

Perspectives on forest conservation: building evidence at the frontier between policy and conservation science

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Abstract The conservation and sustainable management of forests is a topic of significant interest for scholars and policy makers alike. Yet, this is a multifaceted issue that raises important questions related to different societal and scientific perspectives, while values of the multiple services that forest ecosystems deliver for society must also be taken into account. However, perspectives on forest conservation may differ with regard to region and scale. This paper summarizes the contributions of a special issue on forest conservation that brings together diverse disciplinary and regional perspectives. First, we explore the necessity for interdisciplinary perspectives on forest conservation, and particularly the urgent need to bridge between social and natural science views in order to better understand complex socio-ecological systems. Second, we discuss a variety of case studies on forest conservation in different spatial and socio-economic contexts. Third, we focus on the science-policy and science-management interface as the critical “zone” where knowledge about forest conservation is exchanged. Finally, we emphasize again the diversity of possible perspectives on the issue, and conclude by identifying some possible ways of thinking about issues such as integrative versus segregative forest conservation, and science-policy-management interactions.

Keywords Interdisciplinarity · Conservation policy · Science policy interface · Science management interface · Governance · Socio-ecological systems

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Introduction

The conservation and sustainable management of forests have been subjects of increasing attention in recent years. At the global level, the REDD+ mechanism tackling deforestation and forest degradation has attracted unprecedented interest in the context of multidisciplinary scholarship (Angelsen et al. 2012; Pistorius et al. 2012). At national and subnational levels, there is an increasing number of studies that address forest conservation issues and conflicts all over the world (e.g., Hellström 2001; Hickey 2009; Hoberg 2004; Medina et al. 2009; Saarikoskia et al. 2013; Somorin et al. 2012; Winkel 2013, 2014). Many scholars point at growing pressure on forest ecosystems from different sides: competing land use interests (Soares-Filho et al. 2006), intensification of timber and forest management, bioenergy and related policies (Koh and Ghazoul 2008; Söderberg & Eckerberg 2013), as well as (globalizing) markets (Kull et al. 2007) being only a few of the factors that are frequently addressed.

In this context, forest conservation policies and strategies are of crucial importance. Taking a closer look, these policies and strategies differ greatly with regard to the type of forest, but also the socioeconomic context and the respective ‘tradition’ of forest and conservation policy. While conservation concepts are informed by ecological research findings and knowledge, forest conservation policies follow their own—political—logics. They are marked by conflicting interests, beliefs, interpretations, and underlying knowledge cultures (Winkel 2014). Moreover, in several regions of the world, forest conservation policy is marginalized by forces that are beyond the scope of the ‘conservation community’, some of which are mentioned above.

At the same time, ecological knowledge on forests is growing continuously, and, with it, the complexity of forest ecosystems becomes more and more apparent. ‘Old truths’ of forest conservation are challenged by new evidence (e.g. related to the importance of previously neglected early successional stages, Swanson et al. 2010; King and Schlossberg 2014, or the possibilities to partially integrate biodiversity conservation and plantation forestry, Brockerhoff et al. 2008). Yet, the necessity for long-term forest conservation strategies is also reinforced. In forest conservation policy, growing complexity of ecological knowledge meets political needs of simplification and societal polarization. Decision makers face challenging questions about the ‘right’ knowledge basis for forest conservation, the ‘right’ connection of knowledge with policy making, and finally the ‘right’ tools to conserve forests and forest biodiversity given pluralistic (and often antagonistic) societal demands and powerful market forces.

Focusing on academia, there is, on the one hand, a remarkable gap between both the social and ecological sciences research communities. This gap is reinforced by different ontological and epistemological assumptions, different disciplinary cultures and even ‘languages’ (Lele & Norgaard 2005). This holds true when, for instance, a policy is analyzed from an ‘ecological’ and a ‘social’ perspective, and both seem to be incompatible.

Yet, on the other hand, there is growing interest in, and a pressing need to more effectively link the social and ecological science analysis of forest conservation. This priority comes with increasing acknowledgement of the necessity to take up interdisciplinary perspectives in order to provide a better knowledge base for complex forest conservation policy problems. These efforts encompass interdisciplinary research projects, joint data gathering and analysis, and even joint theory building, but also less systematic, but nevertheless innovative approaches for assessing and even bridging the disciplines.

In this special issue, we aim to address the frontier between forest ecology and conservation science (and the respective research on conservation objectives and strategies) on

one hand, and the social and political sciences analysis of forest conservation (involving land use and conservation policies as well as local management practices) on the other hand. The special issue builds largely upon a set of papers that were presented at the interdisciplinary workshop “Perspectives on Forest Conservation—tackling the frontier between policy and conservation science” in Freiburg, Germany, on 19–21 June 2013. In line with the above mentioned objectives, it encompasses papers that:

- assess the role of different disciplines—and the necessity for interdisciplinarity combining both ecological and social science analysis—in the analysis of forest conservation,
- analyze forest conservation policy and the success and failure of distinct concepts in various contexts, and
- address the interplay of different types of knowledge at the science-policy-management interface in forest conservation.

In the following, we first briefly summarize the papers of the special issue. Then, we draw conclusions regarding the main challenges we have outlined above.

Perspectives

The socio-ecological analyses of forest conservation—towards an interdisciplinary perspective

To begin, the diversity of possible disciplinary perspectives on forest conservation is nicely illustrated in the paper of Peters and Schraml (2014), who conduct an exploratory literature review on the use and meaning of the term “sustainable forest management” in different scientific journals. Drawing on what one may understand as a “sociology of science” perspective and a related concept of disciplines as “self-referential communication communities”, they show notable differences regarding the way the (essentially political) concept of sustainable forest management is used and understood in scientific contributions coming from different disciplines. Moreover, echoing discussion of regionalism, Peters and Schraml discuss how the broad validity of sustainable forest management is associated with strongly regional interpretation of the concept, which may have consequences for its implementation through management interventions at the local level. Frequently, different demands for ‘sustainability’ compete: For instance, sustainability for timber production might conflict with climate change mitigation or biodiversity conservation goals. Hence the concept itself can become ambiguous, difficult to interpret, and subject to exploitation for other means by actors with competing political interests and beliefs. Much greater clarity and goals are needed if such manipulation of the concept is to be avoided. Furthermore, much greater interdisciplinarity is needed in the continuing development of the concept of sustainable forest management if it is not to become subject to ever more disparate interpretations.

The interrelation between social and ecological systems related to forest conservation and management is central to the subsequent paper of Kalaba (2014). Aiming to develop a more structured approach to understanding the transformation from ecosystem service to goods, Kalaba broadens our understanding of how ecology benefits society and how dynamism and reciprocity are frequently overlooked as humans tend to take a more utilitarian, resource use-based approach when considering forest value, rather than explicitly considering how human activity can feed back to and modify the forests on

which it depends. Central to his thesis is a call to better understand the interactions in social ecological systems through the development of a new conceptual framework that allows us to better understand how potential ecosystem services can be transformed into actual ecosystem service, or not. Critically, it is the transforming structures, for example laws, institutions, and power relations, that govern (and often restrict) access of ecosystem services by people. It is Kalaba's intention to identify points at which the underlying drivers, structures and processes might be modified through appropriate management intervention to improve sustainability of ecosystem management and use.

Finally, Andrade et al. (2014) take up a distinct perspective and explore the chances and challenges related to the education of interdisciplinary thinkers in conservation at one of the leading environmental science departments in the US, the University of California's Department of Environmental Science, Policy and Management at Berkeley. In their paper, they first explore why disciplinary perspectives—while certainly needed—can also be problematic in the environmental sciences, particularly when faced with complex socio-ecological challenges. Based on the resulting statement that interdisciplinarity is needed, they then explore different contexts of interdisciplinary education in conservation: the department, advising, integrated research collaborations, graduate working groups, interdisciplinary classes, and transacademic research. In their self-assessment conducted jointly with graduate students, they highlight that soft factors and context matters more than formalized rules when truly interdisciplinary perspectives are to be achieved. Such soft factors encompass, for instance, a “safe space” that allows interdisciplinary communication and cooperation without constraining factors such as “dos and don'ts” of disciplinary language (which they nicely label “the disciplines' esoteric vocabulary”). In this way, barriers between disciplines can be bridged through mutual acknowledgement, empathy and, most importantly, patience.

Perspectives on forest conservation around the globe

Our subsequent survey of perspectives on forest conservation around the globe begins in Europe. Schulz et al. (2014) present an exploratory comparison of nine European countries and regions, and assess the influence of a variety of aspects (e.g. forest ownership, economic importance of forestry) on the degree of integration and formality of biodiversity conservation oriented management.

They focus on environmental (conservation) standards and rules that target the—typically European—“integrative” approach to the conservation of biodiversity in forests. This approach explores the situation in forests that are (also) managed for different purposes (mostly timber management). Schulz et al. identify that the stronger and more important the forest sector is in a country, the less likely it is that explicit regulation for integrative nature conservation will exist. This holds particularly true if this strong forest sector has—often for a long time—established its own understanding (and practices) of sustainable forest management. This result is perhaps unsurprising, but serves to highlight further the challenge to put frequently demanded integrative approaches in conservation into forest policy and management practices—here simplified as a powerful forestry sector resisting additional regulations that might compromise or complicate its operations. Their interesting study, however, remains (and is meant to remain) exploratory, particularly as their assessment of political institutions cannot provide for an evaluation of ‘real’ on the ground practices in integrative forest biodiversity conservation.

Such on the ground practices in integrative forest conservation across Europe are a focus of Winter et al. (2014). They analyze integrative forest conservation under the EU's nature conservation policy Natura 2000. This policy established a network of protected areas across all 28 EU member states, and, thereby, aims at integrating forest use and conservation on the protected sites. The analysis of Winter et al. focuses on the impact of the policy on local forest management and conservation practices, drawing on nine local cases studies in three European countries (Austria, France, and Germany). Based on a socio-ecological analysis combining an assessment of management plans (meant to implement the policy locally) in protected forest areas on one hand, and interviews with local stakeholders and managers on the other, their findings raise doubts related to the effectiveness of Natura 2000 as it is currently implemented, at least for their case of beech forests in the continental region of Europe. Winter et al. highlight that vaguely formulated management plans often fail to influence local practices, while the objectives and ecological thresholds the plans propose are frequently inadequate to ensure the conservation of biodiversity in forests (even if the plans can be thoroughly implemented). Remarkably, the authors partially challenge the prominent call for (local) stakeholder involvement (instead of a top down, science-based approach) in the EU's biodiversity conservation policy (Rauschmayer et al. 2009), stating "that the problem in the current management planning process is no longer so much the lack of stakeholder participation".... "[Since] forest managers and forest owners have at least temporarily been appeased through the management planning process, the challenge in implementing Natura 2000 has now been reversed as the policy is no longer too science based and technocratic, but rather does not correspond enough with the findings of conservation science, and is ineffective on the ground". Given this provocative assessment, it remains an interesting question in how far their final suggestion to conceive Natura 2000 as an ongoing learning process may come true in the future.

The next paper remains in the context of the EU's biodiversity conservation policy. Pecurul-Botines et al. (2014) apply a discourse institutionalist approach on two case studies in Soria (north-east-Spain), and assess different strategies that are applied by policy stakeholders in the struggle over management control in protected areas: In their first case, the debate over the establishing of a Natural Park can only be understood when it is contextualized as part of a much older struggle about power between local stakeholders and the regional administrations. This struggle had actually resulted in a balance of power between local villagers and the forest administration about usage rights and forest conservation. Under these circumstances, the Natural Park designation is seen as a threat to the established balance and related usage rights of the locals, which hampers the chances for successful and accepted forest biodiversity conservation in this region. In the second case, however, the implementation of the EU's biodiversity conservation policy, Natura 2000, was perceived differently by involved stakeholders: Framed as an opportunity to generate new income and revitalize interest into forest management in a largely abandoned forest region hit by demographic challenges, the conservation policy created high expectations that, however, declined when the Spanish economic crisis put any chance to receive additional development funds into question. In conclusion, the Spanish cases demonstrate not only that the local institutional and discursive context matters in forest conservation, but also that conservation can become entrenched into patterns of strong traditional conflicts and institutions, that must be dealt with if new conservation ideas are to stand a realistic chance to be implemented.

In Europe, but outside the EU, Kaeser and Zimmerman (2014) highlight how the implementation of a national forest biodiversity policy, in this case aiming to establish

strictly preserved forest habitats, is characterized and impacted by different regional contexts in a Federalist state. Their key point is that policy implementation, and even policy itself, can be constrained by sub-national administrative boundaries—in the case of the nation they studied, Switzerland. Implementation was found to be largely driven by financial resources with less wealthy regions having ‘less to spend’ on biodiversity. An interesting finding of Kaeser and Zimmerman is that regions that have a high area of forest designated for their protective functions, for example to reduce avalanche impacts, tend to have a much lower area of forest designated as biodiversity reserves. They propose that combining the two reserve types could reduce management effort and benefit biodiversity—a win–win situation that would save financial resources whilst also having positive environmental outcomes.

The debate about strictly preserved forests is also central to the paper by Schultze et al. (2014). They point out that one of the factors hindering forest conservation is a lack of a coherent approach to assessing the value of strictly protected forest reserves since criteria for this purpose are lacking. Schulze et al. develop and explore a set of criteria covering the spatial, temporal, and functional attributes of strictly protected forest reserves, which enable them to contribute to the protection of biodiversity at the national or regional level. In doing so, Schulze et al. wrestle with fundamental issues such as forest naturalness and continuity that remain challenging to define and reconcile with short human life-spans or political cycles yet are critical to incorporate into the evaluation process given that evaluations must be made. This in many ways is the outstanding step. Measurable and meaningful indicators must be found for any management or valuation framework to have long-term applicability and value, and Schulze et al. are explicit about this challenge.

The scope is widened beyond Europe in a contribution on the Reducing Emissions from Deforestation and Forest Degradation (REDD) mechanism by Aicher (2014). He considers the importance of knowledge and the way issues and policies are framed, thus taking up a constructionist perspective related to the field of Science and Technology Studies. First, the REDD mechanism is put into the historical context of debates about tropical forests. In this perspective, REDD can easily be deconstructed as entailing a major narrowing of perspectives on tropical forests, as it is limiting their value to carbon stores whose protection may, from a global perspective, serve as a cost-efficient mitigation option. Hence, REDD is portrayed as basically built upon an economic rationale, or technical approach, a “reductionist view” of tropical forests. Against this background, Aicher then discusses whether the concurrent debate on social and ecological “safeguards” for REDD is actually reinforcing the reductionist approach (through putting even more aspects of forest management under a REDD technocracy), or is able to open up the debate towards a more comprehensive perspective. He analyses this question through a comparison of different emerging standards for REDD safeguards, and emphasizes the importance of standards proposed by indigenous peoples’ organisations, which he quite positively sees as being embedded into a different knowledge culture. Aicher ends his contribution with the claim that REDD needs to much more extensively draw on knowledge beyond Western science, technology, and economics. In this way the paper broadens the perspective of this special issue beyond interdisciplinarity and the debate on science policy interactions towards a perspective that also takes (regionally) different knowledge cultures into account. Yet, the consequences of such a claim beyond the conceptual level of REDD in the international negotiations and standard setting remain an issue for further analysis.

Entenmann et al. (2014) assess the applicability and implementation of REDD in Kenya considering different REDD activities and forest types. Based on interviews with key actors engaged at national and local levels, they explore opportunities and barriers to

integrated implementation for biodiversity, ecosystem services and carbon stocks. Provision of ecosystem goods and services generally takes precedence over biodiversity benefits and no clear link is established between the two. The primacy of the provision of goods and services here is driven by socioeconomic concerns that must be addressed before biodiversity outcomes can also be integrated. Yet, Entenmann et al. point out that the dependence of forest goods and ecosystem services upon forest biodiversity is the real challenge and that the two cannot be considered separately in the context of REDD. Rather, a greater probability of success can only be achieved through more integrated communication and cooperation of actors and the fundamental involvement of local stakeholders who will bear both the brunt and benefit of any economic impact.

Osei-Tutu et al. (2014) start with the, at least in theory, common-sense axiom that conservation must take local demands into account, and most importantly, traditional local knowledge. Yet, they then make an interesting point by asking how important traditional and local knowledge really is today given the strong forces of modernization. This serves as a starting point for their analysis of local case studies of forest conservation in Ghana, basically targeted at understanding the importance of local rules (mostly “taboos”) in current management practices. Drawing on an impressive amount of social science data, they show that only those informal rules/taboo that make sense in a modern environment are still important for the local stakeholders and citizens. For instance, so-called “process” and “output” based local norms that draw their legitimacy from either procedural criteria (e.g. fairness) or expected outputs (e.g. the conservation of a forest) continue to be important, while so-called “source-based” rules that draw legitimacy from solely mythical or religious traditional sources erode in importance due to forces of modernity, including formal education and new economic opportunities. Yet, most important, the rules that are still influential are those where legitimacy can be drawn from new sources, for example when a traditional taboo of destroying a forest can be aligned with the modern use of the forest for eco-tourism. This contribution can be seen as a call for conservation policy makers to align the prominent call for the integration of local traditional knowledge with a careful analysis of the actual importance of such knowledge for the local communities in a region today. The issue is then to bring together both traditional and modern societal forces in conservation; a dogma of *per se* assuming central relevance for traditional knowledge and rules may, in contrast, create new conflicts where this knowledge and rules have already been eroded through “modernization”.

The importance of shifting public values and related perceptions and priorities towards forests is also central to the essay of Johnson and Franklin (2014). They comment on the legacy of rapid and apparently permanent shifts in forest policy and management of the federal forests in the US Pacific North-West. This policy shift in the early 1990s was driven by litigation in combination with a more considered understanding of forest ecology. Johnson and Franklin highlight the lasting impacts of this rapid change based on their experience of the Northwest Forest Plan (NWFP). Developing out of conservation disputes centring on the need for conservation of the Northern Spotted Owl (*Strix occidentalis caurina*), the NWFP fundamentally shifted the management of federal forest land from timber production to the conservation of biodiversity and ecological processes. However, adaptive management within the NWFP, while strongly emphasized by the (scientific) makers of the plan, has been thwarted by stakeholders’ desire for certainty and caution against the uncertainty and experimentation involved in adaptive management approaches, and in some cases unwillingness to reinstate natural processes such as an appropriate fire regime. Effectively, a combination of economic and societal caution about change has led to management that is overly static and doesn’t meet the needs either of the ecosystems

being managed or the requirements of the groups for whom they are managed. Franklin and Johnson suggest that the resulting paralysis might be avoided through much stronger ecological foundations (including ecological forestry) in combination with education and effective involvement (collaboration) of stakeholder groups, so fostering a sense of community ownership in order to gain broad agreement on forest management. Finally, they stress the need to find an ecologically sound *and* socially accepted path for forest conservation that mitigates between the (globally observable) poles of strictly preserved protected areas and intensively exploited forest land; a more integrative approach. By putting the tensions between conservation science, policy and management in the centre of their essay, and underlining the need for overcoming such tensions by means of carefully developed and balanced forest conservation concepts aligning scientific evidence, societal preferences and practical (management related) operationality, they pave the ground for the last section of this special issue, which puts the science/policy management interface in the focus.

The science—policy (and management) interface in forest conservation

Our elaboration on the science-policy-management interface begins with the insightful contribution of Pregernig (2014) who conducts a meta-analysis of different theoretical concepts of science policy interactions based on the assumption that these concepts underpin observable “real world” practices at the science policy interface in conservation. First, the knowledge transfer and science policy gap model (labeled as the “natural ideology” of the knowledge society) assumes that the uptake of scientific information must be improved by better communication, but has been shown to be overly simplistic regarding its ontological assumptions and depiction of science-policy interactions. Second, an economics of science perspective conceptualizes the exchange of knowledge and resources between science and society as a matter of supply and demand, which hence must put in relation to each other via “knowledge markets”. Third, a communication theory perspective emphasizes barriers to effective transfer (e.g. the technical language of scientists and an emphasis on uncertainties that policy makers dislike), resulting in different proposals of how to organize science policy interactions more effectively (e.g. through knowledge brokers). Yet, according to Pregernig and others, this perspective underestimates the challenge of information overload in the policy system, and puts too much focus on the supply side while neglecting the specificities at the demand side. Fourth, another set of approaches views science and policy with regard to different system logics (e.g. related to different incentives on both sides). While Pregernig points out that these approaches are influential in conservation, they have their flaws regarding a neglect of the overlap between both “communities” (e.g., through scientific policy consultants). Fifth, utilization research focuses on what policy makers do with scientific knowledge and what complex paths of impact might exist, beyond a simple transfer of knowledge. Sixth, a public choice perspective sees science (and scientific knowledge) as a strategic (power) resource in society and policy making—resulting in the necessity for scientists to reflect on their own role in the resource exchange process. Basically, scientists have to decide if they actively engage in the power game over knowledge (e.g. through epistemic communities that are powerful through consensus) or strive for a role that is rather in line with the idea of an “honest broker” as proclaimed by Pielke (2007). Finally, the perspective of civic science conceives science as only one way of producing evident knowledge. It thus puts forward the claim to democratize science through means of co-production (e.g. as civic science or citizen science). Yet, according to Pregernig, this claim has been more influential in science policy

interactions rhetoric than in practice, and may be difficult to implement in practice. In sum, Pregernig's paper is insightful as it provides the leverage point for the critical contextualization of many contemporary approaches to science policy interactions in conservation that, in many cases, choose one implicit concept while excluding other perspectives.

One such potential perspective is introduced by Boecher and Krott (2014). Starting from the expectation that policy making should be informed by scientific evidence, but being aware of the challenges that such a demand may cause in practice, they propose their own "RIU Model" as an analytical framework for scientific knowledge transfer. The RIU Model conceptualizes the process of knowledge transfer through distinguishing research (R), integration (I), and utilisation (U) activities. Based on the literature, Böcher and Krott derive criteria for each of the three steps that must be fulfilled. They then use the derived model to analyse the case of the development and use of a Decision Support System (DSS) related to climate change and forest adaptation in Germany. This case study entails an interesting and insightful analysis of the 'reality' of science-policy-management interactions, including a frank assessment of, perhaps typical, failures such as weaknesses on the science side due to lacking funding, a *vice versa* neglect of expectations, and shared ideological ties across forest scientists and forest policy stakeholders resulting in the exclusion of forest biodiversity issues from the DSS. In conclusion, the authors emphasize the potential value of the RIU model to avoid such shortcomings.

Finally, De Koning et al. (2014) provide a slight shift in perspective from science-policy interactions towards an elaboration on the science-management interface. They highlight uncertainty and differing interpretations of existing knowledge as key components of the often poor integration of the scientific community's predictions of climate change impacts on forest systems into concrete management intervention. While the potential impacts of climate change on forest composition, productivity, and management practices are often understood, uncertainty as well as scientific modelling that is "indigestible" for forest managers results in reactions ranging from a pragmatic sticking to traditional management schemes (and just denying a necessity for change) up to individualized, local reactions based on personal considerations and evidence. In response, on one hand, the paper underlines the need for greater clarity of information including more specific predictions of change at fine spatial scales in order to allow forest managers to operationalize scientific knowledge of climate change in management decisions. This call overlaps with the goals of the scientific community seeking to make better, more precise predictions of future change for aspects such as biodiversity, carbon sequestration, and ecosystem processes. On the other hand, with respect to the above-mentioned uncertainties and the complexity of the issue, the authors also emphasize the necessity of practitioners and scientists working together more explicitly in order to co-generate knowledge (involving both scientific methods and local traditional experience), through practices such as reflexive monitoring involving scientists and practitioners.

Conclusions

What can be learned from the contributions in this special issue? It is challenging to derive general conclusions based on the very distinct "perspectives" on forest conservation presented here, but on closer inspection, the three main topics, the exploration of inter-disciplinarity (and especially the need to cross the border between the social and the natural sciences), the assessment of different forest conservation contexts, and the conceptualization of the science-policy-management interface, are significantly interlinked.

First, one message that comes out of several analyses of conservation policies in different cultural contexts is that conservation policy and management are not only (or even mostly not) about conservation science, but about values, perceptions, traditional or modern (informal) rules, and diverging societal interests. With this general message in mind, the ‘stories’ that the explorations of different contexts of forest conservation tell are notably diverse, as are the conclusions reached. For instance, Aicher’s (2014) critical assessment of the global REDD rhetoric (and safeguards standards) emphasizes the need to widen the scope of this global forest conservation policy through actively integrating knowledge that originates from other contexts as (western) science, technology, and economy. A similar direction is taken by De Koning et al. (2014), who emphasise the need for scientists and forest managers to cooperate closely in the production of “actionable knowledge” that cannot be based on the available scientific evidence alone. On the contrary, Winter et al.’s (2014) socio-ecological assessment of the implementation of the EU’s biodiversity conservation policy in central European forests identifies not only a certain trade-off between local stakeholder participation and conservation science based approaches, but demands a (re-) consideration of scientific evidence in the policy implementation process. Osei-Tutu et al. (2014), while reiterating the call for the integration of traditional local ecological knowledge in conservation, show, however, that such claims must not disregard the forces of modernization that all (including traditional) knowledge cultures are subject to. Johnson and Franklin (2014) finally, emphasise the need to achieve both a better scientific foundation and stakeholder involvement in the design of forest conservation policies and management.

Obviously, such diverging recommendations must be read against a background of different empirical findings and related, but also disciplinarily constituted, perspectives. Yet this diversity also draws attention to the point that there is no single ideal solution. While Johnson and Franklin’s call to play both cards, better science and more democratic policy-making, is likely the most compelling to all sides, it may face serious challenges when put into practice. This may be the case, for instance, in a situation where local actors shaped by strong traditional institutions perceive any new conservation initiative as unwanted intervention (see, for example, one of the two case studies of Pecurul-Botines et al. (2014), or the critical observation of “appeasement policy” under Natura 2000 made by Winter et al. (2014). It is in such difficult situations that decisions about trade-offs in forest conservation must be made, in the best case including available scientific knowledge and local consensus, but in many cases also involving the necessity to mediate and decide between clashing knowledge cultures, competing interests, and land management ideologies, not to mention the issue of scales (e.g. temporal and spatial). In this sense, the variety of cases and related diversity of conclusions in this special issue can be seen as a call to carefully assess available options, and mediate between different parties, but also to be aware about potential trade-offs, and to be ready to achieve decisions when they are necessary. In many cases, however, the complexity of the issue and the availability of different reasonable strategic alternatives will render forest conservation policy and strategies rather a game of incremental moves than one of pushing through major unswerving strikes.

Second, and also crucial to forest biodiversity conservation is the debate about the overall strategic orientation being either rather “segregative”, that is, separating strictly preserved (natural or semi-natural) forests and intensively used forest timber land, or “integrative”, that is, combining biodiversity conservation issues with other forest uses, including timber management. Reviewing the contributions in this special issue, one interesting observation emerges. On one hand, Winter et al. (2014) in their analysis of the

EU's Natura 2000 policy identify significant weaknesses regarding the on the ground implementation of an "integrative" conservation approach, and even label this approach as partially only symbolic conservation policy. On the other hand, Johnson and Franklin's (2014) essay on Pacific North-West forest policy critically assesses shortcomings of the segregative approach, and calls for a better integration of ecology and other forest management purposes. How can these divergent calls be understood? We argue that these critical assessments of both segregative and integrative approaches may point at the difficulties to achieve the 'right balance' in forest conservation, which of course ultimately lies in the eyes of the beholders, and is shaped by distinct experiences and conservation traditions. The critical assessments of European integrative approaches to forest conservation on one hand, and North American segregation on the other hand, can also be read as a call for more cross-regional cooperation of the respective scientific communities in order to better exchange experiences, and work towards a balance in forest conservation. Given the diversity of social, economic, political and ecological factors that are flowing into such a balance (cf. Schulz et al. 2014), this call can easily be enlarged to one involving different disciplines in such an exchange (cf. Andrade et al. 2014). A better understanding of the different forces involved in forest conservation policy and management may then result in a better understanding of the respective possibilities for, and consequences of, segregation and integration in forest biodiversity conservation.

Eventually, however, the design of forest conservation policies and strategies is a matter of societal choice. In this regard, the organization of the science-policy-management interface is highly important, not only to guarantee that policy makers and stakeholders have access to scientific evidence, but also that conservation science scholars remain informed about practical and societal circumstances and constraints. In this regard, the contribution of Pregernig (2014) is pertinent as it illustrates that the organisation of the "interface" itself entails (and reproduces) certain implicit assumptions about the relationship between science (and scientific knowledge production) and policy making, and, with that, about the very essence of decision making in conservation policy itself. No matter how we understand this interface, rather as a place for partnership and co-production as emphasized by De Koning et al. (2014), or as a case for improved knowledge transfer by systematically acknowledging, and then bridging, the differences between the science and the policy system as recommended by Boecher and Krott (2014), the seven alternative concepts related to the nature of the interface that Pregernig (2014) presents again suggest that there is no black and white portrayal of the complexity of science-policy-management interactions, but, rather, shades of grey. And, again, choices have to be made that must reflect societal preferences. For instance, one prominent finding of the papers of De Koning et al. (2014) and Johnson and Franklin (2014) is that there might be conflicting expectations coming out of the spheres of science and society regarding the importance (and management) of uncertainty: managers and policy makers often want certainty from scientists when this is a something that cannot often be reasonably provided. Frequently, scientists talk in terms of the probability of a certain outcome, or its likelihood, which non-scientists find difficult to interpret, desiring instead a yes or no. This lack of certainty in scientific assessments is often perceived as scientists being unwilling to commit to particular predictions and leads to two contrasting sets of problems, genuine confusion by managers who wish to act but don't know what to do, or the deliberate exploitation of uncertainty for political, economic or other ends. The resulting clash of 'certainty cultures' is only exemplary for other challenges in science policy interactions, yet, more interestingly, what we can learn from different contributions in this special issue is that there is not only one way of dealing with diverging expectations. For instance, one

may conclude that more research, better data, and clearer objectives in order to create more scientific consensus are needed, or/and that better outreach and communication towards stakeholders is required. In an opposite direction, differences and cleavages between science and society may also be understood as a call for less ‘scientific’ (or technocratic) science in the sense that processes of stakeholder engagement are strengthened, and a co-production of knowledge involving scientific methods and other sources of evidence (e.g. traditional local knowledge and experience) is striven for. The strategy to argue for may depend on individual (as well as disciplinary) ontological premises and experiences, as well as specific cultural circumstances. And, again, these specificities may be seen as a call to engage in more cross-disciplinary exchange (and cross-cultural communication), not necessarily to change opinions, but rather to better know and understand the available options—and different opinions.

In conclusion, to provide a better understanding of options by exploring the different “perspectives” on forest conservation, has been the major goal (and hopefully achievement) of this special issue. This is an exploration which is far from conclusive, and important disciplinary perspectives of, for instance, economics, philosophy, and anthropology, are hardly represented here. The same holds true for regional perspectives, for instance from Latin America or Asia. Yet, to expect such conclusiveness is beyond the limitations of one special issue. Rather, the collection of papers presented here is to be read as an exploration of perspectives that can be used to broaden the readers view, and encourages her or him to engage in interdisciplinary, ‘transacademic’ and transregional exchange of knowledge related to forest conservation.

In this special issue, Andrade et al. (2014) use the impressive image of a girl with sheep (or sheep with a girl) to illustrate the power of disciplinary worldviews on our “perspective”. In their example, a graduate student trained in wildlife biology overlooked the girl in front of the picture due to his/her interest into the sheep in the background. We take this picture as our final metaphor, and conclude with the expectation that careful readers of this issue will be able to see both girl and sheep. In that sense, exploring perspectives on forest conservation does not necessarily entail a change in perspective, but the knowledge about, and the acknowledgement of, a diversity of disciplinary scientific and societal views we need to engage with.

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