

These four case study reports conclude that major benefits are to be gained from the use of ecosystem services to consider innovative solutions in ongoing programmes and uptake into tools and processes. The Environment Agency is, for example, updating its approach to River Basin

¹⁵ <http://publications.environment-agency.gov.uk/pdf/SCHO1009BRDG-e-e.pdf>

3 Progress in embedding an ecosystems approach over the last two years

Management Plans using the ecosystem services approach. The approach can help optimise the value stemming from environmental management decisions across a broad range of stakeholders across a range of policy areas, and also help to identify opportunities and avert unforeseen negative consequences.

Natural England is developing three **ecosystem service pilots** in Cumbria, Yorkshire and the South West that aim to revolutionise the way in which upland land managers are able to generate wealth. Through sound science, financial innovation and new partnerships, the pilot projects will seek to transform the economics of upland land management and demonstrate how the provision of a broader range of ecosystem services can be turned into genuine business opportunities. By doing this, it is hoped that the multiple problems of water quality, flooding, carbon storage, and indeed wildlife decline will be addressed in an integrated and cost-effective way.

Natural England has developed a vision for the uplands (Vital Uplands) in which it sets out how ecosystem services will function and benefit society in 2060. **Vital Uplands** covers the wide range of services they provide, their stunning landscapes and rich wildlife and contribution to food production. The vision is underpinned by; *an atlas* which describes, through maps, many of the benefits people derive from the upland environment and how we might secure these for the future and an economic valuation of upland ecosystem services which explains the economic implications of land use change in the uplands at a variety of scales. This uses six case studies. The results of this work can be found at <http://naturalengland.etraderstores.com/NaturalEnglandShop/NE210>

3.3.2 Challenges ahead.

Feedback from stakeholders has suggested that, in order to convince a wider audience of the utility of this approach, we need to have examples of where it has made a positive difference in practice. Defra is therefore currently conducting research that studies examples of where this approach is being taken around the country, and assesses the costs and benefits of this approach. A key part of that research will be to look for the transferrable lessons that are being learned in each case and to pass on this information in order to help others to incorporate this into their own work.

We are also aware that there are many around the country who are embracing this thinking and incorporating it into their work. A challenge ahead therefore is to link up these practitioners so that they can share experiences, information and techniques, so increasing the effectiveness of delivery for future projects.

Examples of this regional activity which the Defra Network is supporting include:

Natural Economy Northwest is seeking to integrate the value of ecosystem services into decision making, particularly for investments. The work of Natural Economy Northwest (NENW)¹⁶ has demonstrated a range of economic benefits arising from Green Infrastructure (GI) that can be directly linked into the economic performance of a region. It has also shown that the better the quality and functioning of the ecosystem services that underpin GI, the greater the benefits. For example, the Northwest's woodlands have been valued at ~£600m in possible markets for carbon sequestration while its wetlands are a similar major resource. Their work has also provided evidence that protecting and enhancing woodlands and wetlands and creating sustainable urban drainage systems can all prevent or alleviate flooding and reduce the risk of substantial flood damage (some 212,500 properties in the NW are considered at risk). This work is repositioning the environment in terms of "Gross Value Added" and demonstrating its potential for creating the conditions for growth and increasing economic security.

¹⁶ See www.natureconomynorthwest.co.uk.

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Phase one of the **Valuing Ecosystem services in the East of England (VEsSiEE) project** assessed and evaluated the ecosystem services in the East of England using a methodology based on the framework of the UN Millennium Assessment. Five case study areas, with a range of ecosystems and characteristics were chosen to test the methodology. The case studies demonstrated the value of some of the most important ecosystem services in the East of England. They focused on different issues in different case study areas to demonstrate how the ecosystem services approach can be applied in a range of situations.

The reports from the phase one can be found at the following link:

http://www.gos.gov.uk/goeast/environment_and_rural/environment_issues/ecosystems_services/?a=42496

As the first phase was based on theoretical scenarios, the **second phase of the VEsSiEE project** will be taking the methodology from phase one and testing it through a range of real life regional and local pilots. The pilots will take an ecosystems approach and apply it to real life decisions or strategy development including to non-“environmental” situations and decisions. By doing this the project aims to develop tools that can be transferred to a variety of policy and decision making contexts.

Through the **Peat Partnership Project**, we have been building a more detailed evidence base of the processes by which peat restoration measures can help contribute towards delivery of these ecosystem services (see also section on future work). Peat bogs provide a wide range of ecosystem services. They are particularly well known for their provisioning services (e.g. agricultural output/fuel) which generate around £30million per annum¹⁷. However, it is possible that the damage costs from annual losses of carbon emissions from degraded peat (through extraction) could be ten times larger. Various peat restoration projects have demonstrated benefits in terms of biodiversity and potential for water quality benefits and avoided water treatment costs, which highlights there are opportunities which exist for making the most of a wide range of ecosystem services. It is important that we fully understand how to optimise the delivery of this range of ecosystem services which peat soils and habitats provide for society.

In March 2009 the Secretary of State announced Defra funding of nearly £1 million for 3 projects selected under the **Multiple Objective Flood Management Demonstration Project Scheme**. The Scheme aims to:

- Demonstrate and promote the contribution that land management can make to managing local flood risk
- Produce other benefits for the environment and communities such as; conserving biodiversity; enhancing the landscape; promoting carbon sequestration and improving water quality
- Provide help to reduce risk for communities where conventional structural measures are not affordable or sustainable
- Improve the evidence that land management techniques have a role in adapting to increasing flood risk in the face of climate change
- Achieve these objectives by working with natural processes. For example; by restoring upland peat bogs; woodlands; water meadows; watercourse buffers; moorland vegetation; gully blocking and coastal features

¹⁷ Note: these are 2001 figures so recent data may provide different figures.

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The funding is being shared between three projects:

- The National Trust's **source to sea** Holnicote Project in Somerset
- The Environment Agency led **Making Space for Water** project in the Upper Derwent Valley, Derbyshire
- The Forest Research led project **Slowing the Flow** at Pickering in North Yorkshire

The projects commenced work in the summer of 2009 and Defra funding under this scheme will run to March 2011. All of the projects are partnership initiatives and each of them will collaborate with the other projects in the scheme. They are intended to inspire further innovation in land management to manage flood risk and provide hard evidence of the value of integrated management.

The Environment Agency is a partner, together with the Westcountry Rivers Trust and South West Water, in a new EU project called **WATER** – Wetted land: the Assessment, Techniques and Economics of Restoration. This 3.8 million euro project will work with partners across the North Coast of France and the South Coast of England to develop a market based catchment restoration scheme which will be based on a Payments for Ecosystem services (PES) model and aims to identify both delivery and funding mechanisms to lever private investment for catchment restoration. It will achieve this by developing a set of five robust cost/benefit guides that demonstrate how investment from private companies in catchment restoration can make a long-term impact on their profitability and competitiveness. Ultimately the aim is that the people and businesses that benefit from good ecosystem function will pay directly the people who deliver good ecosystem function because they have a clear understanding of the economic, social and environmental benefits shown by this project.

These are just some examples of where public, private and third sector organisations are working together in new partnerships to meet their different objectives by working constructively both with each other and with natural systems. It will be important to learn from such new partnerships so that the benefits of their experiences working in this new way can be passed on to other projects around the country.

3.4 Developing ways of valuing ecosystem services

3.4.1 Progress

3.4.1.1 Resources to enable better valuation of ecosystem services

Over the last two years, the Defra Network has been working together to develop new tools which supplement the Introductory Guide to Valuing Ecosystem Services. This includes a set of guidelines for using “value transfer” (also known as benefits transfer) techniques in policy appraisal, so that valuation can be more readily and robustly used in a variety of situations¹⁸. This approach allows analysts to use existing valuation evidence to derive the value of policy changes which impact on the natural environment. Web based guidance is now available on the Defra website, and includes practical case studies to demonstrate the approach in relevant policy contexts, including water quality and land use, upland areas, flood risk management, marine conservation zones and national parks.

This practical guidance is backed up by the forthcoming Value Transfer Strategy¹⁸, also produced in partnership with the Defra Network. This sets out steps to enable better incorporation of valuation evidence into policy and decision making, from developing and consolidating the valuation evidence base to opportunities for raising the capacity of analysts across Government to undertake such analysis.

¹⁸ <http://www.defra.gov.uk/environment/policy/natural-environ/using/value.htm>

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Alongside this work, Defra is currently in the process of updating its environmental impact appraisal guidance so that it incorporates the most up to date information on environmental valuation, highlighting these new practical tools, and is consistent with taking an ecosystems approach. The Treasury Green Book provides the overarching methodology for policy appraisal and evaluation with this updated Defra environmental guidance providing more detailed support for taking account of and valuing environmental impacts in policy appraisal.

3.4.1.2 Impact of valuation on policy making

Improved valuation of ecosystem services has already had significant impacts on policy and decision making in Defra. It has helped demonstrate the benefits of policies. For example, the ecosystem services framework was used in the formal evidence base for the **Marine and Coastal Access Act Impact Assessment**, building on the evidence derived from a study by Beaumont *et al.*, (2006). The analysis for the IA used the underlying ecosystem services framework¹⁹ to consider the full range of benefits that might be derived from a range of hypothetical networks of Marine Conservation Zones (MCZs). The present value of on-site benefits (over a 20 year period) were estimated in the range of £8.6bn – £19.5bn. Although there are still challenges in properly valuing the benefits we gain from our marine environment, this represented a significant step forward in establishing a body of marine environmental valuation literature applicable to the UK and will be critical in ongoing work to decide on future MCZs.

It has also helped to support decisions on management of the natural environment. For example, analysis for the **Water Framework Directive (WFD)** implementation assessed people's willingness to pay for levels of improved water-based habitats and biodiversity that are consistent with achieving overall targets of good ecological status in most water bodies 2027²⁰. A water body at good ecological status should be capable of providing the majority of ecosystem services expected from such water bodies (see table 1). These values have provided robust evidence on the overall estimated benefits to compare with the costs and are being used to assess options for how to achieve the 2027 targets.

Valuation has also helped to demonstrate the benefits of policies, for example in applying the ecosystems framework to consider the benefits of **National Parks spending**. The framework helped to direct a literature review ensuring all relevant areas were considered, and has provided a basis for considering how evidence should be developed/gathered in the future. This has stimulated interest from individual National Parks in carrying out further such work of their own to enable them to consider how they can deliver most value.

It is also helping to clarify and communicate the economic impacts of global environmental degradation. **The Millennium Ecosystem Assessment** estimated that 60% of the services we get from our environment are being used unsustainably. **The Economics of Ecosystems and Biodiversity (TEEB)** (see section 3.5) project has taken this argument further. Overarching values from the first phase of this study suggest we are losing services with a value equivalent to around 50 billion euro (in the first years of the new millennium) from land-based systems alone. These losses are equivalent to around 7% of GDP by 2050. This is a 'welfare' value not a GDP loss as currently many of these services are not included in GDP.²¹ The TEEB initiative highlights the economic scale of a degraded environment, but also shows the possibilities of making the transition to an economy which recognises and takes into account the role of biodiversity and ecosystem services. This is the first time estimates of welfare loss comparable to the Stern review have been produced and its results are already being used to inform negotiations about future targets on biodiversity.

19 The study used 11 value categories based on the ecosystem services framework. See SAC & University of Liverpool (2007) "Marine Bill – Marine Nature Conservation – Valuing the benefits" for more details.

20 See the National Water Environment Benefits Survey (Project 4bc) at www.wfdcrp.co.uk

21 A 'welfare' approach incorporates both market impacts and non market impacts.

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Natural England have set out the evidence for their view of the value of the natural environment in the *No Charge report*. The report sets out the contribution that nature makes to our economy (such as clean water, carbon storage) to ensure that its value is recognised. The recommendation is that the natural environment should be seen as essential infrastructure for society and not as a burden or constraint on other activities. This report can be found at:

<http://naturalengland.etraderstores.com/NaturalEnglandShop/NE220>

3.4.2 Challenges ahead.

Feedback from our stakeholders suggests that increased availability of more primary and secondary valuation studies will encourage the incorporation of ecosystem service valuation into new areas of policy and decision making. There is therefore considerable ongoing work that should further demonstrate the use of ecosystem service valuation over the coming months and years.

Defra and Natural England are assessing the value of the non-market benefits of **environmental stewardship**. This will provide evidence for the overall value for money of the scheme including the relative value of the Entry Level Scheme and Higher Level Scheme. The study “translates” ecosystem services into environmental features that the public will be familiar with so that they can better value the changes.

Defra, the Devolved Administrations and the Forestry Commission have commissioned primary valuation work to value the benefits of meeting the updated **Biodiversity Action Plan (BAP) targets**. This aims to translate meeting the targets into a change in ecosystem services and to value them at a regional and national level. It is hoped that the results of this project can be used alongside work which estimated the costs of meeting the BAP targets in order to assess the value for money of pursuing our domestic biodiversity goals. The project will report later in 2010.

Ecosystem services of peat – A one year study has been let to Moors for the Future, which is a partnership project which aims to restore large parts of the Peak District moors²². The overall aim of this Defra project is to identify the distribution, and assess the cost-benefit flows of different ecosystem services in upland and lowland peatlands. The project will choose upland and lowland peatlands demonstration case study sites in different states of degradation, and assess the information available on the provision and quantification of peatland ecosystem services for each site. The project has the scope to provide some important cost-benefit information on peatland maintenance and restoration that could be more widely applicable.

Green infrastructure can provide a wide number of ecosystem services and benefits including carbon sequestration, recreation, climate change adaptation, flood protection and habitats supporting biodiversity. The aim of a new Defra project is to produce a synthesis of the evidence of the costs and benefits of green infrastructure in a searchable database, to examine the current status and trend in green infrastructure and provide a compelling narrative for planners and policy makers at local to national level on how green infrastructure can help deliver local, regional and national policy objectives.

²² Moors for the Future is one of the UK's biggest peat restoration projects, and has already restored and stabilised up to 6km² of eroded and fire damaged peatlands. Funding partners include the Peak District National Park Authority, Heritage Lottery Fund, United Utilities, Natural England, National Trust, Severn Trent Water, Sheffield City Council, Moorland Association, Derbyshire County Council and the Environment Agency.

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Feedback from a range of stakeholders in 2009 also suggested the need to consider non-economic forms of valuation for the natural environment, to capture values that are not easily translated into monetary terms. Therefore, a Defra project is currently underway to produce guidelines on how **participatory and deliberative methods** can be used within an ecosystems approach and how the non-monetary valuation can be used alongside economic valuation techniques in providing better information to decision and policy makers. This project will report in October 2010.

A further challenge highlighted in the forthcoming Value Transfer Strategy is to get these techniques understood and used by analysts in all tiers of Government so that environmental valuation can be used appropriately in the appraisal of policies and plans. Therefore there is ongoing work both to incorporate these techniques into the appraisal guidance of other Departments, and to build the capacity of analysts to use these approaches.

Finally, it is recognised that there is a need to store all of this valuation information in a safe place and so Defra is supporting the Environmental Valuation Reference Inventory (EVRI)²³ to do this. The EVRI database contains a large number of published primary valuation studies (more than 250 UK-based studies). It is currently being updated to provide more support for value transfer, e.g. through the development of a benefits transfer e-library and encouraging researchers and analysts to add more secondary valuation studies.

3.5 Developing a robust evidence base

3.5.1 Progress made

3.5.1.1 *Strategic research in support of an ecosystems approach*

Over the life of the EAAP, Defra has invested around £1.3m on a research programme focused on collating, interpreting, and deepening the evidence base that supports an ecosystems approach. In 2009, Defra conducted a synthesis of this research to understand better the robustness of that evidence base, and also to gain policy and scientific stakeholder feedback concerning the continuing challenges. This synthesis identified a number of key messages for policymakers.

It was felt that, as a result of this research, policymakers should now be comfortable that an ecosystems approach is a workable policy framework, ready to be applied, rather than a theoretical concept. Further, while the data and tools the policy making process needs continue to be developed, there are enough already available for policy makers in different parts of Government to start to use the approach in their work. The study also concluded that an ecosystems approach represents a potentially valuable approach to decision-making. It is flexible for use in different contexts and compatible with other relevant policies and governance structures – including the current UK Strategy for Sustainable Development.

3.5.1.2 *Major initiatives working with an ecosystem services framework*

In addition to this central research, Defra is contributing to major initiatives such as Charting Progress 2, the National Ecosystem Assessment, and The Economics of Ecosystems and Biodiversity study.

Charting Progress 2 is the second overall assessment of the state of UK seas and is due to be published in July 2010. The report will provide extensive information on developments since the first Charting Progress in 2005, the pressures and impacts on the marine environment and their current status. There will be a dedicated chapter on the impact of climate change on our seas, plus a focus on current gaps in our knowledge and recommendations for further work.

²³ <http://www.evri.ca/>

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The UK **National Ecosystem Assessment** (NEA)²⁴ is the first analysis of the UK's natural environment in terms of the benefits it provides to society and continuing economic prosperity. Part of the Living With Environmental Change (LWEC) initiative, the NEA is an inclusive process involving many Government, academic, NGO and private sector institutions. The NEA aims to create a compelling and easily understood explanation of the state and value of the UK's ecosystem services. It will be useful to institutions and individuals to raise awareness of the importance of ecosystems and the services they provide to society, as well as assisting in strengthening policy-making to ensure effective management in future.

Throughout 2009, the NEA looked back 60 years to understand how our terrestrial, freshwater and marine ecosystems and the services they provide have arrived at their current state and value. In 2010, the assessment will look forward 50 years, developing scenarios for how those ecosystems may change in future, including how climate change is likely to affect them. It will then consider how society might respond to these changes to maintain and enhance the benefits, that we all will continue to get from our natural environment in a changing climate.

The Economics of Ecosystems and Biodiversity (TEEB) initiative originated from a meeting of the G8+5 Environment Ministers in Potsdam in March 2007. The aim is to undertake a Stern style review of the economics of the loss of ecosystems and biodiversity at a global level with the aim of promoting a better understanding of the true economic value of biodiversity and ecosystem services.

The UK contributed substantively to Phase I of the work through participation in project meetings and workshops and by feeding in key work that the UK has done in this area. This input has continued into Phase 2, and Defra and DfID have also committed funding to support the second and critical phase of the study. This will undertake a detailed examination of the economic costs of biodiversity decline and the loss of ecosystem services worldwide. It will produce an estimation of the costs and benefits of actions to reduce these losses in alternative scenarios, focusing on a medium and long term perspective. This and other analysis aims to inform and accelerate better policies that support conservation and sustainable use of biodiversity in all regions of the world. It has already produced some interim outputs: <http://www.teebweb.org/>, which have already proven useful in communicating the scale of the issue of biodiversity loss worldwide and will provide further guidance on accounting for ecosystem services values for policy makers, businesses, local decision makers and citizens throughout 2010.

The **Foresight Land Use Futures Study** explored how land use in the UK could change over the next 50 years. This includes examining society's future needs and values towards land use. It is using the latest evidence across the environmental, economic and social science disciplines to identify where the greatest pressures on land might be and to identify practices which encourage valued and sustainable land use practices.

Results from these studies will feed into **EURECA**, the European Ecosystem Assessment, will assess the state of ecosystems in Europe in 2010 and their possible development beyond 2010. EURECA is also intended to contribute to the MA follow-up as a sub-global assessment. It will include an assessment of the stocks, flows and value of selected ecosystem goods and services under different policy-relevant scenarios. The findings will be integrated in a final analysis, due to be published in 2012.

24 <http://uknea.unep-wcmc.org/>

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3.5.1.3 *Joining up the evidence base*

Defra are also encouraging a more coherent evidence base by working with others. This includes funding part of the UK Environmental Observation Framework, influencing and co-funding ecosystems-related EU research programmes, and strongly supporting the Living With Environmental Change initiative, which contains a specific objective on ecosystem services and is facilitating the interdisciplinary work so important for delivering an ecosystems approach.

By making a contribution to the European **BioDIVERSA** research call, several new projects have been funded which explore the links between Biodiversity and ecosystem function and service provision in different European ecosystems. Many of these research consortia contain UK academic institutions and therefore will help to address some of the evidence gaps noted in section 2.3.

Defra has also influenced the shape of Europe's **Framework Programme 7** to include various topics of importance to an ecosystems approach. The Programme is calling for research on topic such as water management, soil biodiversity in ecosystems functioning (a key evidence gap highlighted in Defra's recent soils strategy²⁵), the response of marine ecosystems to anthropogenic and other pressures, and the involvement of ecosystems in climate change adaptation and mitigation. The European Commission will further explore gaps following on from this round of research and feed this into the development of Framework Programme 8.

In the UK, Defra is a major contributor to the **Living With Environmental Change** programme, a £1bn research programme over ten years focusing on all aspects of the impacts of environmental change on society and the economy. Defra and NERC led on the development of Objective B of the programme, "To manage ecosystem services for human well-being and to protect the natural environment in a changing world"²⁶. The National Ecosystem Assessment is a major project under this objective, and Defra has also supported with NERC a series of pilot systematic reviews into different aspects of an ecosystems approach²⁷.

Defra continues to support initiatives such as the **Environmental Change Network**, the **UK-Environmental Observation Framework** and the **Countryside Survey**, all of which provide valuable long term monitoring information and integrated data sets, which can be used to help us understand interactions and ecosystem processes and tolerances. As described in section 3.1, The Defra Network is also working to ensure that such information is available to the range of people who need to use it in their decision making.

The Defra Network are increasingly working together to deliver the evidence base needed to take an ecosystems approach. For example, in conjunction with the Evidence Investment Strategy development, Defra has recently completed a review of evidence that supports the delivery of PSA28 across the Defra Network and examines where this could align more fruitfully with programmes run by the Research Councils. Analysts from across the Network also worked closely together to deliver the actions in the EAAP relating to ecosystem valuation.

There are also several examples of bilateral work. For example, Forestry Commission and the Environment Agency have published a review of evidence in relation to the role of woodlands in delivering the Water Framework Directive. Defra and Natural England are also working together in many ways to deliver a joint evidence base in support of their goals for the natural environment, co-designing research projects and programmes to maximise value and actively sharing the outputs from research.

25 <http://www.defra.gov.uk/environment/quality/land/soil/documents/soil-strategy.pdf>

26 <http://www.lwec.org.uk/objectives>

27 <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16575&FromSearch=Y&Publisher=1&SearchText=NR013&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

3 Progress in embedding an ecosystems approach over the last two years

3.5.2 Challenges ahead

Defra's new Evidence Investment Strategy (see also section 3.2.1.1) recognises ecosystem services as a key cross-cutting issue that needs to be addressed by evidence gather across the Defra Network. Defra is currently developing an implementation plan to structure this activity in the most productive way. The EIS highlights increasing evidence needs around an ecosystems approach and recommends a number of key questions that need to be addressed. Building on those questions, some key areas for further evidence gathering include:

- The implications of climate change for species (including non-native species) and ecosystems, and on wildlife disease
- Further development of ecosystems approach methodology
- The links between ecosystems and different aspects of human well-being
- The factors controlling soil carbon and the resilience of soils to climate change impacts
- The application of economics to thinking about environmental limits within the context of sustainable development
- The further development of whole catchment approaches to address diffuse pollution, including possible novel sources of pollution, e.g., nanoparticles

These needs may be met by Defra's research programmes, but the EIS also highlights that Defra needs to work more closely with other research funders, including through LWEC and Environmental Research Funders' Forum, and look for new ways to incentivise research and monitoring that meets the changing needs of the different funding bodies. This is particularly important in the case of ecosystem services research, where collaboration between the research funders has the potential to stimulate the inter-disciplinary working that is required.

Working with other funders will also assist in better integrating or combining the various data sets necessary to take this approach and enabling these data to be collected at appropriate temporal and spatial scales. The NEA will provide pointers to where this is particularly necessary as it assesses the available evidence across the UK and analyses it to assess the implications of changes in ecosystems on the benefits they provide to society.

Another challenge that remains is to enable specialists in different disciplines to communicate effectively with each other and with a wider group of stakeholders concerning ecosystem services. The NEA and the new project on the development and use of participatory and deliberative methods will go some way to developing this common understanding, and this is an area where initiatives such as LWEC have considerable potential to assist.

In the field of economics, Defra Network's forthcoming Value Transfer Strategy highlights a number of policy areas where further primary valuation studies would be helpful to enable more aspects of the environment to be considered in economic terms during policy appraisal and decision making. This will need to be coordinated in some cases with further scientific work on some ecosystem services (particularly regulating services). The Strategy suggests the need for a study to help develop supplementary guidelines for scientists to enable them to design their investigations so that outputs can be more readily integrated with valuation work.

4 Conclusions – are we seeing the benefits of taking an ecosystems approach?

The evidence base for embedding an ecosystems approach into policy and decision making has grown greatly over the lifetime of the EAAP. There now exist many tools, sources of information and guidance to enable a wide variety of policy makers to engage with this way of thinking and to use it in their own plan, policy and decision making. The development of this evidence base has already had the added benefit of encouraging interdisciplinary working in the academic community, opening up exciting new avenues for collaborative work to address policy relevant issues, and it will remain important to support such innovative collaboration in future. The NEA embodies this new way of working and continues to push the boundaries of our understanding of the role of ecosystems to our lives and work.

This evidence has enabled several policy areas to take better informed decisions relating to the delivery of a range of policy outcomes which link to the natural environment. It has provided a methodology for assessing costs and benefits for action on water quality and in the marine environment which take account of the value of aspects of the natural environment not previously considered in such decisions.

Different organisations embedding various of the principles of an ecosystems approach into their work are also helping to move the debate from theory into practice in a number of areas. Already, several projects involving public, private and third sector organisations, often in new partnerships, are demonstrating cost efficient interventions that enable ecosystems to increase the provision of previously under-valued services. These include services such as water retention or purification, or, on an international scale, carbon sequestration and storage, and these partnerships are setting up novel systems for passing on the value of these services to those managing ecosystems to deliver those services. Evidence continues to accumulate from this and other work that the outcomes of taking an ecosystems approach are both more sustainable and more inclusive of a wide range of affected stakeholders than if a less holistic approach had been taken.

Considering the services that ecosystems provide has kindled fresh debate about the importance of the natural environment to society and the economy. This framework is enabling an improved understanding of the links between the natural environment and the economy – the need to consider ecosystem services if we are to achieve long term sustainable growth. It is allowing the world of economics and the environment to discuss such issues clearly and to begin working together to find solutions that both communities can share. The language and concepts are complex, and there is no doubt further work to do to enable more people to translate these principles into their own areas.

There is still a role for Defra to advocate the importance and value of the natural environment to convince others who may not have considered its relevance to them in the past, or who believe it to be an issue that should be considered separately from their own goals. However, this is a role that Defra cannot fulfil alone, and improving the understanding of this approach in those private, public and third sector organisations who help us to deliver our goals will add impetus to this advocacy, spreading and developing further the concepts so that they are tailored for the wide range of audiences to which they are important.

4 Conclusions – are we seeing the benefits of taking an ecosystems approach?

Within Defra we must also recognise that we are learning more all the time about how ecosystems interact with each other and with society. We are generating and benefiting from new ways of monitoring, managing and valuing the natural environment and both of these processes may generate new opportunities for us in future. Therefore we must remain flexible in our approach to this thinking, passing on to others examples of where and how an ecosystems approach is adding value to the policy or decision making process, and highlighting where new evidence supports or overturns previous ideas. We will continue to support innovation in science, economics, policy making and environmental management to help ensure that we create the best possible conditions for people to discover, test and benefit from new and more effective ways of delivering a healthy natural environment.

Table 2. Summary Table of documents related to the EAAP.

Documents setting out the context for an ecosystems approach	
Millennium Ecosystem Assessment	www.millenniumassessment.org/
Ecosystems Approach Action Plan	http://www.defra.gov.uk/environment/policy/natural-environ/documents/eco-actionplan.pdf
CBD definition of the ecosystem approach	http://www.cbd.int/decision/cop/?id=7148
Defra's Evidence Investment Strategy	http://www.defra.gov.uk/evidence/science/how/strategy.htm
Delivery Agreement for PSA28 on the natural environment	http://www.hm-treasury.gov.uk/d/pbr_csr07_psa28.pdf
Resources and guidance for embedding ecosystem service valuation into policies and decisions	
Introductory guide to valuing ecosystem services	http://defrawebd/environment/policy/natural-environ/documents/eco-valuing.pdf
Value Transfer Guidance and Strategy	http://www.defra.gov.uk/environment/policy/natural-environ/using/value.htm
EVRI database	http://www.evri.ca/
Documents highlighting the value of a healthy natural environment	
National Ecosystem Assessment	http://uknea.unep-wcmc.org/
The Economics of Ecosystems and Biodiversity	http://www.teebweb.org/
No Charge	http://naturalengland.etraderstores.com/NaturalEnglandShop/NE220
Vital Uplands	http://naturalengland.etraderstores.com/NaturalEnglandShop/NE210

Annex 1 Summary of original actions contained in the action plan

Annex 1. Summary of original actions contained in the action plan

No.		Action
1		Defra to embed the principles of an ecosystems approach in its new standard policy-making procedures, which are being developed in the context of the Renew Defra programme.
2		Defra to embed key 'ecosystems approach' messages in its strategic communications on the natural environment.
3		Defra's Land Use Project to explore the benefits of an ecosystems approach, drawing on lessons learned from land management projects where this approach is being applied.
4	–	Defra to develop further case studies to demonstrate the benefits of an ecosystems approach in policy-making.
4	a	Scoping study on implementing an ecosystems approach to air quality policy on ammonia.
4	b	Scoping analysis of the full range of benefits of Environmental Stewardship in terms of impacts on ecosystem services.
4	c	Development of a framework of action for management and restoration of peat soils based on the delivery of ecosystem services benefits.
5		Defra to work with other Government Departments and the Devolved Administrations to introduce a new system of marine planning that embeds an ecosystems approach into marine management, and integrates effectively with other management processes in coastal areas.
6		Defra to embed the principles of an ecosystems approach in its new policy appraisal guidance for flood and coastal erosion risk management.
7		Defra to embed the principles of an ecosystems approach in its forthcoming Water Strategy.
8		Defra to fund extension in England of the Catchment Sensitive Farming Delivery Initiative through the CSR 07 cycle.
9		Defra to work with Natural England, the Environment Agency and the Forestry Commission to explore how the principles of an ecosystems approach can be embedded in their corporate plans and strategies and to identify potential barriers.
10		Defra to review existing policy and project appraisal tools to explore how the principles of an ecosystems approach, including the valuation of ecosystem services, could be incorporated.
11		The Environment Agency, Natural England and the Forestry Commission to work together with the Government Offices to ensure that environmental priorities are addressed in regional and sub-regional strategies/plans and their delivery, including by baselining environmental pressures in each region.
12		Defra to work with the Government Office network to build awareness of the benefits of an ecosystems approach in the English Regions.
13		Defra to work with local Government to build awareness of the benefits of an ecosystems approach at the local level, including identifying and disseminating examples of best practice.
14		Natural England and the Environment Agency to consider how they can build their capacity at the local level to work with local authorities as local strategic partners.
15		Defra, the Environment Agency, Natural England and the Forestry Commission to pilot practical application of ecosystem services valuation in specific policy areas, including:
15	a	Valuation of the benefits from the implementation of the UK Biodiversity Action Plan.
15	b	Impact Assessment (IA) for the final form Marine Bill introduced to Parliament.
16		The Department for Transport to work with Defra on a long-term strategy for the development of environmental valuation in transport appraisal, including the valuation of ecosystem services.
17		The Department for Communities and Local Government and Defra to work together to influence the design of eco-towns to maximise delivery of ecosystem services.
18		Defra, in partnership with the Environment Agency, Natural England and the Forestry Commission to develop a benefits transfer strategy for use in valuing ecosystem services.
19		Defra to promote the development of the existing Environmental Valuation Reference Inventory (EVRI) database to ensure that it captures studies on the valuation of ecosystem services most useful and relevant for benefits transfer, including from Defra-funded studies.

Annex 1 Summary of original actions contained in the action plan

No.	Action
20	Defra to review work on non-economic and participatory valuation methodologies and produce guidelines on their use alongside economic valuation methodologies.
21	Defra, the Environment Agency, Natural England and the Forestry Commission to develop a strategy for convergence between indicators and targets used in different policy areas to be consistent with an ecosystems approach
22	Defra to work with the Department for Business, Enterprise and Regulatory Reform (now Business, Innovation and Skills) to ensure that the ecosystem services framework is given appropriate consideration in the development of environment-adjusted productivity indicators
23	Defra to ensure that principles of an ecosystems approach are reflected in the UK climate change adaptation framework.
24	Research councils and other partners in the Living With Environmental Change (LWEC) Programme to work together to produce predictions of ecosystem impacts based on a range of climate change scenarios (such as those produced by UKCIP)
25	Defra to ensure that, as part of implementing the England Biodiversity Strategy, effective action is taken to identify the ecosystems most vulnerable to climate change, and provide guidance for adaptation through managing for inevitable change.
26	Defra to ensure that the programme of response to the Climate Change Bill Risk Assessment addresses the impacts of adaptation in other sectors on ecosystem health.
27	Defra to work with partners including the Environment Agency, Natural England and the Forestry Commission to further articulate relevant evidence needs, identify priorities and to co-ordinate future investment in research.
28	Defra and Environmental Research Funders' Forum to review ways of improving the integration of and access to publicly available evidence on the state of England's ecosystems and ecosystem services by the research community and decision-makers
29	The Environment Research Funders' Forum to articulate monitoring requirements associated with an ecosystems approach and to propose a strategy for meeting these and in the Environmental Observation Framework high-level vision and plan.
30	Defra, through the UK Marine Monitoring and Assessment Strategy, to coordinate assessment of the state of our seas and lead the publication of Charting Progress, the 2nd Integrated Assessment on the State of UK Seas. This includes establishing the quality status of UK oceans and seas in order to provide a basis for marine ecosystem management (and meet key requirements of the EU Marine Strategy Directive). (note: amended)
31	Defra to publish a review of the potential benefits and scope of a comprehensive MA-style' ecosystem assessment for England.
32	Natural Environment Research Council and the Environmental and Social Research Council to lead response of research councils to evidence needs through LWEC which will include a proposal for research on ecosystem services early in the programme.
33	Defra the research councils and Environmental Research Funders' Forum to work in partnership to promote and co-ordinate relevant research and, in particular, to develop the role of Living With Environmental Change in this regard.
34	The Department for International Development, the Natural Environment Research Council and the Economic and Social Research Council to explore the links between healthy ecosystems and poverty alleviation and identify future research priorities through the joint 'Ecosystem Services and Poverty Alleviation' research programme.
35	Defra to ensure that relevant research priorities are addressed in the influencing strategy for calls under the EU Research Framework Programme FP7 and, in due course, for the development of FP8
36	Defra to contribute to the forthcoming BioDIVERSA research call on ecosystem functioning and ecosystem services and to engage closely with this programme to ensure its outputs address current and future policy challenges
37	Defra to contribute to a global study analysing the global economic benefit of biological diversity and the costs of the loss of biodiversity as part of the Potsdam Initiative agreed at the G8+5 Environment Ministers' meeting (i.e. Stern-type study for biodiversity and ecosystem services)





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