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Governance of Ecosystem Services: A framework for empirical analysis

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ABSTRACT

Biodiversity conservation policies justified with science and intrinsic value arguments have produced disappointing outcomes, and the need for conservation is now being additionally justified with the concept of ecosystem services. However, little, if any empirical attention is paid to ways in which different types of ecosystem service decisions are made, to what arguments are effective in turning policy into practice and further into conservation outcomes and, in general, to how ecosystem services are governed. To close this gap, this paper identifies the different modes of governance in policy implementation from biodiversity and environmental conservation literature and incorporates them in a conceptual model of ecosystem services commonly utilised at present, the cascade model. The resulting conceptual framework encompasses: (1) hierarchical governance; (2) scientific-technical governance; (3) adaptive collaborative governance; and; (4) governing strategic behaviour. This comprehensive framework provides a structure for empirical analysis of ecosystem services governance, which takes into account the people and organisations making decisions, and, in particular, the different arguments that are used when implementing policies. The framework will facilitate holistic ecosystem service analyses and support policies in generating conservation and sustainability impact.

1. Introduction

The global consensus on the importance of biological diversity and the need to conserve it has been formalised in numerous agreements and strategies (e.g. UN, 1992; EC, 2011). Stopping species extinctions and protecting a proportion of land area have been set as explicit targets. The rigorous evaluation of these targets over recent decades has, however, produced disappointing results, revealing that the apparent political will and carefully drafted policies have not halted biodiversity decline (Rodriguez et al., 2004; Rands et al., 2010). The failure to protect habitats from degradation and conversion, or species from decline and extinction, has forced scientists and decision-makers to take an increasingly holistic approach to conservation, which recognises humans as important beneficiaries of nature. As a result, the arguments for biodiversity conservation now address the complex social–ecological interactions and the multiple benefits that ecosystems provide to people (Cardinale et al., 2012). As an argument-making device, the so called ecosystem service approach enters a wider set of social and political processes, involving a range of complex strategies and motives (Haines-Young and Potschin, 2014; Turnpenny et al., 2014). There is an expectation that the holistic ecosystem service approach would eventually be embedded in these processes; constitute a basis for policy design and be integrated in governance at all levels.

The holism is well warranted but, as research concentrates on producing knowledge about ecosystems and their value for humans, the issues of decision-making, policy implementation and governance are largely ignored. Simply assuming that decisions will eventually change, as new knowledge about ecosystem services is produced, is a significant impediment for the conservation and sustainable use of ecosystem services. This assumption does not take into account the complex interactions within and across the governance systems that may have implications for actual implementation of policies (Nie, 2003; Ratamäki et al., 2015).

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Therefore, the way in which new knowledge feeds into decision-making should be a target of analysis itself, building on explicit research on how ecosystem services are governed, how policies are implemented and what arguments are used in these processes.

The limited attention to policy implementation and governance in the ecosystem service context is surprising, given the empirical evidence base that biodiversity conservation and environmental management analysts have accumulated over the last 50 years. To close this gap, this paper identifies the different modes of governance in policy implementation from biodiversity conservation and environmental management literature and incorporates them in a conceptual model of ecosystem services commonly utilised at present, the cascade model (Potschin and Haines-Young, 2011). The cascade model is a useful simplification of the real world, communicating the relationships between ecosystem services and human well-being at a general level. The model has been applied, criticised and elaborated, to better address particular relations and issues, such as ecosystem service supply and demand (Potschin, 2015). Our analysis elaborates the model with governance aspects.

We propose a framework for empirical analysis of ecosystem services governance. We start by laying out the way in which the ecosystem service framework is expected to broaden the arguments for conserving biodiversity and for generating better conservation outcomes. We then review empirical biodiversity and environmental governance literature, paying attention to different implementation mechanisms that represent distinct modes of governance as well as the ways in which the effects of arguments for biodiversity conservation are evaluated within each governance mode. We conclude by placing the identified governance modes into the conceptual framework of ecosystem services, and discussing the relevant interactions and feedback between governance modes and the particular components of the ecosystem services model. The resulting conceptual framework encompasses: (1) hierarchical top-down governance; (2) scientific-technical governance; (3) adaptive collaborative governance; and, (4) governing strategic behaviour. This comprehensive framework provides a structure for empirical analysis of ecosystem services governance, which takes into account the people and organisations making decisions, and, in particular, the different arguments that are used when implementing policies. The framework will facilitate holistic ecosystem service analyses and support policies in generating conservation and sustainability impact.

2. Conservation effects and the concept of ecosystem services

Evaluation of the effects of specific biodiversity conservation policies usually focuses on the outcomes and impacts, rather than on the ways in which governance turns the policies into practice. The effects and evolution of the arguments for conservation expressed in the design of the policy goals are not generally followed through when evaluating the policy or the various processes of implementation that make up governance and eventually produce conservation effects.

Effectiveness indicators, such as hectares of protected areas and numbers of endangered species, have a well acknowledged (and well deserved) status in biodiversity conservation reporting, and more detailed analyses mostly take these as a proxy for the effectiveness of protection strategies. For example, evaluating conservation action plans takes species status as a surrogate for conservation effects (Laycock et al., 2009) and a more elaborate cost-effectiveness analysis uses detailed species-habitat information for measuring effects of different parcel sizes for protected areas (Mönkkönen et al., 2011). Elsewhere, forest cover is used as the proxy for effect in cost-effectiveness analyses of conservation payments (Ferraro and Simpson, 2002) and protected areas (Andam et al., 2008). In an analysis of cost-effectiveness of the European Natura 2000 Protected Area Management Plans, Wätzold et al. (2010) identify various sources of costs, and thus take a step further in considering the different activities required for implementing the protected area targets. Generally, however, effectiveness evaluations pay little attention to what activities and which arguments direct the decisions and the resources, further shaping the practices that deliver the conservation output.

The heavy reliance on simplified measures of conservation effects in evaluating policies is surprising, given the extent of knowledge about biodiversity and the evolving variety of arguments for conservation. For example, biodiversity conservation policies relying on ethical and moral arguments for protecting nature (Sagoff, 1996) have gradually been backed up by elaborate science-based arguments about the habitat condition, size and connectivity that species and populations require (e.g., Hanski 2000; Margules and Pressey, 2000; Sutherland et al., 2004; Huth and Possingham, 2011). Elsewhere, these ecological arguments have been supplemented by long-term benefit arguments, often operationalized through monetary values (Sagoff, 2011).

In the development of more diverse arguments for biodiversity conservation, the concept of ecosystem services represents a major attempt to capture the complexity and different value bases of conservation (Daily, 1997; Costanza et al., 1997; MA, 2005; Gómez-Baggethun et al., 2010; Potschin and Haines-Young, 2011). The conceptualisation of ecosystem services entails a bridge, or'cascade', from the ecosystem's biophysical structures and processes (supported by underlying biodiversity), to the benefits and values that humans experience (Potschin and Haines-Young, 2011, Fig. 1).

As highlighted in the literature applying the ecosystem services conceptual model (Potschin and Haines-Young, 2011) depicted in Fig. 1 and similar models (De Groot et al., 2002, 2010; Bateman et al., 2011; Mace et al., 2014; Van Oudenhoven et al., 2012), the crucial arguments for biodiversity conservation can be derived from the scientific understanding of each of the model's components: ecosystem structure, functions, services, benefits and values, as well as the relationships between these components. For example, understanding which elements of ecosystem structure and function contribute to the delivery of important services may motivate decision-makers to implement policies that aim at better conservation of these particular elements. There is an urge for further scientific analysis to support the understanding of each of the components of the model and, to add holism, the relationship between them. The results, then, are expected to allow further elaboration of arguments for ecosystem and biodiversity conservation.

By displaying a back-loop from values to ecosystem structures (and underlying biodiversity), the ecosystem services model displays an assumption that the knowledge of value and value arguments are necessary for governing ecosystem services and implementing biodiversity policy (Fig. 1). The reasoning goes that as many policy decisions are based on economic arguments, the

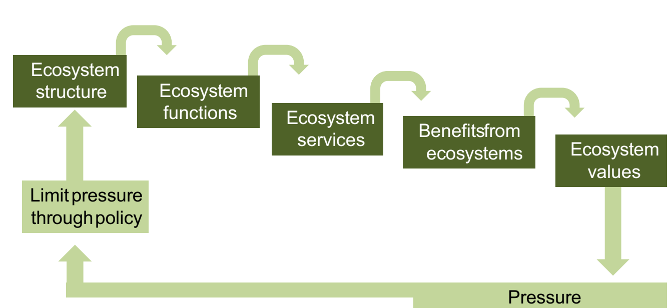

Fig. 1. A conceptual model for analysing ecosystem services ('cascade model'), adapted from Potschin and Haines-Young (2011).

monetary valuations of ecosystem services will feed into decision-making and, by allowing trade-off analysis, will support the decisions that reduce the pressure on ecosystems and biodiversity (Costanza et al., 1997; Christie et al., 2006; Bateman et al., 2011; Potschin and Haines-Young, 2011). Monetary valuation of biodiversity-related benefits may also encourage people to support nature conservation, as they increasingly relate these benefits to their individual well-being (Fischer and Young, 2007; Buijs, 2009; Liu et al., 2010). Additionally, identifying the costs and benefits of protecting or using ecosystem services may show the importance of biodiversity outside protected areas, going beyond traditional,'hot-spot' based evaluation methods (Haslett et al., 2010; Bateman et al., 2013).

In practice, however, valuation of benefits does not filter arguments directly into decisions (Spash, 2007; Vatn, 2009; Spangenberg and Settele, 2010; Primmer and Furman, 2012; Spangenberg et al., 2014). Academic literature on monetary valuation studies has had a poor record in influencing actual policy making (Laurans et al., 2013). On the contrary, the processes by which formal decisions are filtered to practical implementation are unlikely to carry the value arguments as numerical figures. One reason is that the stated preference valuation methods, which are the most flexible in terms of addressing non-use values, often use hypothetical policy framings. The decision alternatives of valuation studies do not easily scale or transfer to the actual policy settings that unfold (Gómez-Baggethun and Barton, 2013). This may be one explanation for lacking filtering to operational decision-making at different levels of governance. Nevertheless, there is a broad agreement that quantified economic values can be an important part of decision-making as long as other value arguments are also given consideration, and the process involves participation of those who are affected by the decision (Spash and Vatn, 2006; Vatn, 2009; Chan et al., 2012; Cornell 2011; Sagoff, 2011; Plant and Ryan, 2013; Spangenberg et al., 2014). To facilitate effective governance of biodiversity, based on the ecosystem services concept and the related approaches to valuing nature, there is a need for deeper analysis of how ecosystem services thinking, and the ensuing arguments, fit in with different modes of governance (De Groot et al., 2010; Turnpenny et al., 2014). Improving the effectiveness of biodiversity conservation with the ecosystem service framework should therefore start from the analysis of governance. Analysing governance allows elaborating on some of the simplifications of the cascade model (Spangenberg et al., 2014).

3. Drawing lessons from biodiversity and environmental governance

3.1. Identifying different modes of governance

To analyse what conditions the effectiveness of ecosystem service arguments and to learn how effectiveness indicators, elaborate ecological knowledge and the improved understanding of ecological functions and human benefits can together feed into the practice of policy implementation, governance needs to be analysed empirically. The new empirical analyses should make use of existing analyses of governance, which are ample in the areas of biodiversity and environmental conservation policy and implementation.

Over the last 20 years, analysts of policy implementation, management, decision support, participatory decision-making and politics have built a solid understanding of decision-making and argumentation in governance (Norton, 2005; Wurzel et al., 2013). To achieve this analytical understanding in ecosystem services governance analyses, it makes sense to link the approach to the familiar cascade model (Fig. 1; Potschin and Haines-Young, 2011).

Starting from the cascade model of ecosystem services and assuming that values are filtered to decision-making, the analysis of governance should begin with a focus on agreed policies or decisions and their implementation. International agreements serve as an illustrative example of such decisions. They reflect collectively agreed values and are implemented by nation states, in a hierarchically organised fashion (Young, 2002; Wurzel et al., 2013). Similar hierarchical structures can be observed for national biodiversity policies, or within organisations, at least as one mode of governance (Primmer, 2011a).We suggest that 'hierarchical governance' should be the first mode to be analysed.

Following the ideas of ecosystem service literature, governance requires science-based knowledge on the probable influence of the decisions on the ecosystems (Vihervaara et al., 2012). Accurate scientific-technical support would allow trade-off analyses and the allocation of land-uses in an informed fashion (de Groot et al., 2010; Potschin and Haines-Young, 2011). Also biodiversity conservation has been an area where scientific knowledge is sought to systematically support decision-making (Sutherland et al., 2004; Huth and Possingham, 2011). This second governance mode can be termed 'scientific-technical governance'.

Shifting attention from knowledge to the actors who use and produce it, we observe governance modes where knowledge producers and decision-makers communicate across sectors and governance levels with the aim of finding ways to advance shared goals (Gunderson and Holling, 2002; Primmer, 2011b; Primmer and Furman, 2012; Hauck et al., 2013). Learning and commitment are the core assumptions in this third mode of governance that can be called 'adaptive collaborative governance'.

Finally, because there is an assumption that the actors utilising ecosystems for economic purposes tend to behave in ways that secure their own interests, rather than those of the collective (Gómez-Baggethun et al., 2010; Kumar, 2010; Lockie, 2013), ways of dealing with such strategic interest-based behaviour should be analysed as well. 'Governing strategic behaviour' is therefore the final mode of governance we identify for further analysis.

Taking these four approaches to governance as the basis, we reviewed biodiversity and environmental conservation literature, to investigate how the argumentation for ecosystem services might be captured and could be supported by empirical analyses. By focusing on arguments, we sought to identify empirical evidence for ways in which decisions are justified and turned into implementation practices, to eventually produce conservation effects. We started our review by conducting searches in Scopus (between 10 and 20 April 2012), with search terms: 'policy', 'argument*' and"effect*' and specified the outcome with 'empirical', 'biodiversity', 'conservation' or 'environment*' and expanded this outcome by including also 'rhetoric*', 'impact', or 'evaluat*'. After this systematic part of the investigation, we picked those articles that addressed the topic of governing ecosystems, i.e., natural environments or natural resources and reported empirical analyses of policy generating effects, paying attention to arguments. We then complemented these with seminal articles describing the mode of governance or illustratively addressing the ways in which arguments, policy and ecosystems are in interplay. We prioritised articles reporting empirical analyses. In the following, we report the observations from these articles.

3.2. Hierarchical governance

We found that a number of law and international politics studies analyse the ways in which formulations in agreements and laws have been influenced by higher level policies, and these included papers dealing with diversions from major policies. These analyses disclose the ways in which international environmental decisions have been filtered to national policies, and further to more local governance levels. Evaluation of the ratification and enforcement of international or other high-level environmental agreements at the national level (Sand, 2001; Beunen et al., 2009; Morris, 2011), can be considered a model of this type of hierarchical implementation analysis.

Although the international policy implementation analyses focus on legal definitions and the nation states' formal take-up of internationally agreed principles in national laws, also countries' strategic choices in implementing international environmental policy are a point of interest (Morris, 2011). Certain powerful sectors and actors play an important role in making narrower national interpretations of the typically very broadly defined international commitments (Dekker et al., 2007). There are even cases of strategic manipulation in hierarchical governance (Morris, 2011). In some cases, international policies, aiming to support a transition towards more ambitious environmental practices, are channelled toward already existing less ambitious national aims (Kanowski et al., 2011). In other situations, national regulations are already more ambitious than the ones imposed by the international policy (Paavola et al., 2009; Kanowski et al., 2011).

It can be inferred that the persistence of the ideas transferring from the higher level policy to the lower governance levels implies effectiveness of the policy and of the underlying arguments. The main obstacles to generating effects relate to national or sectorial interests (Gulbrandsen, 2003; Dekker et al., 2007; Rajamani, 2007; Morris, 2011; Primmer, 2011a) or very technical argumentation (Beunen et al., 2009). For example, in their analysis of European Union policy implementation at a national level in The Netherlands, Beunen et al. (2009) find that the argumentation around the Water Framework, and the Birds and Habitats Directives concentrates on legal technicalities, rather than on conservation itself. Also Sumares and Fidélis (2011) assert that supranational regulation, illustrated by Natura 2000, faces difficulties when EU level objectives are translated to regional and local policies. Transfer of arguments in multilevel governance is also somewhat associated with less hierarchical institutional change (Araral, 2010), diffusion (Jiménez, 2005) or interplay of policies and arguments (Wilson, 2008; Paavola et al., 2009).

3.3. Scientific-technical governance

We then identified examples of biodiversity governance that emphasise the construction of knowledge and support systems that maximise effectiveness in reaching policy goals (Sutherland et al., 2004; Huth and Possingham, 2011). These types of analyses usually focus on a particular conservation issue, such as creation of a protected areas network (Margules and Pressey, 2000), or on policy of a particular sector, such as forestry (Sturtevant et al., 2007). In these analyses, the policies and scientific arguments are sometimes originally assumed to be operationalized and simplified to pragmatic arguments for conservation, and further placed in the local context. Where the scientific-technical governance is not straightforward despite assumed smooth knowledge flow, attention is paid to professional and communication factors shaping governance (Peuhkuri and Jokinen 1999; Primmer and Karppinen, 2010; Valve et al., 2013).

An illustrative example is the analysis of the implementation of a Portuguese forest policy programme with sustainability goals (Mendes, 2006). Here, governance is depicted as operationalization, resourcing and communication activities that can be somewhat controlled by the policy designer; the outcome (i.e. effectiveness of the programme) is eventually measured simply as afforested hectares and numbers of forest-owner organisations recruited. The analysis reveals, however, that arguments preceding the policy generate unexpected friction in implementation and thus impede the overall effectiveness of the programme, along with shortage of knowledge and resources.

Other empirical analyses of scientific-technical governance also outline the science-based arguments embedded in the policies and analyse them paying attention to arguments that have emerged in the practical governance situations, about for example the local conditions and existing practices that only partially allow the integration of new knowledge (Wolf and Primmer, 2006; Kaljonen, 2008; Primmer and Karppinen, 2010; Valve et al., 2013). These analyses point to important deviations from technically aided planning processes, which can be identified and solved only by practitioners. Several analyses of operational biodiversity conservation efforts thus highlight the role of experts and other actors in formulating feasible local conservation solutions and ways of integrating many different goals as well as sharing information (Kaljonen, 2008; Wolf and Primmer, 2006; Kartez and Casto, 2008; Primmer and Karppinen, 2010; Andersson et al., 2012). Although many analyses with a technical focus take knowledge resources to be the main bottleneck for reaching policy goals, they are also critical of the assumptions of knowledge transfer as just a simple technical task supported by smart information management (Jiménez, 2005; Mendes, 2006; Kartez and Casto, 2008). Within this governance domain there is a strand of research on the systematic description of uncertainty of models required to assess outcomes of policies, which shows that the scale mismatch between the decision context and what is calculated with available methods and data hinder communicating findings to policy (Gómez-Baggethun and Barton, 2013).

3.4. Adaptive collaborative governance

As a next step, we looked for examples of collaborative governance approaches, which are commonly analysed in the field of sustainable environmental management (Hajer and Wagenaar, 2003; Reed, 2008; Sandström, 2009). These analyses aim at integrating a range of arguments, both analytically and pragmatically and highlight integration of norms and stakeholder commitment in line with what has famously been termed “collective governance” (Ostrom, 1990). The collaborative approaches reviewed emphasise the importance of knowledge accumulation, collective learning and sensitivity to changes, which are the ideas of adaptive governance of social–ecological systems (Gunderson and Holling, 2002; Crona and Bodin, 2006).

The review showed that these approaches do not take hierarchical governance as a starting point; they actually position themselves by introducing the concept of “bottom up” governance (e.g. Fraser et al., 2006; Sturtevant et al., 2007). While biodiversity conservation evaluations focus on conservation outcomes and effectiveness, the empirical analyses of collaboration and participation do not always assess the conservation outcomes at all. Instead, they concentrate dominantly on sustainable governance outcomes, e.g. the quality of the decision-making or implementation process, and sensitivity to different context-specific arguments. The focus is on overcoming conflicts as well as securing legitimacy and learning (Paloniemi and Varho, 2009; Sandström, 2009; Saarikoski et al., 2012). Generally, however, broad argumentation, inclusive stakeholder participation, well organised participatory processes and genuine knowledge sharing are considered to contribute to positive ecological outcomes as well (Reed, 2008; Williams, 2011). In a meta-analysis of 47 participation studies, Newig and Fritsch (2009) find that participation, or, even more ambitious direct interaction among participants, generally advance environmental goals. To combine the opportunities of collaborative governance and effectiveness evaluation, Rauschmayer et al. (2009) propose both aspects to be evaluated jointly. The general message from collaborative adaptive governance research is one of optimism, and endorsement of its positive effects, even in cases where ecological impacts are not the main target of evaluation.

3.5. Governing strategic behaviour

Finally, we paid attention to interests in arguments and governance. While many actors participating in governance take policies as mandates or guidance, some perceive them rather as challenges or even contestable barriers for their preferred action (Oliver, 1991). Strategic campaigning against conservation arguments typically takes place at the policy formulation phase and diminishes as the policy is implemented (Rivera et al., 2009; Hiedanpää and Bromley, 2011). However, those stakeholders who experience economic losses from conservation sometimes continue to argue against the policy, particularly if they are in a position where they can dominate the discourses surrounding the policy implementation (Rivera et al., 2009; Hiedanpää and Bromley, 2011; Cashore and Vertinsky, 2000).

The review showed that biodiversity policies appear to be influenced by strong actors' interests and arguments even in situations that are hierarchically well organised or technically straightforward. For example, international agreements are interpreted in ways to secure national economic interests when implemented (Gulbrandsen, 2003) and biodiversity policies are operationalized with natural resource dependent sectors influencing the process (Primmer, 2011b; Newig and Fritsch, 2009; Saarikoski et al., 2012). Also the biodiversity conservation administration secures its mandate and responsibilities in situations where collaborative adaptive governance is the assumed governance mode (Primmer et al., 2013; Valve et al., 2013). On the other hand, strategic approaches to policy can also be proactive stances, redefining and framing what the policy entails, and advancing biodiversity as a part of the economic activity (Cashore and Vertinsky, 2000; Primmer, 2011a). Governing strategic behaviour is not an explicit target of many empirical analyses of governance, but it is often reported as a finding.

3.6. Empirical methods for identifying arguments and analysing governance

When exploring empirical methods for the analysis of ecosystem services governance, we found that the studies mostly used qualitative methods. This is to be expected among the studies that allow the identification of arguments in the implementation process, which we focused on. However, our review was targeted at empirical analyses of the effectiveness of biodiversity and environmental policy in general, which did not rule out quantitative measurement of policies, activities, effects and outcomes (Mickwitz, 2003).

Hierarchical governance analyses dominantly utilised qualitative document analysis in generating evidence, however sometimes referring to lessons from particular cases documented in multiple formats. Some of the hierarchical analyses derived arguments from theory, and others from other empirical analyses. The scientific-technical analyses addressing governance typically used a mix of document, focus-group, interview and survey data, acknowledging arguments expressed in policy documents, practical guidelines, operationalization processes and one-on-one communication situations. Much of this analysis appeared to be explorative. Those analyses that went further in testing the effects operationally used also quantitative analyses to test the prevalence of arguments. Empirical collaborative governance analyses often used a broad range of mostly qualitative methods for eliciting arguments and evaluating the effects of a policy. In these analyses the arguments for conservation tended to be identified as a result of an explorative, descriptive analysis of, for example, a participatory process or a network. The analyses of governing strategic behaviour were, as mentioned, not always targeted at the policies, but the interest conflicts became evident, e.g. in hierarchical governance or adaptive–collaborative governance analyses. These analyses also based their evidence on qualitative data, usually drawing on multiple sources. Using also media coverage, the most common sources for identifying governing of strategic behaviour were policy documents and interviews.

4. A framework for analysing governance of ecosystem services

Our review of empirical analyses of governance has focused on arguments used in policy implementation and the ways in which effectiveness of policies is evaluated under different governance modes. It reveals that the attention to arguments and their effects varies to a large extent. Those analyses principally evaluating effectiveness of policy implementation, focusing on technical elements and using quantitative indicators, pay less attention to the range of justifications and operationalization of the policy than the ones analysing stakeholder views. These findings bare relevance for the application and development of the ecosystem service concept, which, if eventually embedded in governance, is expected to function as a value-articulating institution itself (Vatn, 2005).

As the ecosystem service approach and research are expected to introduce new arguments for biodiversity conservation and mainstream the understanding of systemic interdependencies of ecosystems and humans, it should take seriously the challenge of understanding human behaviour in governing ecosystem services (Hodgson et al., 2007). The ecosystem services model's feedback loop from the benefits that people derive from ecosystem services to the biophysical conditions that deliver these services, tells little about what decision-making processes take place or are used behind this arrow, or in relation to other components of the model (Potschin and Haines-Young, 2011; Fig. 1). Governance, indeed, also influences ecosystem functions, ecosystem services as well as benefits and values derived from the services (Spangenberg et al., 2014). Additionally, governance processes derive information about all the components depicted in the cascade model, rather than relying solely on value information. These connections between the components of the ecosystem services and the different governance modes are shown in the conceptual framework presented in Fig. 2.

Assuming decisions are made based on weighing values and the evaluation of trade-offs, a decision made at the top of a hierarchy "trickles down" to practice, aiming at eventually influencing the status of the ecosystem, or its biophysical structure (shown as the back-loop in Fig. 2). This is intuitive when considering decisions made at very high levels; even at a global level. However, the ecosystem service literature highlights that decisions are made at many levels (Kumar, 2010; Hauck et al., 2013). There is a tendency

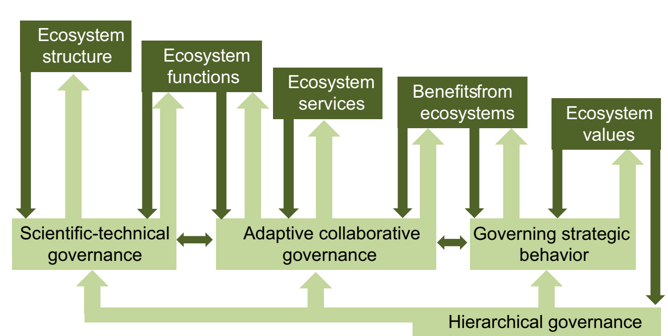

Fig. 2. A framework for analysing governance of ecosystem services.

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to address governmental decision-making, rather than decisions made by different actors in the society, which might be due to much emphasis placed on land-use planning that is often the responsibility of public authorities (Kareiva et al., 2011; Potschin and Haines-Young, 2011; Plant and Ryan, 2013). However, whether we consider governmental decisions, or private sector organisational decisions, some hierarchical systems are generally deployed towards their implementation (Primmer, 2011a). Our review shows that those studies that take hierarchical implementation as a starting point recognise many factors shaping the implementation at different levels, including those that constrain or distort hierarchical implementation. For this reason, it is important to pay attention to the hierarchical mode when analysing ecosystem services governance, even when the analysis has a local or otherwise narrow focus.

For hierarchical governance to generate effects in the ecosystem structure, as is shown in the ecosystem services model (see Fig. 1), the provision of science-based knowledge is necessary to inform management. In other words, scientific-technical governance is needed (Fig. 2). However, hierarchical governance can inform scientific-technical governance only with general arguments that operationalise the goals of the policy, for example by deploying a selection of policy instruments (Wurzel et al., 2013). For this reason, scientific-technical governance must draw on further scientific arguments and derive information about the biophysical ecosystem structure and process directly (depicted by a dark arrow from biophysical structure to scientific-technical governance in Fig. 2). Additionally, scientific-technical governance influences also ecosystem functions for example by controlling water flow or adding fertilizers to a field. As the need for science-based information and decision support systems is commonly endorsed in ecosystem services research (Kareiva et al., 2011; de Groot et al., 2010; Potschin and Haines-Young, 2011), the scientific-technical governance mode fits the model and thus needs to be considered when analysing governance of ecosystem services. Our review demonstrates additionally, that as long as this analysis is sensitive to different arguments, it produces important findings that relate to other governance modes as well.

The concept of ecosystem services connects nature and people. Therefore it is not sufficient to deal with technical arguments and operationalise science-based understanding of ecosystems. Adaptive–collaborative governance joins actors who use science-based knowledge and arguments about ecosystem functions and actors who understand and argument for the different benefits that humans derive from ecosystems (Fig. 2). Adaptive–collaborative governance influences ecosystem functions and ecosystem services and also shapes the benefits that different actors can make use of or enjoy. Ecosystem service literature acknowledges the need to consider different stakeholders' views and knowledge in decision-making processes, and initial empirical analyses reveal the crucial role that understanding the different actors has for securing the relevance of more natural science-driven analyses (Cowling et al., 2008; Rauschmayer et al., 2009; Menzel and Teng, 2010; Primmer and Furman, 2012; Hauck et al., 2013). These empirical analyses should integrate also the different actors' rights to the benefits that ecosystem services contribute to, which have been conceptualised recently, particularly for the analysis of ecosystem service payments (Lockie, 2013). In any case, the adaptive collaborative mode of governance merits the analytical attention of ecosystem service researchers, and should build on earlier empirical work on biodiversity and environmental conservation governance.

As benefit arguments are made with normative or numerical terms, using knowledge about, for example, multiple uses of the same ecosystem and weighing them against each other, the interests of different actors start to influence governance. Governing interest-driven strategic behaviour makes use of knowledge and arguments about ecosystem benefits and values, and also shapes the ways in which the benefits are framed and values weighed (Fig. 2). Value arguments feed back to the decisions that are made, to be implemented again, through a hierarchy. With the assumption that value arguments are systematically weighed in decision-making, as long as knowledge about values exist, the ecosystem service literature has put much emphasis on valuation and measuring ecosystem services in monetary or other numerical units (De Groot et al., 2002; Kumar, 2010; Bateman et al., 2011). While this analysis sometimes teaches us new lessons about what is valued or how values relate to particular decision-factors, it turns attention away from the ways in which value arguments are continuously used and tested in real world decision-situations. Governing strategic behaviour takes place in every negotiation and is conducted by governments as well as other actors. Our review shows how important it is to consider this mode of governance also when other modes are in the focus.

Finally, hierarchical governance does not generate effects only through scientific-technical governance, but also through adaptive–collaborative governance and by governing strategic behaviour, as has been anticipated in those analyses that highlight the multilevel-character of ecosystems service decision-making (Hauck et al., 2013). Assumptions about motivations and rationality are quite strong in the ecosystem service payment literature, perhaps, because economic analyses are based on assumptions about the motivations of those actors who have the right to manage ecosystems and use ecosystem services (Vatn, 2010; Lockie, 2013). However, the interplay between hierarchical governance and governing strategic behaviour and interests merits more empirical attention, as the review demonstrates: hierarchical implementation of high-level commitments is influenced by interests appearing at lower governance levels.

The different governance modes should be recognised also when analysing policy instrument design and implementation (Schneider and Ingram, 1990; Wurzel et. al., 2013). The starting point of instrument design is often hierarchical: the design is at a central level, e.g. at the state, and the administration implements it or participates in its operationalization (Primmer, 2011a; Wurzel et al., 2013). The design and implementation of the instruments can be supported with scientific-technical tools (Cowling et al., 2008; Gómez-Baggethun and Barton, 2013), or applied in a collaborative adaptive fashion (Hauck et al., 2013). Instruments can be designed to address the strategic behaviour of actors in securing their interests, and to balance the different interests. Payments for ecosystem services, for example, are considered to balance the differing interests allowing public demand for ecosystem services to meet their private provision (Ferraro and Simpson, 2002; Vatn, 2010; Lockie, 2013). To be able to make use of the range of governance mechanisms, instruments have developed in parallel, as policy-mixes (Ring and Schröter-Schlaack, 2011; Barton et al., 2014; Ring and Barton, forthcoming). The analysis of policy-mixes is generally sensitive to different governance mechanisms, and is therefore likely to benefit from our framework when addressing instruments for ecosystem services.

Our review demonstrates that the conceptual framework would support empirical analysis of biodiversity and ecosystem services governance at different levels and direct attention to the different, parallel, modes of governance. As an example, the European Union Natura 2000 network implementation illustratively validates the need for analytical attention to the different governance modes (Wätzold et al., 2010; Morris, 2011; Sumares and Fidélis, 2011). A focus on the hierarchical governance mode would pay attention to the protected area network implementation by the nation states and, further, by the regional and local administration, focusing on legal and administrative arguments. A focus on scientific-technical governance would address the data and knowledge resources applied in the implementation, paying attention to the scientific arguments used to justify and carry through establishing the Natura 2000 protected areas. Focusing on an adaptive collaborative mode of governance, attention would be paid to different actors exchanging information and views on the areas to be assigned and their different uses. A range of different arguments would be used in this kind of deliberation, for example when devising the Natura 2000 management plans (Wätzold et al., 2010). Focusing on governing strategic behaviour, attention would be on other interests and land-uses conflicting with the Natura 2000 protected areas, relying on arguments of different benefits and values. For example when new infrastructure is developed, interests are weighed and strategic behaviour can be governed through negotiations, permitting and possibly compensation (Sumares and Fidélis, 2011). Governing strategic behaviour takes place also at the international level, when the EU goals are negotiated and operationalised for national level (Morris, 2011). The simple example demonstrates the need to consider different modes of governance, even if analytical attention is focused on a particular issue of policy implementation.

Using the approach to frame the analysis of much broader ecosystem service policy that acknowledges complexity and multiple benefits (e.g., EC, 2011) would sensitise the analyst to the modes of governance that are assumed and observed. As we get tuned to consider different modes of ecosystem services governance, we will be in a position to identify the potential feedbacks between all the other components of the ecosystem services model, because of the interaction and overlap of the different governance modes and policy-mixes. A systematic approach to analysing governance allows identifying and disentangling the range of arguments used in turning policies into practice in ways that reflect different modes governance.

5. Conclusions

As biodiversity conservation arguments have not been effective enough in changing human behaviour, the expectation is that utilitarian arguments about values and benefits derived from ecosystem services might do so, together with scientific arguments about ecosystem processes and functions as well as the underlying biodiversity. Thus it is important to analyse what conditions the effectiveness of such arguments. To understand this, we need to analyse governance. This entails identifying how the arguments are assumed to produce the desired biodiversity conservation outcomes in the practice of policy implementation, and analysing this practice empirically.

In this paper, we have set out the basis for such an analysis, by reviewing empirical studies of policy implementation, and by fitting the identified governance modes to a well-established conceptual model of ecosystem services, the cascade model. By focusing on empirical literature that pays attention to arguments in the implementation of biodiversity and environmental conservation policies, we demonstrate how hierarchical, scientific-technical and adaptive governance as well as governing strategic behaviour interact.

The developed conceptual framework provides a structure for empirical analysis of ecosystem services governance, which takes into account the people and organisations making decisions, and, particularly, the different arguments that are used when implementing policies. The framework is meant to enable holistic ecosystem service analyses and, further, to support policies in generating conservation and sustainability impact.

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