Practitioner Paper

Integrating ecosystem services into environmental decision making.

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1. Introduction

Natural capital describes the stock of renewable and non-renewable natural resources available to society. From this flows ecosystem services, which are the societal benefits derived from natural capital. These highly influential ways of thinking about environmental management have been the subject of much debate among practitioners and academic ecologists. However, they have gained significant traction in key national environmental policy documents, including the Natural Environment White Paper and 25 Year Environment Plan, policies in the devolved administrations, such as the Environment Wales Act (2016), and the establishment of the Natural Capital Committee. The UK is the first country (and still one of the few) to produce a national ecosystem assessment (UKNEA, 2011), in response to the global Millenium Ecosystem Assessment (MEA, 2005). The original classification proposed in the MEA (of supporting, provisioning, regulating and cultural services) has been extended by the hierarchical classification of the Common International Classification of Ecosystem Services (CICES, 2018).

The UKNEA placed a strong emphasis on creating instrumental knowledge - this is knowledge that can be used immediately by policy makers. However, the take-up of such knowledge has been in institutions and organisations that have had existing concern for the environment, and there is little evidence that the UKNEA has provided significant operational support for decision making. Major practical challenges remain for the implementation of an ecosystem services approach to environmental decision making in the UK. Therefore, this paper is aimed at practitioners and academic ecologists who face challenges (Box 1) in developing an ecosystem services approach to decision making. The paper draws on examples focused in freshwater environments to illustrate these challenges. It highlights where collective research and action by

the ecological research community and practitioners could lead to significantly enhanced ecological and societal outcomes. We define decision makers not just as public officials, but also those with a strategic role in other organisations that own or manage land or environmental resources including environmental NGOs, water companies and other utilities. The paper is informed by discussions held at the British Ecological Society Annual Meeting[1] held in Edinburgh, U.K.

2. Successful ecosystem services projects

Following on from the MEA and UKNEA, a number of pilot projects have been undertaken that demonstrate how the messages from national and international assessments can be operationalised into decision making. These are generally characterised by a strong focus on partnerships among private companies, public sectors bodies, landowners and communities to safeguard and enhance the delivery of ecosystem services. Many of these can be found in freshwater management where they have been adopted to help mitigate against the multiple pressures facing freshwater environments (e.g. habitat loss, climate change and water quality). Innovation has been particularly evident in the water sector where privatised water companies, aiming to manage financial pressures and regulatory requirements, have implemented sensitive catchment management projects (e.g. Upstream Thinking and SCAMP; see Supporting Information for details) that have benefited the natural environment and business practices of the water companies. The water industry regulator Ofwat has been involved in both projects, allowing investment to be made into land management practices. This represents a shift from a 'polluter pays' to a 'protector paid' approach. Ongoing monitoring to demonstrate the success of

[1] Two sessions particularly contributed to this: 'Integrating ecosystem services into spatial planning decision making' co-chaired by the authors, and the workshop 'Do ecosystem service approaches deliver biodiversity conservation?', chaired by Rob Brooker (The James Hutton Institute), 13 - 15 December 2015.

the first phases of the projects has been important in leveraging further funding for both projects.

3. Challenges of integrating ecosystem services into practice

3.1 Applying ecosystem services knowledge to decision making

The ways in which ecosystem services knowledge is integrated into decision making is complex. Doing so requires an approach that differs from the typically top-down, technocratic and linear processes that arguably characterises much UK policy making. The UKNEA was expected by decision makers to provide a robust framework for implementing an ecosystem services approach, but this potential was limited because it was not targeted towards specific end users (Waylen & Young, 2014). A top-down approach is not well suited to the complexities and multiple definitions inherent in the ecosystem services concept, which benefits from more iterative decision making and flows of knowledge among stakeholders (Ruckelshaus et al., 2015).

Stakeholders often exist in separate silos of policy and practice. Silos (Serageldin, 1995) accommodate particular institutional, political or structural norms within them, which define the activities of these organisations and may make interaction between them difficult. Integrating ecosystem services into decision making requires effective working between and within silos. In government agencies, silos may also arise because of separate career tracks existing at local and national levels, meaning that integration between high-level policy makers and local-level decision makers can be difficult to achieve. Planners in local government have little exposure to decision making in the Department for Communities and Local Government (DCLG), making it difficult to feed the professional experience gained through ‘on-the-ground’ activities into

strategic decision making. Efforts to take an ecosystem services led approach to decision making must therefore overcome a variety of ideological, structural and organisational issues.

3.2 Spatial scales and the geography of ecosystem service provision

Ecosystem services arise through combinations of abiotic and biotic factors, and are therefore defined by the geography of land use, soil properties, water availability and species distribution. These patterns are typically not aligned with administrative boundaries or districts that are the spatial units of decision making. The beneficiaries of some services may be geographically distant, and some ecosystems (such as river and wetland systems) may span different jurisdictions. However, the ecosystem service concept encourages decision makers to accrue specific benefits to defined geographic areas. A hallmark of successful ecosystem services projects is ensuring that the nature and purpose of boundaries (geopolitical, of ownership, or management) are understood and then successfully overcome.

Decision making should be done on scales comparable with the ecosystem service. Hauk et al. (2013) argue that ecosystem service benefits are oversimplified at high levels, but regional and local implementation is more complex. Services from which global society benefits (carbon storage, biodiversity conservation) are best safeguarded by decision making at an international level with effective local implementation. Where benefits are accrued primarily to local populations, decision making on a more localised spatial scale (local authority, neighbourhood) is more appropriate. A local wetland nature reserve may be managed to deliver high biodiversity services to meet with national government priorities, but if the public are excluded from the site in order to manage species habitats more effectively, the public benefits of the ecosystem services are reduced. Practitioners would therefore benefit from better ways to engage with

regional or national strategic policy making, to enable local trade-offs to be made that do not compromise wider ecosystem service strategies.

Land-use configuration can also alter the supply and demand for ecosystem services. Demand for recreational, amenity, and flood alleviation services is often higher around towns and cities. Focussing urban developments on land adjacent to existing settlements at the expense of ecosystem service provision can meet demands for housing and industry. However, allowing a degree of land sharing (deriving multiple uses from land parcels) is a more effective way of aligning service supply with service beneficiaries (Stott et al., 2015).

There is also evidence that the spatial configuration of habitat types can alter ecosystem service provision. Some ecosystem services are best delivered by patchworks of semi-natural habitats (pollination), yet other services (biodiversity conservation) are maximised by landscape-scale networks (Chan et al., 2006). The extent to which these principles can be used to inform decision making may be limited as land-use configuration is, in part, dependent on the legacy of previous development, shaped by designating protected areas or existing development permissions. There is an opportunity to enhance urban biodiversity through strategies that do not materially alter business practices or land use, such as through widespread uptake of small scale ‘greening’ features (Frantzesaki and Tilie, 2014). One factor contributing to the success of UpStream Thinking and SCaMP is that uplands are owned by fewer landowners (sometimes also including the water companies) making consensus on land management strategies easier to reach. However, at the catchment scale, and particularly in lowland areas, it is likely that more landowners have a stake in ecosystem service strategies.

3.3 Timescales

The use and provision of ecosystem services varies over time as well as space. Provisioning services tend to become less valuable as countries develop and greater value is placed on regulating and cultural services. In the UK, the Forestry Commission has become increasingly concerned with the recreational and cultural benefits of forest tourism as the economic value of timber has declined. Some ecosystem services, such as carbon storage, are generated over timescales that are longer than the normal life cycles of policies. The benefits of these may be difficult to integrate into decision making, as the benefits are only realised in several years or decades time and not aligned to with short-term policy and funding cycles. The Natural Capital Committee advocate viewing investment into ecosystem services projects the same as traditional infrastructure investment, to focus attention on the long time scales over which many services are delivered.

3.4 Understanding complexity and the role of toolkits

Many toolkits have been produced to help decision makers adopt an ecosystem services approach to decision making. The process of producing a toolkit can itself be an important part of dialogue among stakeholders. However, developing detailed toolkit outputs typically requires extensive time and resources due to their requirements for data, and their development may take too long to influence decision making. Relatively simple toolkits may best support decision makers and be most time effective to use, but oversimplified or inflexible approaches can reduce the value of the outputs (Ruckelshaus et al., 2015) or increase the likelihood of some potentially important biophysical processes being overlooked. Practitioners are faced with a bewildering array of ecosystem services toolkits; the need for a 'tool-assessing tool'[2] highlights the proliferation of them, and the current difficulty in repurposing existing tools to new situations with different levels of knowledge, understanding and required output.

[2] https://ecosystemsknowledge.net/resources/guidance-and-tools/tools/tool-assessor

3.5 The challenges of market-based approaches

The UKNEA argues that the natural world is consistently undervalued in conventional economic analysis, and that financially valuing natural resources will enable greater weight to be given to them in decision making. Financial valuation can bring in new sources of finance to environmental management, such as private investments, as seen in the emergence of carbon markets. A notable success of market based approaches is the global effort to reduce the hole in the ozone layer. The Montreal agreement imposed a cap on the total amount of damaging emissions which reduced over time, and allowed emissions trading within the cap, creating a financial incentive for manufacturers to innovate and create replacements for ozone depleating chemicals.

Despite the potential of market-based mechanisms to enhance ecosystem services, a number of practical and ethical challenges exist. Critics of market-based approaches contend that biodiversity is devalued by monetization and it needs legal protection from market forces, not exposure to them. Practically, market mechanisms can lead to: short-termism; focusing on a single ecosystem service at the expense of others; and in some cases reliance on non-native species to deliver that service. Market-based mechanisms are short-term compared to adding a protected area to national land bank or other legal protection: Silvertown (2015) uses the example of coffee plantations in Costa Rica. The coffee plantations benefit from wild bird populations that live in small areas of woodland, having much lower levels of coffee pests and diseases. However, because the value of commodities changes over time, when the price of coffee fell dramatically farmers stopped growing coffee and switched to growing pineapples. The forest patches that supported birds were not so beneficial for pineapples, leading to their removal, and resulting loss of biodiversity.

Market-based approaches tend to favour single ecosystem services rather than multiple benefits (Muradian & Rival, 2012), because marketisation leads to itemisation of services to create distinct, tradable ‘commodities’. One solution to this is bundling together services, where a package of complementary and related services can be traded as a single commodity. However, this has been criticised as it may lead to inadvertent trade-offs within bundles and some services being overlooked (Kosy and Corbera, 2010). If proxy measurements are used to decide the value of services, rather than measurements of the service itself, multiple benefits are more likely occur: planting a biodiverse, mixed woodland compared to a monospecific woodland exclusively with a high water consumption species to reduce flooding both accrue the same proxy value (area of land planted). Even though the flood reduction effect of the monospecific woodland may be higher, the mixed woodland provides multiple benefits due to its enhanced biodiversity value. However, experience from agri-enviroment schemes shows that proxy payments to land managers for actions such as planting hedges or filling in drainage ditches can stifle innovation in land management practices, and discourage landowners from developing context- or location-specific approaches (Jack et al., 2008). Encouraging innovation and adopting the most cost effective approaches are key benefits of following market-based incentives, and are limited by proxy payment schemes.

One of the challenges facing academics and practitioners is ensuring that a robust evidence base is built that bridges the gap between management actions and ecosystem service outcomes. Markets function best when there is a good level of knowledge held by those both buying and selling (as illustrated by the 2007 sub-prime mortgage crisis). Levels confidence in knowledge about ecosystem services are relatively low among both land managers and those working in statutory agencies, and strikingly only 3% of the freshwater ecologists felt confident

in their knowledge of ecosystem services.[3] Ecosystem functioning is complex and unpredictable, and factors such as unusual seasonal variations and disruption from extreme weather events can make determining appropriate payments difficult. Ensuring payment effects change in landowner practices requires a careful balance between the amount paid, and the financial advantage of less environmentally favourable practices (Muradian & Rival, 2012). Payments need to be sufficiently beneficial to landowners to effect change, although these amounts are usually modest compared to the financial benefits that derive from say, effective flood prevention (Muradian & Rival, 2012). Furthermore, as Baker (2018) reflects, one policy implication of Brexit will be a greater emphasis placed on delivering a full range of public benefits (including air quality, soil conservation, animal welfare), that extend beyond current conservation-focussed objectives for land management. The extent to which this full range of public benefits can be valued is complicated and often highly uncertain. The need for incorporating well designed and effective monitoring to evidence the effectiveness of land management approaches, and mechanisms to measure the value of other benefits, is a key challenge for practitioners and academics.

One final challenge concerns the morality of market led mechanisms. Their use has been criticsed as part of wider debates about climate change policy and delivering socially just outcomes. For example, a flood protection scheme that protects homes and businesses in the south of England may show a more positive financial return than one that protects similar homes and businesses in the north-east of England where property prices are lower. Monetary valuation of property does not take into account the negative impact on mental health experienced by people whose homes are flooded. Charities and NGOs are often cautious about realising the benefits of market-based approaches because of public pressure against

[3] https://www.cieem.net/data/files/Resource_Library/Education/Education-Ecological_Skills_Project_Final_Report.pdf

perceptions of ‘selling off’ nature. The public could be alienated by the financial language of market-based mechanisms, which is far removed from the interaction that people have with the natural environment. Decisions about monetary incentives and raising financial capital can seem ethically problematic to lay people. Furthermore, decisions in which service trade-offs lead to the loss of some services can be morally difficult. A more ethical, rather than a market led, approach to ecosystem services as advocated by Kosoy and Corbera (2010) could foster better conservation outcomes, more informed trade-off decisions and more positive public engagement. However, practitioners lack frameworks in which ethically-informed judgments can be made. The development of codes of conduct by professional societies and associated professional development activities could help foster more ethical decision making.

4. Where do we go from here?

In this section we identify some of the ways academics and practitioners could collectively take forward an ecosystem services based approach. We argue that there is need for academic and practitioner ecologists to work more effectively with other disciplines, and to find ways to better evidence the benefits that can occur from an ecosystem services approach with robust ecological research.

Waylen and Young (2014) argue that the main value of the NEA came from the co-production of knowledge and developing shared values from working, even if this process was sometimes rushed. Ecological expertise is often deployed at a late stage to evaluate the ecological damage of a proposal, rather than at the early problem solving and proposal development stages. It could become positively and more widely valued, if such knowledge were used to frame problems and solutions, and therefore integrate ecologists input in decision making. Engagement with other professions, in particular landscape architects, horticulturalists and other

land managers, would help nuance ecological thinking to be more aligned with the needs of practitioners. This engagement is especially important to work successfully in urban areas. Working with horticulturalists and landscape architects on green roofs or the restoration of urban rivers could involve changes to assessment frameworks and tools that ecologists use. It will also need a shift in mindset as ecologists often put greater priority on working in ecosystems that are primarily native species and dominated by biophysical processes. The support of professional bodies, in particular the British Ecological Society, would be influential in leading this change.

The uptake of an ecosystem services approach is hindered because of little robust evidence about how effective different interventions are. Despite their success, projects such as SCaMP and Upstream thinking have not been widely adopted by other water companies and uptake in lowland catchments is slow. The considerable uncertainty in understanding which species or biophysical processes deliver which services can prevent effective delivery of ecosystem service outcomes. A stronger evidence base and monitoring of interventions, which is often given limited priority (Wilson and Law, 2016), could be met by academic ecologists supporting the design of robust experimental approaches (e.g. Before-After-Control-Intervention). Systematic reviews of ecosystem service projects would also contribute to a stronger evidence base to help practitioners design more effective projects.

Practitioners would benefit from clear statements of the value of ecosystem services to inform decision making, but it is resource intensive and highly contentious to ascribe financial values. Pragmatic alternatives to inform decision making include risk-based assessments of service provision (Mace et al., 2015) and the ‘traffic light’ system used by the Environment Agency in England to indicate relative importance of social, economic and environmental factors. Even without precise valuations being ascribed, undertaking a review of ecosystem service provision can lead to greater awareness of habitats and species and bring together diverse stakeholders

with different priorities to develop a shared approach. Furthermore, landowners do not need to be paid the full value of the ecosystem service they deliver, they need to be paid enough to provide an incentive to change their management practice. Calculating the value to bring about and retain a change in management practice could be more useful than the precise financial value of the flood risk mitigated or carbon storage delivered.

Financial incentives are an important part of the policy mix influencing land managers decisions, as demonstrated by SCaMP and Upstream Thinking. The support of the industry regulators, such as Ofwat, for innovative or experimental approaches is important for developing novel ways to bring stakeholders together. Involvement of regulators also provides a mechanism to integrate successful approaches more broadly into the policy mix and transfer good practice between different policy actors. A ‘protector paid’ approach supports a culture of positively investing in the environment and of pre-emptively protecting at-risk ecosystems from long-term damage. Used alone, this may create unacceptable exposure of environmental processes to market dynamics, but as part of a policy mix including regulatory protection of species and habitats is an important tool for practitioners to deploy (Waylen & Martin-Ortega, 2018).

In urban areas multiple pressures are exerted on ecosystems, and many are managed to mitigate the effects of urbanisation (declining biodiversity, flood risk). However, the literature and policy documents emphasise the delivery of ‘multiple benefits’. Achieving this may be unrealistic or even impossible where urban development exerts constraints on management options. It may be beneficial therefore if decision makers are more willing and empowered to sacrifice some services to better deliver others, and prioritise ecosystem service delivery in discrete locations as part of a network or mix of local and regional provision. The development of ethically-informed frameworks supported by professional societies would help decision makers take difficult trade-off choices.

5. Final thoughts

An ecosystem services approach can make an important contribution to responding to global challenges, including climate change, biodiversity conservation and societal wellbeing. Ecosystem services have undoubtedly raised the profile of biodiversity in decision making and the importance of biodiversity among a wider group of stakeholders. Monetary valuations are controversial, but efforts to integrate ecosystem service values into traditional markets has the potential to leverage otherwise scarce funding and investment into environmental management. Risk-based or relative values approaches, rather than absolute monetary values, offer a promising framework in which decision makers can operate. Ecologists can make a valuable contribution by bringing their expertise to bear on ecosystem services approaches that tackle pressing societal challenges including natural flood risk management, urban greening and upland restoration. We encourage professional and academic ecologists to look carefully at the potential for ecosystem services to contribute to a broad mix of approaches to protecting and enhancing the natural environment.

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Box 1: Questions of relevance to practitioners addressed in this Practitioner's Perspective paper

1. What are some of the practical considerations that arise from recent efforts to implement an ecosystem services approach?

2. What are some of the differing views among professional and academic ecologists that shape the development of mainstreaming ecosystem services policy and practice?

3. What are some of the challenges and opportunities for biodiversity conservation when implementing an ecosystem services approach?