Ecosystem Services and the Ecosystem Approach

Notes of a joint workshop between the British Ecological Society (BES) and the UK Biodiversity Research Advisory Group (UK BRAG):

Imperial College, London, 4 September 2008

Chair: Professor Georgina Mace FRS, Director NERC Centre for Population Biology, Imperial College.

Introduction

Ecosystem Services is one of the BES's four areas of focus for its policy activities and it is appropriate that this is so: this is an area of growing importance to both the ecological science and the policy communities. 'The Role of Biodiversity in Ecosystem Function' is also one of the UK BRAG research themes. The BES and Defra held a joint workshop in 2006, looking at the gaps in research on ecosystem services relative to policy needs and gaps in policy implementation. The BES – UK BRAG workshop sought to deliver an update on progress made in both areas since 2006, to an assembled audience of over 75 ecologists, economists and policy-makers.

The aim of the session was to enable researchers and policy makers interested in a whole ecosystem approach to share expertise, and to give participants a chance to network across different disciplines. With this in mind, a panel of invited speakers gave short presentations covering policy issues and examples of applied science, finishing with ideas for how research was needed in policy applications. The workshop concluded with a panel discussion and debate with participants.

Presentations

Professor Georgina Mace introduced the presentations, making the point that the Ecosystem Services approach is increasingly being used in policy making. She pointed out that this makes for significant and interesting scientific and ecological challenges, with a need to look at the new questions now being posed.

The slides presented can be downloaded as .pdf files from either the BES or UK BRAG websites. See www.ukbrag.org.uk and www.britishecologicalsociety.org/articles/publicaffairs/meetings/.

1. **Setting the Scene**
   Dr Peter Costigan, Science Co-ordinator, Natural Environment Group, Defra. Chair of UK BRAG

Dr Costigan's presentation focused on UK BRAG: its roles and responsibilities. UK BRAG is a daughter body of the UK Biodiversity Partnership, concerned with progressing actions on the UK Biodiversity Action Plan. Its role is to bring science and policy together to analyse the needs for biodiversity research in the UK. Some 30 scientists and officials are represented at UK BRAG meetings, all of whom are involved in the practical side of researching and conserving UK biodiversity. It is not a funding body, although funders of research are amongst its members.

UK BRAG is the UK's national biodiversity research platform, providing a link between UK and EU-level policy-making with respect to biodiversity, and contributes to biodiversity research networking in the UK. Joint meetings with the BES provide an excellent opportunity for UK BRAG to tap into the expertise of the ecological community, and facilitate the networks which are so important to the future of biodiversity research.

Future challenges for UK BRAG include: influencing the funders of research; ensuring effective engagement with biodiversity at an EU level; better engagement with business. The Environment Research Funders' Forum (ERFF) Environmental Observation Framework (UK-EOF) will provide an excellent opportunity to meet the challenge posed by data gathering across a broad range of projects, providing an opportunity for better coordination of long-term monitoring activities. It is also important that LWEC (Living With Environmental Change) is now up and running under the Directorship of Prof. Andrew Watkinson.

Finally, Dr Costigan outlined the Defra view of the Ecosystems Approach:

- whole systems, not single outcomes
- the importance of joined-up working
- a greater focus on people: the core of the Ecosystem Approach is how ecological processes contribute to human well-being
- Linking environmental, economic and social benefits

Over the coming months, Defra would explore the development of a National Ecosystem Assessment, for England, as announced by Hilary Benn, Secretary of State for the Environment, on 21 July 2008 (http://www.defra.gov.uk/corporate/ministers/speeches/hilary-benn/hb080721.htm). The Ecosystems Approach is now firmly on the political agenda.

2. **The Challenges of Implementing an Ecosystem Approach**
   Professor Edward Maltby, Director, SWIMMER, University of Liverpool

The ecosystem services area of research provides an opportunity for those from the natural and social sciences to work together in a novel and, more significantly, an integrated way. It is very important for there to be a common language and dialogue between the natural and social sciences: Ecosystem Services directly relates to human well being.

Until now, the Government has developed sector-specific policies, with Government itself organised in a sectoral way. The environment doesn't work like this and sectoral politics can divert from the bigger picture. Government policy has also been largely focused on species and protected areas, diverting policy-makers' attention from ecosystems and ecosystem function. The demand is for a new way of looking at environment issues, with a need to take account of ecosystems being dynamic and responding to both environmental and human pressures.

The Ecosystem Approach requires the correct balance between three factors: economic prosperity, social well-being and environmental sustainability. Until now, there has been an inappropriate division between the costs and benefits of managing the environment.

Scientific understanding of the relationships in the Millennium Ecosystem Assessment still requires development.

It is not always possible to maximise the delivery of ecosystem services. For example, it might be possible to maximise nutrient retention to reduce eutrophication in a system, but this may consequentially reduce biodiversity in some way.

The University of Liverpool had been part of a consortium which examined the relationship between ecosystem services and poverty alleviation in India and the Hindu Kush. The project had revealed that integrated management based on interdisciplinary understanding could really improve human livelihoods. The project had led to the setting of priorities, for example developing a map of the linkages between ecosystem services and poverty, and pushing to the fore the need for the development of institutional and governmental frameworks.

Key issues raised by Professor Maltby were:

- the need to set societal priorities
- the need to strengthen the evidence base
- the need to select desired scales and targets
- developing a socially acceptable valuation of ecosystem services
- how to deal with trade-offs ('optimise' rather than 'maximise')

There is a strong need for increasing recognition of the links between ecosystem functions, a country's economy and human well being. The CBD (Convention on Biological Diversity) objectives will best be met by an ecosystems approach attaining the right balance, and the outcome of getting the balance right can be measured in human well being. Overall, there is a real opportunity to use the new 'Ecosystem Approach' but this can only come through the creation of a culture of co-operation within and between relevant organisations.

3. Sub-global Assessments: Exploring the National Need

Professor Roy Haines-Young and Dr Marion Potschin, University of Nottingham

Professor Haines-Young and Dr Potschin had been commissioned by Defra to examine the case for a national ecosystem assessment in the UK, following on from the Millennium Ecosystem

Assessment (MA). Their study is very relevant to the Defra action plan "Securing a healthy natural environment" (http://www.defra.gov.uk/wildlife-countryside/natres/eco-actionp.htm) Key questions pertinent to the study were: 'What does an MA-style assessment mean?'; 'Who are the customers?'; 'Who would be involved?' There is also the question of how to promote "whole system thinking" generally, which in turn highlights the importance of a coordinating role.

The chief importance of the Millennium Ecosystem Assessment had been to show the links between ecosystem services and human well-being. A national assessment would provide ecologists with a tremendous opportunity to show how important the environment really is to people.

The analysis had shown that current or planned initiatives could deliver some of the information which might come out of a UK MA. However, it had also revealed significant gaps. Work linking together ecosystem services and human well-being is often fragmented, with these links not well qualified. The issue of how to "value" is also as yet unresolved. Professor Haines-Young suggested that, as a result, one role which the MA could play is in the co-ordination of these initiatives and so focus on reporting their results.

The options proposed for the national MA carried particular implications for cost, profile and effort. Following consideration, the CEM together with the project team, had decided upon a 'Broad and Shallow' approach. This would be wide in scope but initially limited in the range of new commissioned research and monitoring activity. A broad start, with identification of existing evidence, with eventual identification of priorities for future research and possible increased depth of analysis, would be integral to this methodology.

Professor Haines-Young and Dr Potschin, together with the project team, had recommended that Defra fund a UK-wide MA, rather than a national assessment for England only, as per their original brief. Particularly with respect to the marine environment, they felt that this would be more useful. Other facets of the approach for consideration could be: a global perspective (the UK depends on flows of ecosystem services from elsewhere and impacts on ecosystems through these flows); a cross-sectoral approach (i.e. when assessing freshwater ecosystems, look across all those sectors which impinge on the water supply); supply and demand - which services might we need in the future and in what quantities?
Professor Haines-Young stressed that valuing ecosystem services was more than simply 'putting a price on nature', which had negative moral connotations. He recognised that the concept of valuing ecosystem services would take ecologists out of their 'comfort zone' but that the national MA, and valuing ecosystem services, could offer a major stimulus to embedding an ecosystem approach in decision-making.

A means of communicating the concept of ecosystem services to the public was vital. At present 'ecosystem services' was not intuitive terminology for the majority of people. The ecological community should set its mind to communicating these ideas more simply.

4. Valuing the Arc

Dr Ruth Swetnam, University of Cambridge

'Valuing the Arc' is a five year interdisciplinary research project funded by the Leverhulme Trust and is currently in its second year. The project is designed to value ecosystem services across the Eastern Arc Mountains in Tanzania, a global biodiversity hotspot which is facing an increasing range of anthropogenic pressures.The study area consists of montane, sub-montane and upper montane tropical forests, with only 30% of the original forest cover still intact. Many endemic species are found in the area, of which many are threatened.

The Eastern Arc mountains provide the majority of water for Dar es Salaam, the capital of Tanzania. In addition, many people live in the mountains, directly dependent on them for their livelihoods.

The project is going through an initial 'scoping phase', assessing which of the services provided by the mountain ecosystem are most important. Data gathered through the next phase will be used to model and map the location of the key services (for example, carbon, timber and non-timber products). Modelling to ascertain and map the key beneficiaries of services will then feed into a stage mapping the costs and benefits of conserving them. With any recommendations it is important to know where there are "winners" and "losers" and if there are any disparities. It is also important to involve local people and the project has people from Tanzania with local knowledge working alongside UK researchers.

Dr Swetnam's initial work has focused on two forest reserves, Shagayu and Image (pronounced im-ah-jay). At Shagayu population pressures are removing a lot of forest for agricultural land, whereas at Image the pressures are lower and the reserve is surrounded by a more 'natural' landscape.

Analysis had shown that Shagayu stored a huge amount of carbon: approximately 2.6 million tonnes. As a forest reserve, with its associated store of carbon, Shagayu is worth approximately $22.1 million US. As land converted to agriculture, Shagayu would be worth only a fraction of this, at $3.9 million US. It is approximately five times more valuable, to each inhabitant of Shagayu, to keep the land as forest than to convert it to agriculture. However, this worth clearly depends on who is valuing the forest and who receives the payment for its conservation, or conversion; local people living around the reserve do not see any of this money and so, to them, the forest has more immediate worth as a timber source and then as agricultural land.

In conclusion, the key messages were:

- Valuing ecosystem services is a spatial process, not simply a bald accounting exercise. It is vital to map who benefits, both directly and indirectly, from the ecosystem.
- All costs must be considered: there are management costs in conserving forests.
- Engagement with policy-makers is vital: the scenarios must be presented in all their complexity.
- Inter-disciplinary working is vital and can be achieved successfully.
- Poverty is a tremendous problem. Ecologists and others must be pragmatic: the only way to conserve biodiversity and ecosystem services is to make sure that the people depending on these areas receive some form of direct payment or benefit.

5. **Biodiversity and Ecosystem Services in Europe**
   Professor Alastair Fitter FRS, University of York and EASAC.

The role that organisms play in some ecosystem services is small, in others it is huge. If organisms play a large part in the delivery of a service, are particular organisms necessary? Is the service better delivered by many species? What are the consequences of loss of species from an ecosystem for service delivery? These were just some of the questions and considerations being examined by the EASAC (European Academies Science Advisory Council) working group examining the links between biodiversity and ecosystem services (http://www.easac.eu/page.asp?id=28).

The effects of biological richness on productivity, soil formation and nutrient cycling are well supported by scientific literature: there is sufficient evidence to support the hypothesis that the numbers of species in an ecosystem plays an important role in delivery of these supporting services. A loss of soil, with associated loss of supporting services, would have an impact on the delivery of other ecosystem services, but what exactly these impacts would be are less well known.

The evidence base supporting the link between biodiversity and regulatory services is weaker. Evidence implicates biodiversity in net carbon exchange between productivity and decomposition but understanding of which organisms are most important to the delivery of the service is poor. As a consequence of the poor evidence base, we cannot make accurate predictions about how the flux of gases will change under differing land-use scenarios.

We manage land for the delivery of provisioning services, i.e. specifically for either the delivery of food, fibre or fuel. It is possible to achieve very high productivity in the delivery of the particular service through intensive management. The delivery of this service is therefore not dependent on biodiversity, but the question is one of sustainability -there are large-scale consequences of driving down biodiversity on this way. This is likely to be damaging other services if we focus just on one. CAP reform needs urgently to take this principle into account.

Biodiversity provides direct economic benefits through cultural services (ecotourism/ recreation) and directly benefits some regulatory services (e.g. natural enemies for disease-causing organisms). Biodiversity may also confer resilience to change in relation to some provisioning services (e.g. pollination); there is very good evidence that the range of pollinators is important in resilience.

The overall message of the presentation was that ecosystems deliver multiple services. Even an intensively managed landscape will deliver multiple services, albeit with some of those services minimised.

Single ecosystem services can often be delivered with low biodiversity, for example: carbon sequestration in peat; food from intensive agriculture; grouse shooting from heather moors, but managing the land in this way is unsustainable. The provision of multiple services and resilience of biological systems to change requires biodiversity.

Ecosystem services provide substantial economic benefits and the cost of replacing current service delivery can be high, but these services are sometimes irreplaceable It is essential that the consequences of land-use are fully understood, even if this has to involve a new regulatory framework.

6. **Ecosystem Services for Poverty Alleviation**
   Professor Andrew Watkinson, Chair, ESPA Programme Advisory Board

One of the Millennium Development Goals is to achieve environmental sustainability. This must be delivered in the context of a changing world. The IPCC (Intergovernmental Panel on Climate Change) has convincingly shown that climate change is happening and is anthropogenically driven.

The Millennium Ecosystem Assessment has shown that there are indirect drivers of change, which impact on direct drivers of change to ecosystem services.

The aim of the Ecosystem Services for Poverty Alleviation (ESPA) programme is to improve the management of ecosystem goods and services to alleviate poverty in the developing world (http://www.nerc.ac.uk/research/programmes/espa/). The programme also aims to provide sound scientific understanding of how ecosystem services can be managed to alleviate poverty.

ESPA is funded by the Department for International Development (DFID), the Economic and Social Research Council (ESRC) and the Natural Environment Research Council (NERC). DFID aimed to strengthen the capacity of developing countries to carry out research, and to act on these findings.

Research priorities have been identified by taking maps of world poverty and looking at what could be climate tipping points.

Research priorities identified include:

- The Indian monsoon. What will happen to the monsoon under a changing climate? If the monsoon fails in India, India may be forced to enter the free market for food. How will this impact on world food security?
- The delivery of ecosystem goods and services in China.
- Food production in Sub-Saharan Africa: climate models have shown an increase in drier areas and decreasing food production as the globe warms.
- Amazon: the destruction of the rainforest and the impact this will have on ecosystem services and the climate. Action must be taken to maintain the Amazon for the benefits of those living there.
- The resilience of the coast: ocean acidification and eutrophication.

The perspective of those depending directly on these services must be considered in any valuation: valuation should be done from their perspective and it must be these people who receive the benefits of conserving these services.

Equally important to achieve is stakeholder buy-in from the regions within the areas of ESPA's research focus. The response from the Chinese Ministry, local government in China and the Chinese population to the programme had been terrific.

Professor Watkinson's opinion was that the ecological work being carried out in this area in the UK was not fit for purpose: members of the BES should reappraise their research activities to make

sure that any mismatch between the needs of policy and scientists' research was addressed. Education was also vital: ecological textbooks currently give scant mention to the concept of ecosystem services. This needs to change and in future ecosystem services should be covered thoroughly in biological and ecological degree courses.

7. **Living with Environmental Change (LWEC)**
   Dr Daniel Osborn, NERC

Dr Osborn delivered a summary of the main policy drivers behind the Living with Environmental Change programme (LWEC). The average person living in Africa in 2008 is poorer than thirty years ago, whilst developing countries are increasingly consuming more than the planet can realistically, sustainably, provide. Society needs to act intelligently in future and develop means to secure sustainable delivery of ecosystem services.

LWEC is an unprecedented grouping of partners signed up to common aims (http://www.nerc.ac.uk/research/programmes/lwec/) (). ESPA and other activities already come under the LWEC banner, whilst the LWEC Partners' Board is in the process of formulating further projects. The Met Office and the Technology Strategy Board are to join LWEC as partners.

The delivery aims of LWEC include:

- whole-system assessments and risk-based predictions of environmental change and the effects on ecosystem services, economies and communities, and
- guidance for more effective sustainable management of ecosystem services, as a foundation for resilient economic development and social progress.

Examining ecosystem services is thus a key component of the delivery aims of LWEC. In addition there is the issue of "human wellbeing" which is included in the objectives of LWEC, but is difficult to define, and leads to the question as to whether contented people treat the environment differently to populations who are stressed or unhappy in some way.

LWEC is intended to meet many of the needs identified by the Stern review on the economics of climate change (http://www.occ.gov.uk/activities/stern.htm). Solutions identified by government economists may well involve new technology and could include revisiting existing technologies such as that of producing genetically modified crops. There is a real need to monitor and to anticipate ecological consequences.

The ecological community should remain aware of opportunities for funding which may arise from other research council programmes: these may link to LWEC.

8. **The Benefits of Working Together**
   Dr Peter Carey, Centre for Ecology and Hydrology (CEH)

Dr Carey outlined three different means by which different communities can come together:

Multi-disciplinarity: working with a mixture of disciplines. Non-integrative.
Trans-disciplinarity: take others' ideas, mix them up and generate something better.

Inter-disciplinarity: pool approaches and come up with something new.

Evaluations of the strengths and weaknesses of each approach, by Drs Gunther and Baerbel Tress, had revealed that a lack of common language between academic areas often presented a barrier to effective joint-working. The barriers must be anticipated in each collaboration and efforts made to break them down when this is feasible. In addition, analysis had revealed that an inter-disciplinary project requires more time than other approaches.

When working on a project across disciplines, it is important to identify those with the ability to work across boundaries; those who can speak the language required in the different areas. A 'Rosetta Stone' was needed, similar to that developed by the conservation community in the United States.

Using a slide to illustrate the numerous definitions of ecosystem services employed by various sectors, Dr Carey pointed out that even definitions that appear similar can provoke arguments in a legal sense and that an economist's view of an ecosystem is very different from that of an ecologist. He urged ecologists to spend time explaining to economists 'that ecosystems have functions and what these functions were'. Economists need to understand that ecosystems are dynamic and changing.

Ecologists too could learn lessons from economists. Economists have to model the future in a very uncertain environment, working in terms of 'uncertain probabilities'. Ecologists may need to start looking at the future in these terms. As an example Dr Carey referred to Socolow Wedges (also known as Stabilisation Wedges) where predictions are made of the annual savings in carbon emissions needed to stabilise global warming by 2050.

In summary Dr Carey emphasised that there are still barriers to understanding across disciplines. In answer to a question he pointed out that the term "service" can be applied equally to either a positive benefit or to mitigation or protection from an environmental *disbenefit*. The latter is a challenging area and one which has not yet been sufficiently considered by ecologists.

Discussion

The session ended with a discussion between the audience and the panel of those who had delivered presentations during the workshop, chaired by Professor Mace.

Key themes to arise from discussion with the panel were:

Valuation and Application

- Is the ecosystem approach in danger of being seen as a 'solve all'?

- There is discomfort amongst some in the ecological community regarding valuation for ecosystem services. Economic valuation is not the only basis on which to make choices or trade-offs. There are other ways in which the "worth" of the environment can be measured and we should not be afraid to mix and match value definitions. It will be more effective to apply the ecosystem approach in 'bite-sized' bits, addressing particular societal priorities

such as poverty alleviation, delivery of water, mitigation of disease. Taking a wider approach to tackling one issue will mean going across disciplines.

- There is a need to be explicit about trade-offs.

- There are some strong advocates of pure economic approaches, so there is a need to be pragmatic and to learn to use economic models effectively. There is an emerging field of behavioural economics that tackles issues in ways other than simple monetary terms.

- One aspect of the ecosystem approach is the recognition that adaptive management is necessary; 'learning by doing'.

- The Ecosystem Approach allows discourse. It allows us to move from stating that 'system X is here, don't disturb it', to 'system X is here, don't disturb it because it provides a number of valuable benefits, quantified as Y'.

- Ecosystem services thinking' could make a tremendous contribution to attainment of the Millennium Development Goals. If we pay people, for example in Tanzania, to conserve their forests and this payment is accompanied by improved and robust institutional structures to deliver this payment, we may be able to lift them out of poverty straight away; a very powerful message.

- Economic valuation *can* be part of a toolkit. Valuation is uncomfortable, but is needed at the start to give policy makers something to work with.

- If ecosystem services cannot wholly be valued through economic means, the ecological community very quickly needs to generate an alternative mode of valuation, to avoid losing out to powerful groups making an economic case for road development, airport development, etc. It is not yet clear what this mode could be: the economic model, although distasteful to some, is yet a viable way of arguing for ecosystems to be considered in decision-making which affects them.

- Pragmatism, not idealism, must rule with respect to valuing ecosystem services. If we don't place a value on ecosystem services, their default position for policy-makers is zero. The goal must be to make sure that ecosystem services are taken into account in decision-making: a means of avoiding conflicts. Valuation should be seen as a tool to help a policy-maker reach the best decision for their constituents. Although this may not always produce the answer that the ecological community wants, equally it may provide a means for the choice not to always be between 'nature' or, for example, infrastructure. Valuation of ecosystem services will introduce an element of compromise.

- There is an echo in the debate of the way that forestry in the UK went in the 1980s, when forests were "valued" to ascertain their future. Ecologists need to be aware of, and to learn from, past debates. In the 1980's it was found that decision making with uncertainties meant that progression was in very small steps. It was then, and still is, "learn as you go". "People are not driven by money, but if you assume they are you predict their responses very well" (quote attributed to Roy Lorrain-Smith).

Working Together

- There is a need to bring together groups other than ecologists and economists: there are others with a stake who need to be party to workshops and discussions. Funding programmes should not just be evaluated by ecologists and economists, in order to foster interdisciplinary working.

- Social scientists and ecologists are grappling with the same problems when it comes to Ecosystem Services, and may even be using the same techniques, but they just have a different way of expressing the problems – different languages in effect. Dialogue between different groups needs to be improved, with a need to avoid "silo thinking" and putting labels on disciplines.

- Programmes submitted for consideration under LWEC programmes should consider both policy and research. LWEC is in its essence an integrated programme, with co-design from the policy and research sides, and this will continue right through to evaluation.

State of the Science

- Ecologists are concerned by the mismatch between the rate at which the science is developing with respect to ecosystem services and the *need* they perceive amongst policy-makers to implement an ecosystem approach. The NGOs appear to be more comfortable about taking an Ecosystems Approach even when there is a gap in the evidence base. Scientists need to keep feeding information in, recognising that the pace of policy implementation will not slow.

- A briefing from the BES would be useful to set expectations amongst policy-makers, setting out the current state of the science in this area. The Ecosystem Services Advisory Group could take the lead amongst the membership in drafting this[1].

Public Engagement

- There needs to be a raised awareness amongst the public about ecosystem services/valuation and what it really means, including the uncertainties, as it is the constituents' voices that guide politicians.

- Public engagement is needed to try and make Ecosystem Services more implicit in decision making. If both benefits and disbenefits are included for a system under consideration there may not be a happy answer, but it may be possible to reach compromises.

- Engaging the public and disseminating information about the ecosystem services concept is vital. Raising awareness amongst a lay-audience could lead to the development of a

[1] The BES plans to develop such a synopsis in 2009, possibly in partnership with other organisations such as CEH and the Institute of Biology.

constituency upon which the ecological community can draw to develop an impetus towards a particular policy direction.

- Economics is also about creating markets and incentives – the economic argument is just another point of view, and conservation is still a valid argument as well.

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