Ecosystem Services Valuation for Coastal Managers

A guide to support the integration of ecosystem services into the management of coastal areas

Plymouth Marine Laboratory
Contents

Introduction ................................................................. 1
Introduction to ecosystem services valuation .......... 2
Why this approach is important ................................ 3
Blue growth ............................................................... 3
Evolving frameworks and classifications .................. 4
What is natural capital accounting? ......................... 5
Usage/application of the ecosystem service approach in policy and management ................ 5
Pros and cons of ecosystem services valuation ........ 5
Valuation: approaches and methodologies ............... 6
Why perform an ecosystem services valuation .......... 8
Data/information availability and usage .................... 10
Using ecosystem services in site management ....... 11
Communicating with the public ............................... 13
Use in policy - a brief history ................................. 15
Case study 1: North Devon Biosphere Reserve ....... 16
Case study 2: Recreation in Poole Harbour ............ 18
Conclusion ............................................................... 20
Further reading and references ............................ 21
Glossary ............................................................... 22

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Introduction

Plymouth Marine Laboratory (PML) has extensive experience in Ecosystem Services valuation; as lead authors for two sections of the National Ecosystem Assessment, partners of several European research projects that have conducted Ecosystem Services valuations (including VALMER and VECTORS), and authors of many high-ranking, peer-reviewed publications and reports in this field.

PML is committed to use this wealth of knowledge to support local coastal managers and partnerships to capitalise on this approach to improve coastal management. To help achieve this, PML held a workshop on 4th March 2016 and invited local Coastal Officers to attend. Ten practitioners attended from nine organisations (please see list on previous page).

The workshop provided a mix of presentations and interactive discussions that allowed the group to:
» Learn more about the ecosystem services approach and how it can be applied;
» Identify the barriers and advantages of using the ecosystem services approach to manage natural environments;
» Discuss the data requirements and how these could be achieved;
» Share ideas and best practice.

The workshop highlighted PML’s commitment to work with local partners and helped to develop new collaborations and support networks.

PML will continue to work with the practitioners and encourage them to contact us if we can be of further support.

Use of this guide

This guide is an introduction to ecosystem services to support the integration of ecosystem service approaches into coastal management. PML are keen to support the management of coastal areas and to help practitioners to make the most of ecosystem service approaches. As part of this process a workshop was with x number of coastal officers and environment practitioners in the SW. Some of the content of this guide is based on the workshop presentations and interactive discussions with the practitioners attending.

We give permission for content from this guide to be used to support coastal officers in their role, such as in management plans etc., but ask that PML is acknowledged in any publication or presentations using the citation below. Please also provide a copy of the material produced to Marine_EcoServices@pml.ac.uk or by post to Jenny Lockett at the address on the back of this guide.

Please cite this document as:

Plymouth Marine Laboratory. 2017. Ecosystem Services Valuation for Southwest Coastal Managers. A guide to support the integration of ecosystem services into the management of coastal areas. Plymouth, UK.
Introduction to ecosystem services valuation

Marine ecosystems contribute to human wellbeing in many ways. These services to human society include provision of food, raw materials for pharmaceuticals and opportunities for recreation. Furthermore, marine ecosystems have a role in maintaining our climate, transforming waste products and preventing coastal erosion. Applying an economic value to marine ecosystem services offers a different perspective, changing the focus from how people are impacting the oceans to how the oceans impact us and our lives.

By reversing the looking glass we can examine environmental challenges in ways that can better inform the management and governance of the marine environment. This will support decision-making that accepts some changes and losses for the benefit of other goods and services that we value more highly.

The potential to use ecosystem services to support management decisions has led to extensive research into how ecosystems generate services, how changes in biodiversity affect these services, and in some cases, whether technology can be used to substitute for them. It has also supported research into the value to people of benefits generated by ecosystem services and how these values can be used to support ecosystem management decisions.

Ecosystem services typology

<table>
<thead>
<tr>
<th>Provisioning</th>
<th>Regulating</th>
<th>Habitat</th>
<th>Cultural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food provision:</td>
<td>Air purification</td>
<td>Gene pool protection</td>
<td>Aesthetic experience</td>
</tr>
<tr>
<td>Wild capture sea food</td>
<td>Biological control (checks &amp; balances)</td>
<td>Migratory and nursery habitat</td>
<td>Cultural heritage</td>
</tr>
<tr>
<td>Farmed sea food</td>
<td>Climate regulation</td>
<td></td>
<td>Cultural diversity</td>
</tr>
<tr>
<td>Biotic raw material:</td>
<td>Coastal erosion prevention</td>
<td></td>
<td>Information for cognitive development</td>
</tr>
<tr>
<td>Genetic resources</td>
<td>Disturbance prevention and moderation</td>
<td></td>
<td>Inspiration for culture, art and design</td>
</tr>
<tr>
<td>Medicinal resources</td>
<td>Regulation of water flows</td>
<td></td>
<td>Leisure, recreation and tourism</td>
</tr>
<tr>
<td>Ornamental resources</td>
<td>Waste treatment and assimilation</td>
<td></td>
<td>Spiritual experience</td>
</tr>
</tbody>
</table>

Interconnection of marine biodiversity and ecosystem services
Why this approach is important

Identification of trade-offs between different uses (and protection) of marine and coastal environments through ecosystem service assessment and valuation of benefits can help to increase efficiency of coastal and marine decision-making processes and make trade-offs more apparent.

The ecosystem services approach can contribute to the design of local and national policies and management strategies:

» Aimed at preserving marine and coastal resources in a context of continuous environmental pressures which are expected to be intensified by global warming.

Example: Benthic bioturbators

Benthic bioturbators are a functional group of species that have a key impact on their environment, contributing to the mixing of sediment layers in the seabed. Through an examination of their role we can start to see the functions/processes that underpin ecosystem services and the benefits they provide. The relationships involved are not linear and processes may underpin several services. We need research to understand the key pathways and links, which we can then use as indicators of likely change in provision of services and benefits under different drivers of ecosystem change.
There are multiple ecosystem service frameworks available and it is important not to get too involved in the minute detail or waste time reinventing wheels. Useful starting places include TEEB (2010), CICES (2016) and the UK-NEA (2011, 2014). No single framework is likely to be final but it is important to make sure the framework used is relevant to the context.

Benefits are those things that require some human effort to obtain, therefore all ecosystem goods (e.g. fish, energy, seaweeds) can be considered benefits that we value (e.g. through markets) as can many cultural factors relating to the environment.

Ecosystem services are the result of bundles of ecosystem processes/functions that contribute to the creation of benefits – they are the components that we use either passively or actively to generate benefits and economic wealth. One service is provision of stocks of fish that are available for people to catch. These fish stocks have in turn been generated by secondary production in the ecosystem. All the ecosystem processes that in combination regulate our climate are collectively a climate regulation service.

Processes/functions are the ecological processes that control the fluxes of energy, nutrients and organic matter through an environment that would happen irrespective of whether or not humans were around to make use of them.

Processes and services can be interchangeable – a good example is water quality. Sometimes water purification or bioremediation are the services we value, but sometimes these services are considered to be processes that underpin recreational services (e.g. being able to swim in clean water, or contribution to recreational angling) or our ability to site aquaculture in a location or catch safe seafood.

We need to make assessments of the services to see how changes in them might affect the delivery of benefits generated from services. This could include assessing fish stocks, climate regulating processes and market values. Typically we should value the benefits, but sometimes the benefits are so wide-spread and diffuse, and services contribute to so many benefits, that it becomes impossible to measure the benefits generated from the service. In which case it becomes justifiable to assess and value the service.

All of these ecosystem services frameworks are placed into fairly standard impact assessment models where impact scenarios are compared to scenarios where nothing changes. Services are assessed, typically using indicators, which are mapped to illustrate a spatial component.

*Note that the term good(s) includes all use and non-use, material and non-material benefits from ecosystems that have value for people.
What is natural capital accounting?

While ecosystem goods and services are the benefits people obtain from ecosystems, natural capital refers to the elements of nature that directly and indirectly produce value or benefits to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions. Natural capital accounting is the process of calculating the total stocks and flows of natural resources and services in a given ecosystem or region. Natural capital assets are a series of stocks, from which flows of ecosystem services are generated.

Usage/application of the ecosystem service approach in policy and management

Uses ecosystem services approach:

- Natural Environment White Paper
- EU Biodiversity Strategy
- Common Fisheries Policy

Does not use ecosystem services approach as yet:

- Marine Planning
- Marine Licensing
- Environmental Impact Assessment
- Strategic Environmental Assessment

Local examples:

- North Devon Biosphere Reserve Management Plan
- Tamar Estuary Management Plan

Pros and cons of ecosystem services valuation

(as identified at the workshop)

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledging the value of all aspects of the environment</td>
<td>Confusing terminology</td>
</tr>
<tr>
<td>Communication tool</td>
<td>Lack of understanding by some sectors</td>
</tr>
<tr>
<td>Helps capture the ‘bigger picture’</td>
<td>Time/resource constraints</td>
</tr>
<tr>
<td>Support Strategic Environmental Assessments</td>
<td>Too difficult to do</td>
</tr>
<tr>
<td>Understand trade-offs</td>
<td>Valuation dangerous (if doesn’t provide the answers we want)</td>
</tr>
<tr>
<td></td>
<td>Valuation unrealistic</td>
</tr>
</tbody>
</table>
**Valuation: approaches and methodologies**

**Attitude or judgment-based values** are based on empirically derived descriptive theories of human attitudes, preferences, and behaviour. These values are not necessarily defined in terms of trade-offs and are not typically constrained by income or prices, especially those that are outside the context of the specified assessment process.

**Economic values** assume that individuals are rational and have well-defined and stable preferences over alternative outcomes, which are revealed through actual or stated choices. Economic values are based on utilitarianism and assume substitutability, i.e., that different combinations of goods and services can lead to equivalent levels of utility for an individual (broadly defined to allow both self-interest and altruism). They are defined in terms of the trade-offs that individuals are willing to make, given the constraints they face. The trade-offs that define economic values need not be defined in monetary terms.

**Community-based values** are based on the assumption that, when consciously making choices about goods that might benefit the broader public, individuals make their choices based on what they think is good for society as a whole rather than what is good for them as individuals. In this case, individuals could place a positive value on a change that would reduce their own individual well-being. In contrast to economic values, these values may not reflect trade-offs that individuals are willing to make, given their income.

**Values based on constructed preferences** reflect the view that, particularly when confronted with unfamiliar choice problems, individuals do not have well-formed preferences and hence values. This view is based on conclusions that some researchers have drawn from a body of empirical work addressing this issue. It implies that simple statements of preferences or willingness to pay may be unstable (e.g. subject to preference reversals). Some have advocated using a structured or deliberative process as a way to help respondents construct their preferences and values. This report refers to values arrived at by these processes as “constructed values”.

**Bio-ecological values** depend on known or assumed relationships between targeted ecosystem conditions and functions (e.g. biodiversity, biomass, energy transfer, and transformation), ecosystem functions, and the respecified biophysical goal or standard.

**Energy-based values** are defined as the direct and indirect energy required to produce a marketed or un-marketeted (e.g. ecological) product or service.

**Market prices** are most commonly used for provisioning services, such as changes in fish stocks as we can refer to market prices for fish. A market is not ‘well-functioning’ if say, for instance, there are distortions caused by government intervention – such as taxes or subsidies.
**Costs based approaches** estimate the costs incurred in recreating a regulating ecosystem service artificially:

» *Avoided cost method*: costs incurred in the absence of the ecosystem service.
*Example*: cost of repair and restoration from storm surge damage that would occur without coastal mangroves.

» *Replacement cost method*: costs incurred by replacing ecosystem services with artificial technologies
*Example*: cost of a waste water treatment plant in place of wetlands.

» *Mitigation or restoration cost method*: cost of mitigating effects of a loss of ecosystem services, or the cost of achieving their restoration.
*Example*: use of hard engineering for flood defence where flood attenuation services are lost due to land use change (e.g. deforestation).

Although direct market approaches are based on observable prices and costs, there are important limitations to consider:

» Lack of markets for ecosystem services or related goods and services

» Markets are distorted by:
  » Subsidies;
  » Lack of competition;

» Replacement cost approaches can overstate value as value is based on cost of alternative not the value of the benefit provided.

**Production function approaches**

» Estimate the contribution of an ecosystem service to a final commodity.

» Improvement in the resource base or environmental quality, i.e. enhanced ecosystem services, lowers costs and prices or increases quantity of goods.

» Applicable to regulating and supporting services

» Two-step procedure which requires knowledge of the relationships between ecosystems services and valued end points:
  1. Determine physical effects of change in resource or ecosystem service;
  2. Impact of change is valued in terms of corresponding change in marketed product.

» Production function approaches have specific problems:
  » Data and knowledge of cause-effect relationships is often lacking.

  » Interconnectedness and interdependence (e.g. joint production, synergy, mutual exclusivity) of ecosystem services increases the likelihood of double counting.
Why perform an ecosystem services valuation?

Why perform an ecosystem services valuation?

Informative use
» Improve knowledge
» Integrate knowledge
» Initial diagnosis of key marine issues
» Raise awareness

Decisive use
» Anticipating future changes
» Facilitate comparison of trade-offs
» Compare management options
» Increasing wellbeing

Technical use
» Design management options

The triage process

Stage 1: The need for a marine ecosystem services assessment (MESA) and general scoping

Stage 2: Refining the scope of the assessment

Stage 3: Choice of methods, tools and means for quantifying marine ecosystem services
**Project example: VALMER**

The VALMER project aimed to quantify and communicate the value (economic, social and environmental) of marine and coastal ecosystem services. It focused on the Western Channel area and the waters of southwest England (Devon, Dorset and Cornwall).

The waters of south-west England are under increasing pressure from a wide range of competing uses and interests; effective and informed management of this shared space is vital to the sustainable use of this valuable resource. We know that ecosystem services assessment has the potential to improve marine management and planning but, to date, there have been limited documented cases.

Through VALMER, scientists examined this and also provided policy makers with a clearer understanding of the values that can be placed on the marine environment and how these can be used to make more effective decisions.

<table>
<thead>
<tr>
<th>NDBR</th>
<th>Poole Harbour</th>
<th>Sound - Fowey</th>
<th>Golfe Normand-Breton</th>
<th>PNMI</th>
<th>Golfe du Morbihan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aim</strong></td>
<td>Design management options</td>
<td>Improve knowledge</td>
<td>Initial diagnosis</td>
<td>Initial diagnosis; Exploratory scenarios</td>
<td>Compare Management options</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>Benthic offshore</td>
<td>Mixed (Harbour)</td>
<td>Mixed (coastal and offshore)</td>
<td>Intertidal zone; fish habitats</td>
<td>Kelp forests</td>
</tr>
<tr>
<td><strong>Issue</strong></td>
<td>Impact on benthic habitats</td>
<td>Recreational Use</td>
<td>Mixed</td>
<td>Increasing demand of all uses</td>
<td>Increasing demand for kelps</td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td>Fish stocks, nutrient cycling, carbon cycling</td>
<td>Recreation</td>
<td>Varied</td>
<td>Recreation, Provisioning services</td>
<td>Food, remarkable species, ecotourism</td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td>Bayesian Belief Networks</td>
<td>Travel Cost Method, survey</td>
<td>Varied</td>
<td>INVEST Ecosystem accounting</td>
<td>Indicators Dynamic modelling</td>
</tr>
</tbody>
</table>

The aims, issues and methods of ecosystem services valuation can be very different for different sites. Within VALMER each of the six sites (NDBR: North Devon Biosphere Reserve, PNMI: Parc Naturel Marin d’Iroise) studied required a bespoke approach to tackle specific issues and specific management needs.

**VALMER conclusions**

» Ecosystem service approaches do resonate with stakeholders.
» They can be used effectively in a range of contexts.
» Both monetary and non-monetary approaches are useful.
» Mapping and visual representations are effective communication tools.
» Confidence and uncertainty need to be communicated.

Further information and guidance can be found at: http://www.valmer.eu/results/

For case studies on the “North Devon Biosphere Reserve” and “Poole Harbour” see pages 16–23.
Data/information availability and usage

Ecosystem service valuation requires significant data/information relevant to the service being valued to inform the analysis. A lack of relevant information can present a significant barrier and the resources are not always available to fund the collection of new data that is needed. However, some data can have multiple applications, and it is useful to think more broadly about what data is available, or can be easily obtained, and how it can be used to get meaningful results.

Data can be relevant to many different services, and could be indicative of different features so can have multiple applications. For instance data on water quality can help to inform valuation of a range of services including, recreation, aquaculture, and biodiversity. The table of example data, constructed during the workshop, presents some examples of data and the range of ecosystem services that they could inform.

Site managers often have access to a wide range of data, through their partners, such as local authorities, and a lot of data is openly available (see below). The data that is available can inform a wide range of services and it is important to consider the trade-offs and think more broadly about what the data can tell us.

### Example data and relevant ecosystem services

<table>
<thead>
<tr>
<th>Example data/information/evidence</th>
<th>Ecosystem service could potentially inform valuation</th>
</tr>
</thead>
</table>
| Water quality: estuary, coastal and freshwater | » Recreation  
» Fishery/aquaculture  
» Tourism  
» Water cycle  
» Health and wellbeing  
» Biodiversity |
| Key cruising routes: mooring/anchorage slipways | » Recreation  
» Biodiversity/disturbance  
» Carbon sequestration  
» Water quality  
» Conflict/competition between sectors e.g. swimming and boats  
» Invasives |
| Census/housing e.g. occupancy | » Value related to proximity to green/blue space |
| Deprivation data | » E.g. link to fishery change |
| Income/education | » Health and wellbeing |
| Health and access to health services | » Access to green/blue spaces  
» Wellbeing and health benefits |
| Cetacean counts | » Health of the ecosystem  
» Recreation  
» Tourism  
» Leisure |

### Resource efficient data collection

Depending on the ecosystem services being valued there are likely to be particular data that are necessary and cannot be substituted. Data collection can be resource demanding and it is a considerable concern for site managers as to whether these resources are available and, if they are, whether the valuation is useful enough to warrant the effort required. This must be considered on a case-by-case basis but it is important to keep in mind that there are a wide range of data collection methods available and it may be possible to find the right balance between the approach, and associated effort required, and the output achieved. For example, relevant and useful information can be collected through targeted focus groups and surveys, which could be delivered through existing networks and events, e.g. newsletters, forums etc.

A growing acceptance of citizen science has emerged in recent years, which offers significant opportunities for site managers to focus the interests of keen local volunteers into strategic data collection activities, such as wildlife or recreational user counts. It is of course important to make sure that data is robust, for further advice contact PML (Marine_EcoServices@pml.ac.uk).

### Who may hold relevant data?

- **Statutory bodies**: Natural England, Defra, Environment Agency, Cefas, Natural Heritage
- **Scientific organisations**: PML, Marine Biological Association, SAHFOS
- **Conservation groups**: Wildlife Trusts, RSPB, Marine Conservation Society
- **Water board**: South West Water
- **Local Authority**: Parish, Town, District, and County Councils
- **Transport links**: First Great Western, airports, coach companies
- **Tourism board**: Visit Devon/Cornwall
- **Businesses**: hotels, wildlife tours
- **Food production**: farmers, fishermen
- **Local sports clubs, recreational groups

Ecosystem services valuation is a tool that can be used to identify the services provided by a particular site or habitat and assign a contextual value to the associated benefits for society. This knowledge can help site managers to understand the interconnectivity between services; how they impact each other, where trade-offs can/will be made, how future pressures may affect the services and the resultant impacts for society. This understanding can be helpful when planning the management needs of a site but also in conflict resolution (between user groups) and responding to development plans.

A key opportunity for using ecosystem services valuation is in site management plans, which could be reconstructed according to an ecosystem services framework, or could incorporate ecosystem service approaches into relevant sections of the plans. For example, at a minimum level, future management plans could include research into ecosystem service valuation or targeted data collection and/or collation of existing data to help prepare for using ecosystem services valuation in the future. The degree to which the ecosystem approach is included will depend on the site needs and the resources available but also whether the lead individual for the site feels the approach will significantly benefit the management plan. In order to consider whether use of the ecosystem services approach is worthwhile the workshop participants performed a SWOT analysis to help them identify all of the potential strengths, weaknesses, opportunities and threats (the results of which can be seen below).

### Strengths
- All encompassing and comprehensive
- Framework to structure approach
- Inventory of what the site provides
- Clarifies trade-offs in decision making
- Means of prioritisation
- Broadens perspective in plans
- Challenges assumptions
- Part of environment, social, economic
- Valuation supports decisions
- Explicit
- Interdisciplinary
- Shifts focus from people’s impact on the environment to the impact of the environment on people
- Communication tool

### Weaknesses
- Not well understood
- Not rapidly communicated
- Requires good interdepartmental communication
- Resource hungry
- Lack of good case studies
- No policy driver
- Boundaries to what you can manage

### Opportunities
- Natural capital - identification and accounting
- Terminology
- Highlight cross linkages
- Cultural challenge
- Learn from Integrated Coastal Zone Management
- Prioritise data
- Broadening approaches to consider other aspects
- Break down discipline/sector silos
- Train current/next generation practitioners
- To make it an efficient/realistic communication tool
- Identify areas which deliver the most services
- Tool for drawing down funding e.g. invest to get rid of invasive species to generate wider benefits. Funders are a key audience of plans.

### Threats
- Philosophy can be challenging
- Too difficult to do especially valuation
- Lack of enthusiasm
- Interdisciplinary needed
- Time required to do it properly
- Resources to do it properly
- Misuse/bias of weighting values – biased communication of values
As identified by the workshop participants, there are significant challenges in terms of the resources required to undertake ecosystem services analysis and how well the approach is understood and accepted. The site manager will therefore need to decide whether it is appropriate for their management. A few things they may wish to consider when making this decision are listed to the right.

Other applications for the ecosystem services approach could include valuation of the actual management of the site in order to justify funding (e.g. for an estuary partnership). It could be beneficial to use the framework of ecosystem services valuation to demonstrate the inherent value of the management body itself and use this to draw down funding. The body would need to evaluate the benefits to society of their actions and how this offers good value for money but the results could be very useful for comparing the value of the organisation to alternative forms of management.

Ecosystem services valuation also provides an important tool for communicating with the public. While we would adjust the messages and terminology to suit this audience the ecosystem services approach still offers considerable benefits. Tips and advice on communicating are provided in the next section.

Key considerations in adopting an ecosystem services approach

» Who is the audience for the management plan?

The management plan will most likely be read by funders and organisations with an interest in the governance of the site, such as statutory bodies. This audience will most likely be familiar with ecosystem services valuation and interested in its application.

» What values can legitimately be cross-compared from other studies e.g. VALMER?

Results and findings from ecosystem services valuations of other sites can be used if there are relevant and comparable features.

Incorporating ES into the Exe Estuary Management Plan 2016 - 2021

Following the workshop, PML worked with the Exe Estuary Management Partnership (EEMP) to help them to include ecosystem services into their management plan for the first time. The EEMP recognises the importance of understanding and valuing the components of the estuary not only in terms of biodiversity and habitats, but also with regards to the functioning of its ecosystem and its provision of ecosystem services and benefits, which their management plan now reflects.

The management report includes a new section on ‘Nature’s value’, which describes the ecosystem services provided by the estuary and the inherent trade-offs and interactions that take place between the multiple benefits and uses of the site. While throughout the report the background and evidence sections for many of the key areas, such as climate change and water quality, have been backed up with evidence from the National Ecosystem Assessment.

You can view the management report at https://www.exe-estuary.org/web/exe-estuary/partnership-documents5

If you are involved in site management and would like help to incorporate ecosystem services information and approaches into the management then please contact PML at Marine_EcoServices@pml.ac.uk
Communicating with the public

A key component of site management is communicating with the public who are the local stakeholders for the site. The main aim is to help them understand and appreciate the site in the hope that they are then more likely to help look after it and minimise behaviours that may have a negative impact, such as disturbing feeding birds. Site managers aim to engage and enthuse local communities through leaflets, newsletters and websites etc. as well as events. Some of the exciting things that site managers communicate are the ecosystem services and how they benefit the local communities.

Research at PML has demonstrated a direct link between people and the number of ecosystem services that they perceive and appreciate in the environment. Some preliminary analysis has identified that people who perceive more ecosystem services are more likely to engage in acts that intend to protect the environment, e.g.

- Buy sustainable fish
- Manage waste responsibly
- Volunteer in beach cleans
- Encourage family and friends to look after the environment

In addition, other important factors are known to influence behaviour, including:

- Personal value orientation
- Socio-demographics
- Coastal experience, i.e. visit frequency

Making the most of communication opportunities is essential and there are some key considerations to writing any text for the general public.

Dumbing down or making accessible?

- If a word can be misinterpreted it will be, choose your language carefully.
- The problem is, precision demands jargon and jargon is for those in the know, it is not helpful.
- Ecosystem goods and services is used a lot but is not liked or understood by the public.
- Do you really want to use it? Are there alternatives that are more accessible and engaging e.g. Nature’s value or Nature’s benefit (see table below from FM3, 2010)

Tip: ask yourself - does it mean anything outside of the inner circle?

<table>
<thead>
<tr>
<th>Name</th>
<th>% Very appealing</th>
<th>Mean score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature’s value</td>
<td>61%</td>
<td>5.5</td>
</tr>
<tr>
<td>Nature’s benefits</td>
<td>53%</td>
<td>5.3</td>
</tr>
<tr>
<td>Earth’s benefits</td>
<td>55%</td>
<td>5.2</td>
</tr>
<tr>
<td>Environmental value</td>
<td>49%</td>
<td>5.2</td>
</tr>
<tr>
<td>The planet’s assets</td>
<td>45%</td>
<td>5.0</td>
</tr>
<tr>
<td>Nature’s health and safety systems</td>
<td>46%</td>
<td>4.9</td>
</tr>
<tr>
<td>Environmental wealth</td>
<td>45%</td>
<td>4.9</td>
</tr>
<tr>
<td>Environmental goods</td>
<td>44%</td>
<td>4.9</td>
</tr>
<tr>
<td>Natural life-support</td>
<td>44%</td>
<td>4.9</td>
</tr>
<tr>
<td>Ecological wealth</td>
<td>42%</td>
<td>4.8</td>
</tr>
<tr>
<td>The planet’s products and services</td>
<td>34%</td>
<td>4.6</td>
</tr>
<tr>
<td>Natural infrastructure</td>
<td>32%</td>
<td>4.6</td>
</tr>
<tr>
<td>Ecosystem services</td>
<td>31%</td>
<td>4.5</td>
</tr>
<tr>
<td>Nature’s social safety net</td>
<td>34%</td>
<td>4.4</td>
</tr>
<tr>
<td>Natural capital</td>
<td>30%</td>
<td>4.3</td>
</tr>
<tr>
<td>Earth’s capital</td>
<td>29%</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Who are the stakeholders?

- Academics/innovators
- Businesses
- Councillors
- Cross-border groups
- Decision makers
- Engineers
- Environmental bodies
- Funders
- Landowners
- Local authority councillors
- National government
- Own organisation/internal officers
- Parish councillors
- Port authority
- Project partners
- Public
- Residents
- Statutory consultees
- Tourists
- Users: commercial, statutory, military, recreational
- Wider local community
- Wildlife enthusiasts
- Young people
Make sure you know who your target audience is and ask yourself:

» What is important to them?
» How can the communication be framed to be relevant to them and their interests, needs?
» What language will they understand/connect with?

Tip: if the terminology is used by media sources, such as BBC news, then it should be safe to use for your communication but be careful of words that have been shown to disengage people, such as ‘stakeholder’.

If you don't know what is important to them then how can you find out?

» Social media e.g. Twitter feeds, what are local community groups sharing?
» Focus groups
» Social marketing

Tip: target your communications for particular audiences.

Key ways to incorporate relevance:

» Talk about nature’s benefits or values
» Go broad to think about the benefits of nature
» Health and safety connection is always good
» Nature is a provider - medicine, food
» Acknowledge that there are some parts of nature it is difficult or impossible to quantify
» Clarify value, don’t over estimate
» It’s not all about money

Tip: take care, financial ‘experts’ are not always trusted so don’t use them to add credibility to your message.

Social media provides numerous free and easy platforms for communicating with large numbers of people but needs to be managed carefully.

» Choose the right platform and explore free online guides, a little bit of research could help you establish the right social network for you.
» Build a relationship. Engage with people in your network, get them involved and always promptly reply to outreach. Social media isn’t a soapbox, but a tool for engagement.
» Use images. People are becoming more attracted to images such as infographics or easily digestible videos like those on Vine.
» Use analytics. There are hundreds of tools to analyse your social media success and failures. Many are free and part of the site itself, while others provide a third-party analysis. Don’t just collect reports; read them, translate them and turn them into action.

Remember, social media is a useful tool for finding out what your audience is interested in and what is happening in their world as well as sharing information. Follow local groups and keep an eye on what they are posting so you can make your posts relevant to them and support their networks.

» Think before you tweet. Social networking encourages fast reactions, but think before you tweet or post – if you say something you regret, it may be too late to take it back.

Journalists and scientists may misunderstand each other:

» Scientists often use a precise language that can make their work less accessible to the outsider.
» Scientists may be concerned about talking to the media out of fear of being taken out of context.
» Scientists are often uncomfortable about talking outside their area of research or the larger context of their work.
» In extreme cases where a scientist does not engage with the media, a knowledge gap can be created, which inevitably needs to be filled – BP, Climategate.
» Remember a journalist wants a story to keep his editor happy, who wants to keep the proprietor happy, who wants to sell newspapers.

Social media platforms explained

Twitter: I’m eating a #cookie
Facebook: I love cookies
Four Square: This is where I eat my cookies
Instagram: Here’s a vintage photo of my cookie
YouTube: Here I am eating a cookie
LinkedIn: My skills include eating cookies
Pinterest: Here’s a cookie recipe
Use in policy - a brief history

The National Ecosystem Assessment (NEA; http://uknea.unep-wcmc.org/) appraised the UK’s natural environment in terms of the benefits it provides to society and continuing economic prosperity. The first of its kind in the world, the UK NEA was prepared and peer reviewed by over 500 experts. It is the most comprehensive assessment of the UK’s natural environment and resources ever undertaken.

Professor Mel Austen (PML) was on the Expert Panel of Phase 1 of the NEA and was the coordinating lead author of its ‘Marine’ chapter, which was published in June 2011. Her colleague, Dr Nicola Beaumont, was a lead author for the ‘Economic Values from Ecosystems’ chapter and also led an economic analysis of Coastal Margins and Marine Habitats, which underpinned the Economics chapter.

The NEA strongly influenced the development of the Natural Environment White Paper, ‘The Natural Choice: securing the value of nature’ (https://www.gov.uk/government/publications/the-natural-choice-securing-the-value-of-nature), for England and developed a set of principles for incorporating ecosystem services and their value within conventional government decision-making. At the launch of the NEA, Professor Robert Watson, Chief Scientific Advisor at Defra, commented that he had never before seen a publication inform the development of policy so rapidly, feeding in as it did to the White Paper published the following week (BES and UK BRAG, 2011).

The Natural Environment White Paper outlines the UK government’s vision for the natural environment over the next 50 years. Many parts of the document reflect elements of the ecosystem approach including the government’s commitment to establish the Ecosystems Knowledge Network, which is dedicated to showing what the approach means in practice.

Before 2013, government impact appraisals rarely embedded knowledge of ecosystems and their services into project, programme and policy appraisals but this is now considered critical for decision-making. Barriers to, and opportunities for, embedding an ecosystem services framework into decision-making at the practitioner, institution, and socio-political levels were identified in the UK National Ecosystem Assessment Follow-on (UK NEAFO) in 2014, which recognised that this knowledge could provide many wider benefits for society if taken into account at an early stage of policy development.

The NEA and subsequent papers and reports have brought ecosystem services valuation into the mainstream. It has become an established framework for environmental governance and management, changing the agenda on how to manage coastal systems.
Case study 1: North Devon Biosphere Reserve

What: Large-ish scale, exploratory, using secondary data, non-monetary
Who: North Devon Biosphere Reserve (NDBR), Marine Biological Association
How: Modelling approach (Bayesian Belief Network)
Why: To assess the ecosystem services approach as a tool for designing management options and to raise awareness of the importance of sedimentary habitats.
Stakeholders: Fisheries, local authorities, management partnerships, NGOs, ports, recreation, statutory agencies.

Approach:
1. Data collation
2. Ecosystem services assessment
3. Develop scenarios with stakeholders
4. Modelling change in ES
5. Implications for governance

The case study focused on the area’s extensive seabed muds, sands and gravels and the role they play in storing carbon, processing waste, and providing nursery grounds for commercial fish and shellfish. Recent and historic surveys, as well as modelled maps, were used to determine the type and extent of different habitats. The potential level of each ecosystem services was then determined by considering the preferences of juvenile fish and shellfish for sediment type and water depth (nursery provision), sediment mud content (waste processing), and this potential service delivery was then mapped.

Service delivery
A key focus of the case study was to gather relevant data on service delivery and its impacts on sensitive habitats. This information informed the Ecosystem Service Assessment (ESA). Concurrently management scenarios were developed with stakeholders to explore how delivery of ecosystem services may change with alternative management and use on a 15 year time horizon.

The data, and ESA were used to construct a model and characterise the current situation while the management scenarios were used to condition the model. Model outcomes in terms of changes in ecosystem services were presented back to the stakeholders, and information on how this could be used for governance was gathered.

Habitat map:
Underlying data derived from multiple sources including:

- RWE npower surveys
- UKSeaMap
- Bristol Channel sediments and macrofauna (Warwick and Davies, 1977)
- Outer Bristol Channel Survey (Mackie et al., 2006)
- Lundy habitat mapping surveys
- Barnstaple Bay grab sampling
- MNCR inlets in the Bristol Channel

Lundy Island, North Devon Biosphere Reserve.
Case study 1: North Devon Biosphere Reserve

**Modelling approach**

The model was populated by a variety of data types including habitat sensitivities and vulnerabilities from the literature, information on ecosystem services and their relationship with habitats from the ESA, likely pressures arising from activities from literature reviews, EIAs and expert opinion. The model was run for each cell in the grid for the current situation and for three scenarios, aggregates extraction, aquaculture and MCZ designation. The output comprised of maps of changes in services as departures from the existing situation (increases or decreases). Net change was determined taking into account impacts from the management scenario or proposed development together with any fisheries displacement. The estimation of current ecosystem services provided by subtidal sediment habitats showed the ecosystem services considered are provided in different areas across the biosphere and identified the key sites most important for provision. Changes in ecosystem services delivery from subtidal sediment habitats varied for each of the three scenarios. The designations of the recommended Marine Conservation Zone (rMCZ) scenario showed both increases and decreases in provision for different ecosystem services.

**Key lessons from the North Devon Biosphere Reserve**

- “Hotspot” maps of ecosystem services change were very well received by stakeholders.
- Maps of potential delivery of ecosystem services can inform management bodies, such as the Inshore Fisheries and Conservation Authority.
- Visual representation of confidence assessments within the maps would be beneficial.
- Trade-offs between different ecosystem services types can be visualised spatially, taking into account secondary effects of management interventions (e.g. displacement of fishing activity). This is particularly relevant for the rMCZ scenario and may inform the management plans for sites that progress to designation.
- A shortage of empirical evidence for assumptions, compounded by uncertainty in the model lowered confidence in the results.
Case study 2: Recreation in Poole Harbour

What: Small scale, very specific aim, primary data, monetary valuation.


How: Travel cost method, with further assessment including multicriteria analysis. Online surveys conducted with different user groups, e.g. water-skiing, bird watching, windsurfing, kite surfing, jet skiing, and kayaking/canoeing.

Why: To fill an evidence gap:
- Little research has been carried out into drivers for recreation in Poole Harbour;
- The relationship between marine habitats and species and enjoyment of recreational activities is unknown;
- Managers want to ensure Poole Harbour remains a desired place to visit for people doing these activities.

Important features of Poole Harbour: broad features

The environment: The underlying natural features, including: the enclosed, sheltered nature of the harbour views of the water and coastline, wildlife and clean water in the harbour.

Facilities: The availability of built infrastructure including: car parks and toilets, slipways, moorings and bird hides, cafés, shops, accommodation.

Cost factors: The cost of using the infrastructure and facilities, including: ferry/car parking charges, permit fees/slipway fees and nature reserve entrance fees.

The environment of Poole Harbour: specific features

Views of the coastline: This describes the appearance of the harbour, overlooking the water.

Wildlife: This describes the different animals (e.g. fish and birds) and the habitats in which they live (such as seagrass beds and saltmarshes).

Water quality: This describes how clean and clear the water is in the harbour, including bathing water quality.

Analytic hierarchy process: format of questions
The study focused on valuing a range of recreational activities, including kite surfing, windsurfing, kayaking, and waterskiing. This was done using a questionnaire and the Travel Cost Method. As well as gaining monetary value information a profile of the people undertaking these activities was also established to improve understanding of the attributes of different users.

The data allowed the researchers and managers to understand how the harbour is currently used, the interactions between different recreational activities and how potential changes to the harbour would affect people’s decisions to return to the area.

In addition to the questionnaires, an estimate was made of the total number of recreational users which could be extrapolated to estimate a total value of each activity to the local and wider economy.

Data was also collected through citizen and opinion panel surveys to determine how important the harbour is for residents of the area. 546 people completed the questionnaires, with half of the respondents living locally to Poole Harbour. Results showed that respondents are on average willing to travel further to Poole Harbour rather than visit a closer, substitute site. The harbour is especially important for beginner and intermediate kite surfers and windsurfers.

Key lessons from Poole Harbour

» A face-to-face survey, carried out in conjunction with counts, would have been preferred.

» Additional counts throughout the year would also have improved the quality of and confidence in the data.

» Neither were possible due to limited resources.

» The online survey nonetheless worked well, and reflected the resources available. It took considerable effort with local and national groups to market the survey adequately.

Outcomes

» Establishment of the Poole Harbour Recreation Forum, which aims to improve communication and reduce conflict between users.

» The results will also be used:

  » To inform Poole Harbour Commissioner’s policies for managing recreation in the harbour;
  » By Poole Harbour Aquatic Management Plan review 2016;
  » By tourism boards, local authorities, national governing bodies.

» Other local areas are considering similar studies.

The results show most respondents were happy with current management in place for their activity. The results also identify factors of change that would increase/decrease the number of return visits and overall visitor numbers to the area in the future, providing an insight into the qualities a visitor is looking for and suggestions for improving the management of their activity. Results also provided an economic value in the form of an average spend per person per activity per year in GBP. These figures were extrapolated using the total number of people undertaking each of these activities to give a total overall economic value per activity in GBP, which can be seen in the graph above.
Conclusion

The ecosystem services workshop was a great starting point for initiating closer collaboration between PML and south-west based site managers. As a world-leading research organisation PML is keen to use the knowledge and understanding it has to reach out and work with local management bodies to support them in their site management but also to learn from their practical application experience. We hope that the workshop has been the start of a long and fruitful collaboration and invite site managers to stay in touch with us, request advice and guidance when needed and to continue to share experiences.

A survey was conducted before and after the workshop to gauge the perception and understanding of ecosystem services of the participants and to gauge whether this had improved, as a way of evaluating the success of the workshop. The trends showed that most people’s confidence in ecosystem services increased from before to after the workshop. The greatest improvements seem to be for 1) understanding how ecosystem services can be used in management plans; and 2) being confident in using the approach within their profession.

In addition, we requested participant feedback on the workshop and their experiences of the day. All were very complimentary about the workshop and were positive about the mix of sessions. Across the group each aspect was positively noted on (some liked the interactive sessions, others liked the case study, others like the generic overview).

Many fed back that they liked the idea of having more case studies and/or explicit help with measures or site specific data. We hope that through ongoing collaboration we can ensure PML provides whatever data and support we can to aid the development of ecosystem services valuation for local site based management.

Our thanks to everyone who attended and made the event so successful.
Further reading and references


Glossary

AONB.........Area of Outstanding Natural Beauty
BES...........British Ecological Society
Defra.........Department for Environment, Food and Rural Affairs
EIA..........Environmental Impact Assessment
ES.............Ecosystem Services
ESA..........Ecosystem Service Assessment
ICZM.........Integrated Coastal Zone Management
IPBES........Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
MCZ..........Marine Conservation Zone
MESA.........Marine Ecosystem Services Assessment
MNCR.........Marine Nature Conservation Review
NDBR.........North Devon Biosphere Reserve
NEA..........National Ecosystem Assessment
NGO.........Non-Governmental Organisation
PML..........Plymouth Marine Laboratory
PNMI.........Parc Naturel Marin d'Iroise
rMCZ.........recommended Marine Conservation Zone
SAHFOS......Sir Alister Hardy Foundation for Ocean Science
SEA.........Strategic Environmental Assessment
SWOT.........Strengths, Weaknesses, Opportunities and Threats
UK BRAG.....UK Biodiversity Research Advisory Group
UK NEAFO.UK National Ecosystem Assessment Follow-on
VALMER.......Valuing Ecosystem Services in the Western Channel
VECTORS  . VECTORS of Change in European Marine Ecosystems and their Environmental and Socio-Economic Impacts