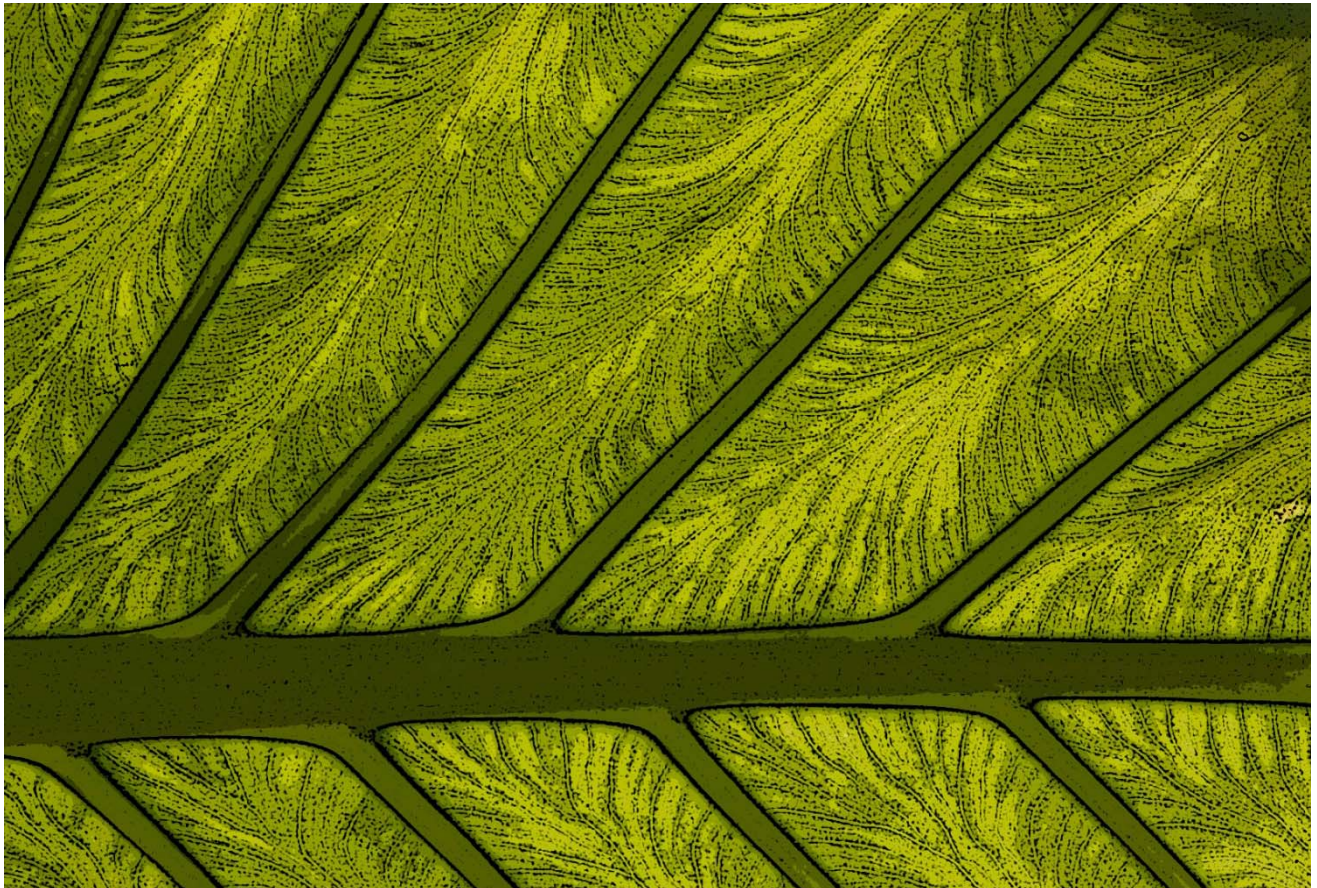


# Ecosystem Services

## Overview of Projects



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[www.nottingham.ac.uk/CEM](http://www.nottingham.ac.uk/CEM)

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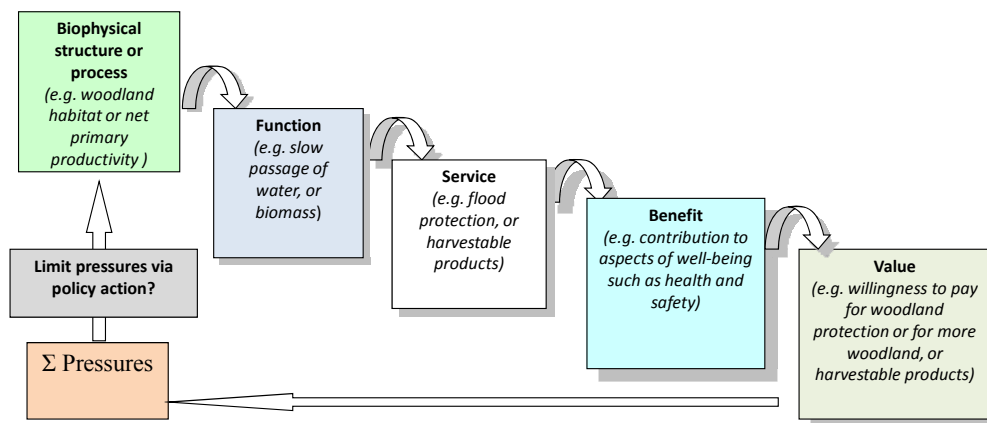
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**Nottingham**



Centre for Environmental  
Management

CEM's understanding of the Ecosystem Service Approach is demonstrated in the following "cascade model".

The relationship between biodiversity, ecosystem function and human well-being



Adapted after: Haines-Young, R. & Potschin, M. (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, 110-139.

Sutherland et al. (2009) recently identified in their essay "One hundred Questions of Importance to Conservation of Global Biological Diversity"<sup>1</sup> of which eight questions addressed the Ecosystem Service Approach. The work by CEM over the last six years has contributed and partly answered these questions. See matrix below (for lessons learned etc. please visit the individual projects/-reports and project websites).

<sup>1</sup> Conservation Biology 23(3):557-567.



ES Questions	Thresholds <sup>2</sup>	Methods Assessment <sup>3</sup>	Value of biodiversity <sup>4</sup>	Protection of extreme events <sup>5</sup>	Biodiversity human welfare <sup>6</sup>	Distribution of benefits <sup>7</sup>	Climate change <sup>8</sup>	Soils <sup>9</sup>
21. Valuation Network								
20. ES & landscape Character								
19. Ind-ES								
18. PEGASO								
17. RECCE								
16. UK NEA scenarios								
15. EsA & participatory appr.								
14. EMBED								
13. System Review Limits & resilience								
12. System Review Catchment								
11. Valuation of Natural Resources								
10. Ecosystem Accounting								
9. ES through Agri-env Schemes								
8. NEA-scoping								

<sup>2</sup> Do critical thresholds exist at which the loss of species diversity, or the loss of particular species, disrupts ecosystem functions and services, and how can these thresholds be predicted?

<sup>3</sup> What is the effectiveness of different methods for the assessment of ecosystem services?

<sup>4</sup> How can biodiversity considerations be integrated into economic policies to reflect the monetary and non-monetary value of biodiversity, ecosystem processes, goods, and services?

<sup>5</sup> How can ecosystems be managed to increase protection of humans and biodiversity from extreme events?

<sup>6</sup> How, where, and when has biodiversity loss affected human welfare?

<sup>7</sup> What strategies for distributing the material benefits derived from biodiversity most effectively foster environmental stewardship and biodiversity conservation?

<sup>8</sup> How can protected area networks be designed to increase carbon storage benefits and mitigate climate impacts, with these benefits as incentives to support conservation actions?

<sup>9</sup> How does soil biodiversity contribute to the extent and persistence of Ecosystem services, including agricultural productivity?



ES Questions	Thresholds	Methods Assessment	Value of biodiversity	Protection extreme events	Biodiversity human welfare	Distribution of benefits	Climate change	Soils
7. ES concept, methodologies								
6. Upland's ES								
5. FRESH								
4. Regional PES East Midlands								
3. State and trends of England's ES								
2. Parrett: applying the EsA								
1. Defining Limits for SD								



## CEM's Ecosystem Service Approach related projects by CEM

### ***21. Interdisciplinary Network for valuing biodiversity, ecosystem services, and natural resource use***

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This network is coordinated through the University of East Anglia. CEM is a partner and leads the non-monetary valuation part. Besides scientific development in the area the network aims to:

- Developing Research Capacity,
- Developing Robust Methodology
- Network Activities, such as workshops, meeting etc.
- Engaging the Research and Policy Communities
- Empirical Illustration

The network will start in January 2011 and run for 2 years.

### ***20. Ecosystem services and monitoring landscape character and quality***

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This project is funded by Defra (BD6503) and led by Land Use Consultants, CEM is contributing through Fabis Consulting.

**The aim of the project** is to develop and test a robust, repeatable and comprehensive approach for assessing the landscape benefits (taking account of direct and cumulative effects) achieved under Environmental Stewardship, England's flagship agri-environment scheme.

The project is planned to run from August 2010 to July 2013. In addition to developing a comprehensive approach to the monitoring of landscape benefits achieved under Environmental Stewardship, the project will suggest amendments and improvements to the scheme operation for the benefit of landscape character and quality. This will take account of the on-going development of Environmental Stewardship, including the delivery of ecosystem services and the meeting of climate change objectives under the scheme.

### ***19. Indian Ecosystem Service Initiative to promote sustainable livelihoods (IndES)***

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This is a pump prime project under the ESPA (Ecosystem Service for Poverty Alleviation) programme funded by LWEC. The programme is supported by DFID, NERC and ESRC.

CEM is leading on this project and will – together with colleagues from the UK as well as from India - work towards a proposal for the consortium grant (deadline 2011).

The aim of IndES is to build a new trans-disciplinary consortium that can develop and test novel, yet robust, evidence-based decision support tools for creating sustainable livelihoods in East India. The proposal builds on recent situation analyses for the subcontinent, and complements other initiatives by seeking to synthesise knowledge about the value of ecosystem services (ES) and human well-being with insights on ecosystem functioning.



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### **18. *People for Ecosystem Based Governance in Assessing Sustainable Development of Ocean and Coast (PEGASO)***

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This is an EU FP7 project coordinated by the University of Barcelona. It will run from Feb. 2010 – January 2014.

The main objective of PEGASO is to build on existing capacities and develop common novel approaches to support integrated policies for the coastal, marine and maritime realms of the Mediterranean and Black Sea Basins in ways that are consistent with and relevant to the implementation of the ICZM Protocol for the Mediterranean.

PEGASO is consistent with the frameworks of the Barcelona and Bucharest Conventions which seek to achieve a coordinated approach to sustainable resource management and development, and to protect these regional seas and the quality of life of their peoples. It also continues ICZM efforts, supporting new marine and maritime policies.

CEM's will lead the theoretical framework of the ICZM Platform (T2.1) as well as the tools of Land and Environmental Accounts (LEAC, T4.1) and scenarios (T4.3).

For more details see: [www.pegasoproject.eu/](http://www.pegasoproject.eu/)

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### **17. *The Resilience of Ecosystems to Environmental Change (RECCE)***

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The aim of this project funded by Defra (NR0124) is to take stock of the scientific, management and policy literatures on this topic, and assess the robustness of the current evidence base that might therefore be used to frame policy and management responses. The approach used in this study is that of a 'systematic review'. This is a technique that has been used widely for the analysing identifiable bodies of research, and involves making a methodological and structured assessment of research findings in a way that is designed to eliminate any bias associated with the review process. This work builds on two earlier pilot studies dealing with aspects of resilience that have been funded by Defra/LWEC, which indicated that there was a sufficiently large evidence base on the topic to make a full systematic review in this area possible.

The work is done in collaboration with the Environmental Change Institute from the University of Oxford. The focus of the review will be on issues relevant to the UK, but it will clearly draw upon the wider international literature. The section will be guided by the available materials and advice gained from experts and policy advisors, who will be drawn into the discussion through a structured consultation process involving face to face meetings and internet e-forum. A range of experts will also be used to provide a component of independent scrutiny of our interim findings and draft conclusions. For more details see: [www.RECCE.org.uk](http://www.RECCE.org.uk)

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### **16. *UK National Ecosystem Assessment - Scenarios***

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Within the National Ecosystem Assessment (NEA) scenarios are required to: (1) examine how ecosystems and their services in the UK change under a range of plausible futures; and, (2) identify the effects of changes in ecosystems on human well-being and who might most be affected by them.



To help quantify and make transparent the assumptions underpinning the scenarios developed within the NEA, a set of production functions for the different services will be constructed using Bayesian Belief Networks (BBN). Such networks offer a way of combining both quantitative and qualitative data within a single framework, and combine empirical data with information derived from stakeholder elicitation, expert judgement and model-based projections.

The work programme is divided into (1) an organisational phase, extending through to mid-April 2010, which will deliver an assessment and customisation of existing scenario studies and a refined understanding of user needs; (2) a quantification phase, extending through to June, 2010, which will deliver an assessment of changing service outputs and values under a set of contrasting future assumptions; and (3) a synthesis phase, extending through to the end of the assessment, involving the use of scenarios to explore potential response options, their refinement based on feedback and the preparation of a final report on the outcomes of the work.

See for more details: <http://uknea.unep-wcmc.org/>

#### ***15. Participatory and deliberative techniques for embedding an ecosystems approach in decision-making***

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This project is funded by Defra (NR0124) and led by the University of Exeter and CEM is contributing through Fabis Consulting. Building on the recent work of Defra's natural environment strategic research programme, the purpose of this project is therefore to take a "fresh and forward" look at the range of participatory and deliberative techniques available to those wishing to embed an ecosystems approach into decision making. In particular, **the objectives of this study are to:**

- identify and review the most effective participatory techniques for involving specified sectors of society in national, regional and local decision-making processes relevant to an ecosystems approach;
- produce guidelines to help decision-makers and analysts to use appropriate methods at key points in the policy and decision-making process and in the process, assess which techniques are most valuable for drawing out the fields of knowledge that each of these sectors have; and,
- establish the contribution that participatory techniques can make to improving the way in which non-monetised costs and benefits are taken into account alongside monetised costs and benefits at key points in decision making such as appraisal processes.

For more details see: <http://participatory-ecosystems.co.uk/>

#### ***14. Embedding an Ecosystems Approach in Decision Making: Measuring the added value (EMBED)***

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**The aim of this study (funded by Defra, NR0135) is to identify what is the value added to decision makers in actual practice of taking an ecosystems approach** The aim will be met by evaluating, individually and as a set, four demonstrator projects that are currently taking an ecosystems approach to policy or decision making and which are expected to influence societal choices in the management of environmental resources, such as changes of land use or investment in 'green



infrastructure'. Collectively these represent a diverse range of applications that can be used to better understand the barriers and opportunities for embedding an ecosystems approach in decision making, and will potentially provide examples of best practice that can demonstrate how the approach can be used more widely. The case studies have been selected to encapsulate key issues surrounding the application of an ecosystems approach and to extend and not duplicate what has already been achieved through other work or initiatives funded by Defra and others. In particular, the work will examine the extent to which a place-based perspective may usefully frame questions such as those about environmental limits and values that arise in applying an ecosystems approach. As a result the study will help Defra and its partners to better understand how the links between ecosystem services and human well-being can be taken into account in decision making at different spatial and temporal scales. CEM is leading on this project and works in collaboration with Groundswell Research.

For more details see: [www.EMBED.org.uk](http://www.EMBED.org.uk)

### **13. Environmental limits, ecosystem resilience and supporting services**

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This pilot study undertaken by CEM for the Living with Environmental Change (LWEC) Programme, funded by NERC and Defra developed a draft protocol for a full systematic review on the general question of **"Is ecosystem resilience impaired by the loss of supporting ecosystem services?"**. In order to refine this broad question, the study initially examined the following reviewable questions:

- Can resilience criteria be used to define minimum levels of ecological functioning?
- Can minimum levels of ecological functioning be used to define ecological thresholds and limits?
- Can the loss of supporting services be reflected in the marginal changes of value in the other types of ecosystem service?
- Is the minimum level of ecosystem functioning required to sustain the output of ecosystem services adequate in the context of future climate change?

The report for this pilot can be downloaded from the CEM website – however it is followed up through a full systematic review (see RECCE – project no 16 above).

### **12. Catchment planning and the ecosystem approach: progress towards application**

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This pilot study undertaken by CEM and ORMI for the Living with Environmental Change (LWEC) Programme, funded by NERC and Defra developed a draft protocol for a full systematic review on the general question of **"Are catchment-based approaches to managing for environmental change effective in securing ecosystem services for human well-being?"**. In particular, given the five policy principles by Defra our review considered the following questions as the analytical starting points for the review process:





- Why is the catchment scale advocated as an appropriate scale for managing ecosystems and associated services for human well-being, and what evidence is there to support this view?
- Which ecosystems services are promoted by the theory and application of catchment based approaches to natural resource management, and where is there scope for enhancement?
- How effective are catchment-based approaches in fostering structures of national and local decision making to make 'appropriate' interventions in the natural environment?
- How do catchment-based approaches define and interpret the idea of 'environmental limits' and what evidence is there to suggest they take into account ecosystem functioning?
- To what extent do catchment based approaches promote adaptive management of the natural environment to respond to changing pressures, including climate change?

These were refined by stakeholder engagement.

### **11. Valuation of Natural Resources**

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This NERC scoping study was lead by Cranfield University with CEM as partner.

The Natural Environmental Research Council (NERC) identified the need to review the existing evidence base to support its strategic priorities in its Science Theme for the **Sustainable Use of Natural Resources** (SUNR), particularly with respect to the valuation of **natural resources** and related **ecosystem services** (referred to here as NRES).

In this context, the broad purpose of this scoping study is to inform NERC strategies on the valuation of NRES, thereby enhancing the Council's potential contribution to achieving sustainable development.

The study aimed to produce a 'state of the science' review of valuation in terms of what exists, what is being done, how well it works and perceptions of likely future needs and future priorities.

This scoping study is followed up by the "Valuation Network" (see project no 19 above).

### **10. Implementation of Ecosystem Accounting**

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CEM is the lead of this four year running (2008-2011) project funded by the European Environment Agency. The Project will increase the scope of existing land cover and ecosystem accounts by several measures. The project includes input and links to:

- TEEB: The Economics of Ecosystems and Biodiversity
- Eureka2012 (the Sub-global Millennium Ecosystem Assessment for Europe)
- Has develop an online e-forum on the Common International Classification on Ecosystem Service ([www.cices.eu](http://www.cices.eu))



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### ***9. Delivering environmental services through Agri-environment schemes: a scoping study***

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CEM were recently commissioned by the Land Use Policy Research Group (LUPG) to undertake a scoping study on delivering environmental services through agri-environment schemes. The study considered environmental services provided by land managers to and reviewed the existing use of incentives to encourage the sustainable management of natural resources and associated environmental services. It explored the available information to identify how this knowledge can practically contribute to the delivery of environmental services through agri-environmental schemes and other PES mechanisms, and identified the major gaps in existing knowledge and suggested future research and strategies to drive forward work in this area.

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### ***8. Scoping the potential benefits for a MA-style Assessment for England***

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CEM lead the consortium that undertook work for Defra (NR0118) in 2008, its recommendations lead Hilary Benn to announce that the Government will finance an assessment for England. This is now running and CEM is leading the scenario part of the UK NEA (see project no 15 above).

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### ***7. An Analysis of methodologies for defining ecosystem services***

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This study lead by CEM for the Joint Nature Conservation Committee (JNCC, a Defra agency) focussed on the following components:

- methodologies for describing ecosystem goods and services;
- the links between services, functions, ecological structures and processes and human well-being;
- the relationship between biodiversity and ecosystem services;
- the valuation of ecosystem services; and,
- providing a synopsis of similarities and differences in approaches and their applications.

The report was published in 2009.

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### ***6. England's Upland Ecosystem Services***

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This study undertaken by CEM for Natural England developed methods for creating conceptual evidence-based systems-maps for ecosystem services using Bayesian Belief Networks. These conceptual maps described the ways in which upland services are generated and the impact of key drivers upon them. The work also explored typologies for describing the ways in which habitat quality, conservation status and biodiversity characteristics of site relate to the output of the selected ecosystem services, and to how such knowledge can be used for the spatial mapping of services and their valuation.

The reports were published in 2009 and are also available on the natural England's Vision website.



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### **5. *FRESH: Framing Ecosystems Services and Human Well-being***

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This CEM and ORMI lead transdisciplinary research seminar series run over two years and was funded by the UK research councils (NERC and ESRC). The seminar series aimed at broadening and deepening discussion about the idea of 'ecosystem services' as this relates to issues of human well-being on the sustainable management of landscapes. It explored the possibilities and limits of using an 'ecosystem services' perspective for developing integrated approaches to environmental and economic accounting. The seminar series concluded with an international symposium at the Royal Geographical Society (London) in September 2009, in which over 200 delegates took part. A major output of this seminar series is a special issue in "Progress in Physical Geography" its publication is expected for the end of 2010 (see [www.nottingham.ac.uk/FRESH](http://www.nottingham.ac.uk/FRESH) for details).

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### **4. *Regional bodies and PES (Payment for Ecosystem Services) models***

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This study was undertaken by CEM in partnership with ARUP, a consultancy specialised in business consulting, planning, design, technology and engineering skills. The project is funded by the East Midlands Development Agency (EMDA) and aims to identify the potential role(s) of regional-level public bodies and authorities in supporting, encouraging and helping bring about economic benefits from ecosystem services. Thus the project considered, characterised and recommended:

- The range of benefits derivable from well-functioning ecosystem services;
- The estimated regional economic benefits arising from well-functioning ecosystem services;
- The potential for regional benefits (financial and non-financial) in the East Midlands context (e.g. scale, value, opportunities, constraints)
- The range of regional-level public bodies and authorities with the potential to support, encourage and help bring about financially self-sustaining ecosystem services; and,
- Emerging case studies from the region (e.g. coastal defence benefits of natural habitats).

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### **3. *England's terrestrial ecosystem services and the rationale for an Ecosystem Approach***

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CEM were the scientific lead of a consortium that undertook work for Defra (NR0107) in 2006-7, which made recommendations to Ministers on how an integrated policy framework for the protection of natural resources based on the Ecosystem Approach can be developed. The work also considered whether there was sufficient evidence to identify trends in terrestrial ecosystems and the services they provide, and what approaches could be used to assess the health of an ecosystem, the value of the benefits it might provide and whether thresholds or limits for the output of services could be identified (project website: [www.ecosystemservices.org.uk](http://www.ecosystemservices.org.uk)).



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## ***2. The Parrett Catchment: A Case study to develop tools and methodologies to deliver an Ecosystem Approach***

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The aim of this study for Defra (NR0111), led by CEM, was to make a critical examination of how the Ecosystem Approach (EsA) can be applied at regional scales and what new insights and opportunities it provides for linking priorities for ecosystem services into wider sustainability assessments. It explored a regionally-based case study, the Parrett Catchment in south west England. The area is one in which there is wide-spread local acknowledgement that a range of interrelated issues affecting land use and quality of life need to be resolved in the catchment. It was found that the development of strategies for the sustainable development of the Parrett Catchment required consideration of a range of multifunctional values and cumulative impacts in relation to ecosystem services and that it was important to incorporate this knowledge into decision making. The study made recommendations on the value of an EsA and how it can best be integrated into decision making (project website: [www.catchmentfutures.org.uk](http://www.catchmentfutures.org.uk)).

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### ***1. Defining and Identifying Environmental Limits for Sustainable Development***

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Natural resource system can respond to increasing external pressures in various ways. Some systems show a gradual decline in the level or quality or benefits they provide. Others show a more rapid change or even exhibit sudden collapse. Our review suggests when a natural resource system exhibit a rapid 'regime shift', then this may be evidence of the existence of an environmental threshold, marking the boundary between alternative stable states. Water quality in lake systems that are impacted by nutrient input, and marine fisheries suffering over-exploitation have all been found to show this type of behaviour. In these situations it is particularly important to define an environmental limit so we can prevent the pressures upon systems from triggering such a threshold response, because evidence suggests that when thresholds are crossed it may be difficult to restore systems to their former condition.

This Project was funded by Defra (NR0102).

Overviews of projects and final reports can be found on: [www.nottingham.ac.uk/CEM/research.htm](http://www.nottingham.ac.uk/CEM/research.htm)