



Ecosystem Science for Policy & Practice



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Context

Ecosystems provide humankind with a wide range of resources, goods and services. Yet the rate at which we consume and exploit these is increasing so rapidly that many of the major ecosystems are threatened with loss of function, which is required to support the existence of humanity. Ecosystem services and natural capital provide guidance to better manage and preserve our ecosystems. The ecosystem services (ES) and natural capital (NC) concepts have been adopted in high-level policy frameworks. However, there is a wide gap between the wealth of ecosystem science and the practical application of this knowledge in policy and decision-making practice. The OPERAs project explores whether, how and under what conditions these concepts can move beyond the academic domain towards practical implementation in support of sustainable ecosystem management.

Objectives

1. Improve understanding of the effects that multiple drivers have on ecosystem management in the context of EU regulatory frameworks and how these impact ecosystem services;
2. Explore and validate mechanisms, instruments and best practices to maintain a sustainable flow of ecosystem services, while preserving ecological value and biological diversity;
3. Qualify any trade-offs/synergies between the traits and functions of ecosystem services and their social and economic values both in Europe and globally;
4. Improve existing decision-support tools and instruments to better capture and represent the concepts of ecosystem services;
5. Provide policymakers and stakeholders with clear guidelines on effective and cost-efficient ecosystem services governance structures and practical management measures;
6. Develop and test protocols to generate ecosystem services datasets and policy indicators that are both consistent and sensitive to bio-physical and socio-economic change;
7. Ensure the long-term perennity of key databases and other major research outputs.

Work performed during this period of the project

The practical implementation of the project objectives is being achieved through four scientific work packages (WPs) – Knowledge, Instruments, Practice and Resource Hub (see Figure 1) plus WPs on management and dissemination. The main tasks undertaken in the 18-36 month period of the project are given in Table 1.

Table 1 The main tasks undertaken in the second reporting period of OPERAs

WP Practice	WP Knowledge	WP Instruments	WP Resource Hub
<ol style="list-style-type: none"> 1. Report on standardized metrics/indicators for monitoring the efficiency of ES/NC based measures 2. Report from progress in the exemplars, partly through a Second and Third Blue Print 3. Design a database to compile lessons learned across WP 4. Develop a process towards guidance for selecting instruments for maintaining and protecting ES 5. Elaborate an iteratively process to elicit lessons learned from Meta-Analysis and Exemplars 	<ol style="list-style-type: none"> 1. Present the state-of-the-art in economic valuation of ES/NC (D3.2) 2. Report on existing and potential governance modes for ES/NC, including a framework for ES/NC integration at different levels of governance (D3.3) 3. Establish a set of recommendations for integration of ES/NC in existing accounting and reporting formats (D3.4) 4. Present and overview of strategies and methods for social valuation of ES/NC (D3.5) 5. Test and compare methods for ES modelling and assessment in various exemplars. 	<ol style="list-style-type: none"> 1. Analyse the operational potential, needs, and demands for ES/NC concepts in policy development and implementation 2. Develop new and improved information tools that include EX/NC concepts 3. Improve and further develop existing decision-support tools that include the ES/NC concept, including multi-criteria decision support tools, various types of Environmental Assessments, social cost-benefit analysis, and scenario and foresight tools 4. Develop and apply new and improved implementation management and appraisal tools and instruments to support the implementation and uptake of ES/NC concepts; 5. Guide the development, choice and application of instruments that include ES/NC concepts both within and beyond the OPERAs project 	<ol style="list-style-type: none"> 1. Develop the demonstration model of Oppla 2. Begin work on the Business Plan and Governance Structure for Oppla to ensure sustainability 3. Launch the ' Ask Oppla' function of the Oppla web interface 4. Organisation of 2 Userboard workshops 5. Coordination of stakeholder engagement activities within 4 exemplars (European, French Alps, Dublin, Scotland) 6. Set-up and maintenance of Monitoring and Corrective Action Mechanism for stakeholder engagement

Main results achieved so far

Quantification of global carbon sequestration

A global study has reported on an ES metric that accounts for the full implications of biogeochemical carbon sequestration and forms a basis for monetary valuation, the Greenhouse Gas Value (GHGV) (Bayer et al., 2015). The contribution of CO₂ to GHGV was, for the first time, quantified in its spatio-temporal variability depending on three environmental drivers (see the figure below). The value quantifies the benefit in terms of greenhouse gases of preserving an ecosystem over a multi-year time frame by accounting for the greenhouse gases stored in an ecosystem, sequestered on an annual basis and the probability of the ecosystem to be destroyed by e.g. fire or insects.

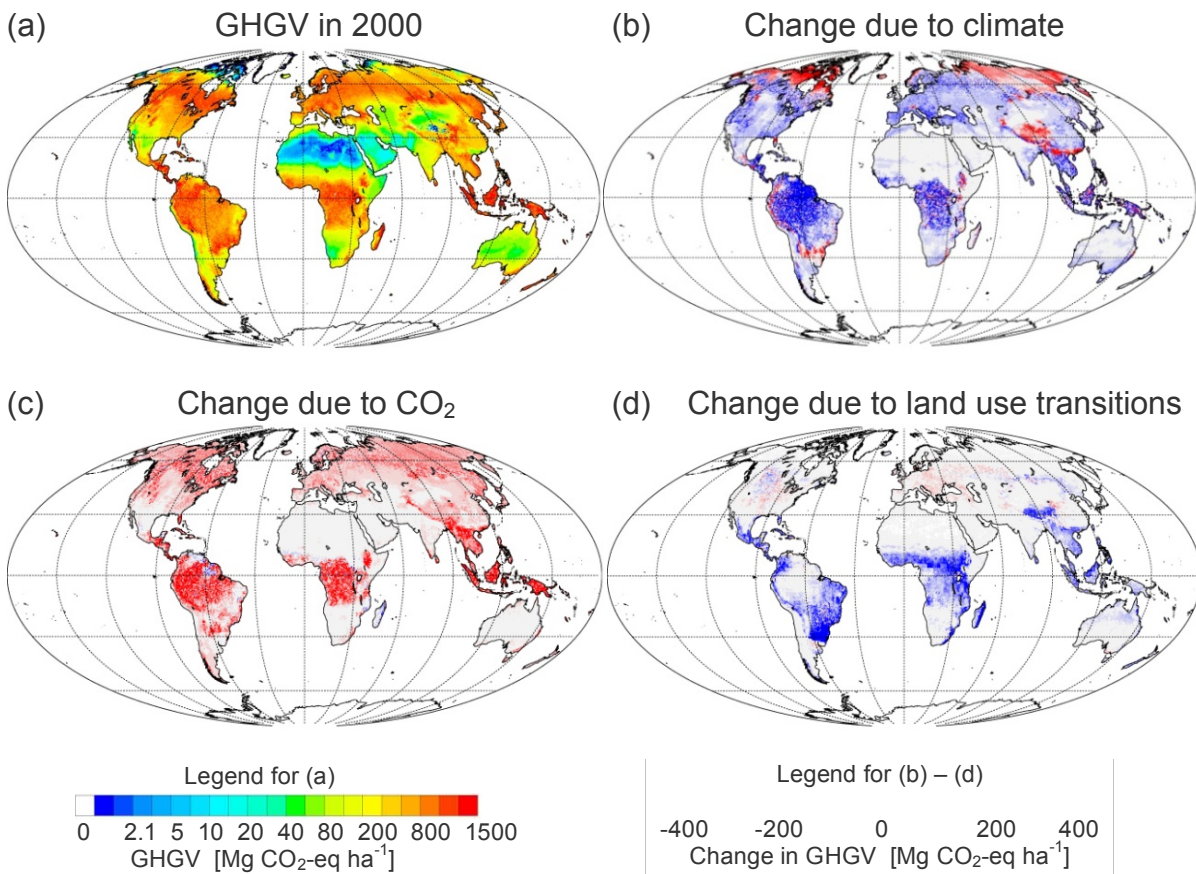
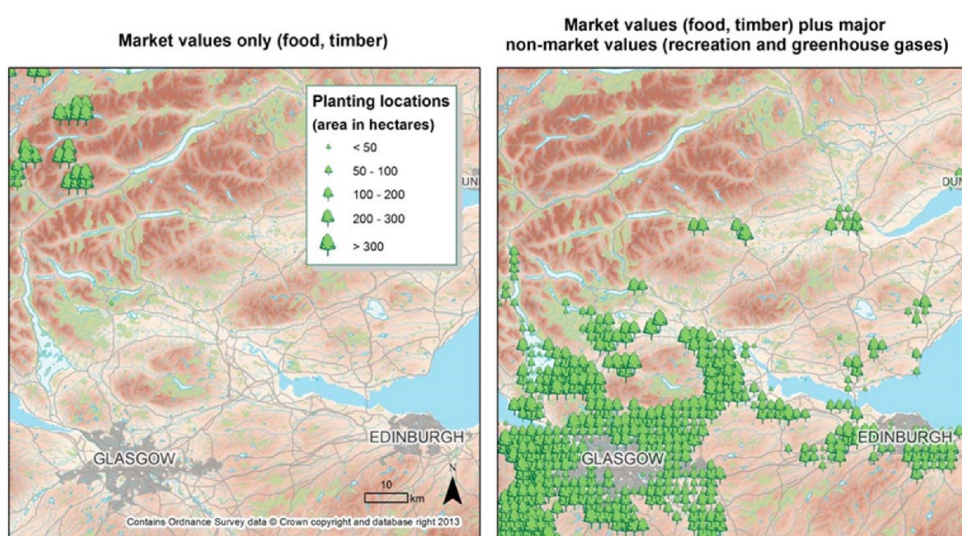


Figure. The contribution of CO₂ to Greenhouse Gas Value was quantified with the LPJ-GUESS ecosystem model for the year 2000 [Mg CO₂-eq ha⁻¹] (a) and the change in GHGV for future periods (2000-2100) was attributed to the environmental drivers climate (b), atmospheric CO₂ mixing ratio (c), and land use (d) (figures from Bayer et al., 2015). The work's outcomes were

translated into an online application (see <https://operas-ghgv.ourecosystem.com>) to allow for easy access to the information.

A review of monetary valuation methods

Expressing the importance of ecosystem services into monetary values is increasingly popular among researchers and practitioners. The conversion of quantities into values has both advantages and disadvantages. An important advantage of estimating monetary values for ecosystem services is that this allows for a sensible comparison of costs and benefits of public and private decisions that affect the value of ecosystems and their services. Not having a value for ecosystem services means that these comparisons are not possible, and may give the erroneous impression that there is no value at all. This leads to ongoing overexploitation of ecosystems, and to the further loss of biodiversity and environmental degradation.



At the same time, a number of disadvantages of economic valuation of ecosystem services are evident, in particular with some of the non-market valuation methods. For example, stated preference approaches typically rely on hypothetical

representations of ecosystem service change and hence elicit hypothetical WTP or WTA, not what people actually pay, which is considered a more reliable indicator of economic value. Also, stakeholders and especially the public at large, may not be aware or familiar with the range of ecosystem services provided at local and global scale, let alone that they have experience paying for these often non-priced public goods and services. This may result in valuation bias that has to be accounted for and tested in the design of the valuation study if possible. Moreover, the results of non-market valuation methods are often site- and context-specific, thereby reducing their general applicability. It is furthermore difficult to project values and preferences into the future, although this problem is not specific for economic value but holds for any assessment of value (also implicit value assessments).

A review of socio-cultural valuation methods

Economic valuation of public environmental goods is based on an individual approach. Alternative approaches have been developed over the past decades focusing on and interpreting

environmental valuation more as a process of social construction, in which public preferences are constructed through social interaction and engagement. Here, in addition to economic values, socio-cultural values and perceptions play a crucial role in determining the importance of natural ecosystems to society and their preservation. Socio-cultural values are based on the notion that healthy ecosystems are a crucial source of cultural well-being and essential for a sustainable society. Ecosystem-related socio-cultural values are defined more broadly and include equity, physical and mental health, education, cultural diversity and identity (heritage value), freedom and spiritual values, which are more difficult to capture through monetary valuation methods. Moral and ethical considerations also play a role, including the idea that not all public environmental goods and services are amenable to privatization and commercialization. People may behave differently as consumers when buying market goods and services than as citizens when addressing public environmental goods and services. These different approaches are not necessarily mutually exclusive, and may complement each other and as such enrich the underlying information base for policy and decision-making.

Non-market economic valuation, deliberative socio-cultural valuation, and deliberative monetary valuation all share a common objective. All of these methods can be used to provide insight into what is it that maximises social welfare or well-being. Economic valuation methods can be criticised for capturing only a single dimension of value, namely that associated with individual utility. In principle, economists argue that ethical or social considerations also enter the utility function. However, this claim is difficult to support with environmental goods, i.e., where these are public goods, where there is a shared dependence on the environment, or where there is an ethical argument for equal access to environmental goods. Deliberative settings have the capacity to inform people about complex ecosystem services and about other people's values and relationship with the environment. Deliberative monetary valuation has been used to strengthen the output from conventional economic valuation tools. Nevertheless, significant problems remain in addressing the challenge of incommensurability of values. No transdisciplinary tool yet exists that can adequately represent the range of values that exist. However, there are examples of promising approaches that can be applied to gauge the extent of true incommensurability and to meet the practical needs of ecosystem management.

Status of integrating ES/NC in natural capital accounting

The Figure show the feasibility of Economic Accounting for Natural Capital Stocks and Flows, and provides a comprehensive overview of the different components of natural capital and ecosystem services. Constraints still remain, however, in the implementation of the natural capital accounting concept. Some components of natural capital can be captured relatively well, as data is generally available and as the accounting units are accessible to observation, even though the methods of measurement undergo constant improvement. Among these are for example water quantity, carbon stocks in vegetation and soils, fish resources, or the extent of ecosystems. For other components of natural capital stocks, such a stock-taking appears possible in principle, but is constrained by data availability and an incomplete understanding of the natural biophysical and ecological processes underpinning the maintenance of natural capital and the production of

ecosystem services. Once the data and natural scientific foundations are improved, such analyses will be possible, for example about the overall state of land ecosystems. Similar considerations apply to capturing the flow of ecosystem services. Some services such as the production of fish or local recreational values of landscape can be assessed with existing data and methods. In some cases like the services provided by wild pollinators, this is possible

	What can be covered in national accounts?	What can't be covered? (at this stage of data availability)
Natural capital (stock) including biodiversity that is not "capital"	Ecosystem Extent for most ecosystems (e.g. MAES)	Complexity of ecosystems, species, genes – need complementary indicators
	Ecosystem-biodiversity: extent & quality for some habitats & indicators Some links at most to certain species indicators (outside of core accounts) Some <u>implicit links</u> to species element of BD via ecosystem accounts, natural capital & ESS	
	Fish resources, timber stock, agricultural land	Marine ecosystem condition?
	Water quantity	Water quality?
Ecosystem services (flow)	Carbon in soil and carbon in vegetation	Other locally important regulation services?
	Carbon sequestration (terrestrial)	
	Fish, timber harvest, food production	Many cultural values (at national scale) e.g. landscape value
	Value of wild pollinators ?	
Recreation value (at local scale)		

Key: Deep green: good coverage, light green: partial coverage; red: no coverage; mauve: little current coverage
Note: what can and cannot be integrated in monetary terms depends both on data and methods and this will be issue and country specific and will change over time.

today, but an improved data basis is needed. However, some aspects of natural capital are very difficult to capture, due to the characteristics of some of the stocks and flows. Marine ecosystems and water quality are examples of natural capital stocks that are difficult to capture in an accounting framework. In some cases, available methods do not allow reliable estimates at all, such as the complexity of ecosystems or the pool of genes.

Oppla: enabling decision-making on services offered by nature

People in policy, business and practice are thinking about nature in a new way that focuses on how it can support human well-being. This way of thinking, including concepts of 'ecosystem services' and 'natural capital', allows many actors to become involved, not only nature organisations or environmental Ministries, but also land owners, managers of natural resources, businesses, as well as government and governance across sectors. Much research has been carried out in this field. There are many examples that support new thinking for decision making or practical applications. However, this knowledge and these examples are dispersed across many sources and are often difficult to access when needed. This means that much valuable knowledge and experience is never used, the search for it is unnecessarily demanding and consequently research is often duplicated.

Science, policy and society have been disconnected. Historically, economic sectors have been viewed separately, research and policy have also operated within silos, and the various actors involved have used different language and concepts. The recent move in policymaking towards a more integrated, transdisciplinary approach, involving multiple stakeholders, provides the right impetus for change. This move calls for easy and quick access to reliable information to integrate thinking about nature's services into natural resource management and conservation activities. Oppla assists people to make nature work for the benefit of humankind.

What is Oppla?



Oppla is a web portal (an ‘Open Platform’) that provides a number of facilities to support communities of science, policy and practice. It will enable business, citizens and policy makers to better manage our natural capital for human well-being by drawing on robust scientific knowledge and best practice. Oppla is a hub for a community of practice that shares resources, new ideas and practical experience. It also functions as a marketplace — enabling members to find tools, training and consultants specialising in natural capital and ecosystem services. The Oppla website is complemented by events, a helpdesk and other services on demand. All of which will help users to find the information and assistance they need more quickly, more easily and more reliably. Oppla is also a novel test case for how the outputs from European-funded projects can continue to exist and prosper beyond the life of the originating projects.

We are developing a new approach in which research partners cooperate with small businesses to ensure that Oppla is supported by a viable business model upon launch. This requires Oppla to become an independent legal entity that will generate income to both maintain the web portal infrastructure, to mobilize the community of users, but also to develop the system further into the future. Hence, Oppla is being established as a not-for-profit legal entity registered within the European Union. Once fully operational, Oppla will support policy processes at all levels from the local to the global. A prototype version of Oppla will be released in September 2016 with the launch of the fully functional version expected in April 2017. Potential users can sign up to receive further information at: www.oppla.eu.

Guidance on the selection of tools

OPERAs has 18 tools and instruments with short descriptions, factsheets, metadata and SWOT analyses and of these, 13 have already been included within Oppla. Recommendations for the choice of instruments (metadata on resources needed for an application) and detailed good practice guidelines and training materials are available for each tool and instrument.

The expected final results and their potential impact and use

OPERAs partners are currently engaged in the dissemination of the project results at major international conferences and through the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). In the longer-term, OPERAs has a number of expected outcomes that include:

- Policy impacts that will enhance individuals' well-being through improved management of ES & contributions of NC to the green economy.
- Economic and societal impacts by increasing the effectiveness of ecosystem management and significant advances in ES understanding, methods, theory and application.
- Practical guidance for the policy community by delivering a range of tested tools and instruments in operationalising the EC/NC concepts.
- The Oppla web-based portal that will be co-developed by scientists and practitioners representing different perspectives of the ES/NC concepts.
- A 'Community of Practice' built around Oppla for continued practice that will benefit from the OPERAs outcomes.

Further information on the project can be obtained from the project's website (www.operas-project.eu/) or by contacting the Project Coordinator: Prof. Mark Rounsevell (mark.rounsevell@ed.ac.uk).



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