

Communication

Science for Trade-Offs Between Conflicting Interests in Future Forests

Annika Nordin ^{1,*}, Stig Larsson ², Jon Moen ³ and Sune Linder ⁴

¹ Department of Forest Genetics and Plant Physiology, Umeå Plant Science Centre, Swedish University of Agricultural Sciences (SLU), SE-901 83 Umeå, Sweden

² Department of Ecology, SLU, P.O. Box 7044, SE-750 07 Uppsala, Sweden; E-Mail: stig.larsson@slu.se

³ Department of Ecology and Environmental Science, Umeå University, SE-901 87 Umeå, Sweden; E-Mail: jon.moen@emg.umu.se

⁴ Southern Swedish Forest Research Centre, Swedish University of Agricultural Sciences (SLU), P.O. Box 49, SE-230 53 Alnarp, Sweden; E-Mail: sune.linder@slu.se

* Author to whom correspondence should be addressed; E-Mail: annika.nordin@slu.se; Tel.: +46-90-786-8537; Fax: +46-90-786-8165.

Received: 13 July 2011 / Accepted: 2 August 2011 / Published: 9 August 2011

Abstract: Forests deliver multiple ecosystem services to society. Management of forests must be able to deal with trade-offs when the delivery of different ecosystem services comes in conflict with each other. The research program *Future Forests* (<http://www.futureforests.se>) attempts to form a scientific basis for managing such trade-offs between conflicting interests in northern boreal forests. Some key characteristics of the research program are interdisciplinary and participatory research and a clear communication agenda for stakeholders. This paper gives a brief overview of the underlying ideas behind the program, and an introduction to the papers published in this *Special Issue*.

Keywords: boreal forests; conflicting goals; interdisciplinary research; participatory approaches; research program

1. Introduction

Ecosystem services are the benefits people obtain from ecosystems. The Millennium Ecosystem Assessment [1] categorized ecosystem services into *provisioning services*, *regulating services*, *supporting services*, and *cultural services*. For forests, all wood-based products are provisioning ecosystem services, while for instance carbon sequestration and clean water are regulating services, photosynthesis and nutrient cycling are supporting services, and recreation and aesthetics are cultural services. These are just a few examples of important ecosystem services forests deliver to support human wellbeing. Management of forests have to take all of these services into account, and must be able to deal with trade-offs when the delivery of the ecosystem services comes in conflict with each other. This is a difficult task that requires a holistic approach to forest management, which includes not only silviculture, but also understanding of attitudes and values of different stakeholder groups and analyses of conflicts between opposing goals. In other words, management of multi-use forests falls into the realm of so-called “wicked problems” [2,3] where optimum solutions are difficult to find and where an interdisciplinary approach is necessary to provide a basis for decisions.

The newly started research program *Future Forests* [4] attempts to form a scientific basis for managing trade-offs between conflicting interests in northern boreal forests. Figure 1 describes some of the important trade-offs addressed by the program. These trade-offs are not just between timber products and non-timber products, but also within each category. For instance, there is a competition for fiber between the pulp and bioenergy industries. An optimal solution where all services are maximized is thus not possible, hence the “wickedness” of the problem.

Figure 1. Schematic description of trade-offs between and within timber products and non-timber products in Swedish boreal forests.



Future Forests started in January 2009 with funding for a four-year period. The funding comes from the Foundation for Strategic Environmental Research (MISTRA), the participating universities and one research institute (the Swedish University for Agricultural Sciences, Umeå University, and the

Forestry Research Institute of Sweden), and from the Swedish forestry industry. Following an evaluation in 2012 the program may receive funding for an additional four-year period. The program currently involves *c.* 50 researchers from the natural sciences, social sciences, and the humanities. The researchers are organised into ten disciplinary component projects ranging from silviculture through to forest governance. About 25% of the total budget is set aside for interdisciplinary work, and a group of stakeholders is connected to the program. They represent, for example, the forest sector, decision-makers, government authorities, and NGOs for conservation and reindeer husbandry.

The starting point for the research program is Sweden and the Nordic countries, but with an international outlook included, as trends and drivers in global markets, international agreements and public opinions have large effects on forests in Sweden, like elsewhere. Hence, we anticipate that results from the research program will be applicable also to other northern countries with extensive forests. The aim of this paper is to present the underlying ideas behind the program, together with our scientific approaches. We also introduce the papers included in this *Special Issue*.

2. Interdisciplinarity and Participatory Research

It is clear that society's increasing demand on deliveries of forest ecosystem services in combination with climate change and globalization are influencing the basic framework for how society may use forests. The *Future Forests* research program aims to contribute new scientific knowledge to those decision makers that may influence how forests should be used to support human wellbeing. Thus, *Future Forests* faces a challenge mutual to all applied user-oriented research: reconciling the supply and demand of scientific information between scientists and decision makers. McNie [5] and Pielke [6] both suggest that scientific knowledge needed by decision makers should expand alternatives and clarify the consequences of choices. A "knowledge-action system" that turns science into policy requires mechanisms to prioritize, conduct, and disseminate research according to the needs of targeted stakeholders [7].

We have tried to include such mechanisms into the organisation of *Future Forests*. One major goal of the program is to be flexible enough to address questions that arise as the program progresses. These questions can originate from stakeholders or decision makers, but also from researchers within or outside of the program. This "action-oriented" research is done in working groups that gather researchers from different disciplines for series of workshops with the goal of scientifically analyzing and synthesizing a particular problem. At the time of writing, nine working groups have been initiated, two of which are currently finalizing their scientific reports. The working groups address questions such as forestry, climate mitigation and carbon accounting, biodiversity in production forests, international forest trends, and integrated ecosystem management of moose and forests. A couple of groups are studying more conceptual issues that are central to the program, such as risk and uncertainty, and science and values. We anticipate that we can initiate between two and four such working groups every year, which will substantially increase the scientific interface between our program researchers and other research groups.

The interdisciplinary research approach applied by the working groups is necessary for addressing complex research questions within natural resource management, and in addition it may stimulate scientific creativity and flexibility and thus open up new avenues of research (e.g., [8,9]). Stakeholders

may also participate in the working groups to ensure that research questions are grounded in real-world problems and to help bridging the gap between science and action [10]. We recognize, however, that conducting interdisciplinary research involving stakeholders is not without its own problems. For instance, difficulties in understanding and trust among different disciplines, and differences in commitment between team members may cause interdisciplinary processes to come to a halt [11]. This is not helped by the often lower publication rates, due to a slower group process in an interdisciplinary team. The *Future Forests* program leadership has the responsibility to support program researchers to overcome these obstacles. For instance, sufficient financial resources need to be allocated to interdisciplinary working groups.

A further important focus in the program is a well-planned and structured communication process to aid in bridge-building between researchers and stakeholders, as well as among researchers from different disciplines. In this way, communication will serve as a strategic tool to support and strengthen the research program in its efforts to reach vision and goals. Collaborative learning is a cornerstone in the communication strategy of the program. This is a means of designing and implementing a series of events (e.g., meetings, field trips) to promote creative thought, constructive debate, and the effective implementation of proposals. Through facilitation, collaboration makes use of the different perspectives among researchers and stakeholders in order to find new ways to manage or solve problems, and tests the innovations in practice in a process of experimental learning (shifting between phases of action and reflection). Through collaborative learning we will focus on enhancing preconditions for communication and integration between different research projects and organizational parts within *Future Forests*.

Communication is one of several means to help the program reach the overall objective. The overarching communication objective will be to optimize the learning potential of the individuals and groups involved, create constructive relations, and build both the individuals' and groups' capacities. Thus the knowledge generated by *Future Forests* should be perceived as reliable, but also as socially robust (*i.e.*, understandable, acceptable and applicable). In this way *Future Forests* will hopefully gain a high-profile reputation among a wide group of stakeholders, supply key stakeholders with demand-driven knowledge, and increase the use and implementation of tools and research findings from the program.

3. Introducing the *Special Issue* on Research within *Future Forests*

The papers in this *Special Issue* are intended to illustrate the breadth of research within the program. They should be seen as a sample rather than as a complete overview, and represent a starting point for the program. In this introduction, the papers have been divided into four themes central for the program.

The first theme is the **governance** of forest resources. In *Sandström et al.*, the governance challenges of managing trade-offs between different forest products or ecosystem services are discussed. The paper examines the multifunctionality of Swedish forests with a specific focus on non-market driven functions of a common pool resource character, such as the protection of biodiversity and watershed management. The paper concludes that new governance institutions that are designed to solve problems of multifunctionality are needed. In *Keskitalo et al.*, the potential for

adaptive or foresight planning in relation to risk is compared between Sweden and Canada. Focus is given to economic disturbances, storm damages, and pest outbreaks. The paper shows that even though economic resources are important for adaptive measures, knowledge or institutional resources may be of equal importance. In *Stenlid et al.*, obstacles against the potential for controlling new diseases in forest ecosystems are identified. These include political beliefs in free trade systems, technical difficulties, philosophical views that forests are part of natural ecosystems and should not be managed, and communication problems between scientists and decision-makers. A common recognition of the nature of the problem is needed for timely and adequate responses. Finally, in the paper by *Nordlund and Westin*, the value and belief bases of forest management attitudes among private forest owners in Sweden are described on the basis of a questionnaire.

The second theme examines **international forest trends**. *Beland Lindahl and Westholm* study these trends in literature, policy documents, and interviews with selected experts from the forest sector. They especially focus on four areas: changing energy systems, emerging international climate policies, changing governance systems, and shifting global land use systems. *Jonsson* focuses on global wood products markets and the effects of continued globalization *versus* regionalism, and of the extent to which climate change concerns will result in changes in consumer preferences.

The third theme concerns adaptations and mitigations to **climate change**. *Keskitalo* uses a literature review and country reports from the 27 EU states to discuss national adaptation strategies towards climate change in the forestry industry. *Egnell et al.* examine the energy potential in Swedish forests as a basis for discussing mitigations of climate change through the use of renewable bioenergy, and *Björkman et al.* focus on the risk of increased insect attacks on forests as a consequence of climate change.

The fourth theme is about **changes in forest management** and subsequent effects on the ecosystem, with a special focus on intensified forestry to meet higher demands for forest products and services. *Nilsson et al.* use a simulation model to calculate the effect of various levels of intensified forest management on 15% of the Swedish forest land. These management methods include nitrogen fertilization, the use of somatic embryogenesis for producing tree seedlings, and the use of exotic tree species. *Strengbom et al.* evaluate the potential effects on biodiversity from intensively fertilized Norway spruce plantations. *Laudon et al.* review some of the most important questions regarding the effects of intensified forestry on the sustainability of soil resources and water quality. These include the potential effects of nutrient additions on biogeochemical cycling within catchments and the physical disturbance associated with harvesting and site preparation. *Lindkvist et al.* make a historical overview of the use of nitrogen fertilization in Swedish forests from the 1960s onward.

Finally, as an example of the program's intention of **participatory research** to link academic and stakeholder perspectives, *Futter et al.* provide a trans-disciplinary commentary on the implications for forestry of implementing the Water Framework Directive (WFD) [12] in Sweden. This commentary is the result of a workshop with researchers from the program, officials from the Swedish Forest Agency, and representatives from the forest company Sveaskog. While the WFD is an ambitious legislation designed to protect water quality through watershed management, forestry is not mentioned at all. Key concerns about implementing WFD in Sweden include concerns of the definitions and monitoring of good water status, concerns about a lack of clarity in the framework, inadequate environmental impact assessment processes, and uncertainties about measures of improving water quality. The lack of

recognition of the ecosystem services provided by forests and the positive effects of forestry on water quality could also pose a problem for the implementation of the directive.

We hope that the papers in this *Special Issue* are of interest to a wide audience, and that they may serve as an entry point to the *Future Forests* program and our research. Please, follow the development of the program on our home page [4].

Acknowledgements

The research is funded through *Future Forests*, a multi-disciplinary research program supported by the Foundation for Strategic Environmental Research (MISTRA), the Swedish Forestry Industry, the Swedish University of Agricultural Sciences (SLU), Umeå University, and the Forestry Research Institute of Sweden.

References and Notes

1. Millennium Ecosystem Assessment. *Ecosystems and Human Well-Being: Synthesis*; Island Press: Washington, DC, USA, 2005.
2. Conklin, J. *Dialogue Mapping: Building Shared Understanding of Wicked Problems*, 1st ed.; Wiley: Chichester, UK, 2005.
3. Ritchey, T. *Wicked Problems: Structuring Social Messes with Morphological Analysis*; discussion paper; Swedish Morphological Society: Stockholm, Sweden, 2007. Available online: <http://www.swemorph.com/pdf/wp.pdf> (accessed on 3 January 2011).
4. The Future Forests homepage, Umeå, Sweden, 2011. Available online: <http://www.futureforests.se> (accessed on 3 August 2011).
5. McNie, E.C. Reconciling the supply of scientific information with user demands: An analysis of the problem and review of the literature. *Environ. Sci. Pol.* **2007**, *10*, 17-38.
6. Pielke, R.A., Jr. *The Honest Broker—Making Sense of Science in Policy and Politics*; Cambridge University Press: Cambridge, UK, 2007.
7. Dilling, L. The opportunities and responsibility for carbon cycle science in the US. *Environ. Sci. Pol.* **2007**, *10*, 1-4.
8. Nissani, M. Ten cheers for interdisciplinarity: The case for interdisciplinary knowledge and research. *Soc. Sci. J.* **1997**, *34*, 201-216.
9. Heinze, T.; Shapira, P.; Rogers, J.D.; Senker, J.M. Organizational and institutional influences on creativity in scientific research. *Res. Pol.* **2009**, *38*, 610-623.
10. Hadorn, G.H.; Bradley, D.; Pohl, C.; Rist, S.; Wiesmann, U. Implications of transdisciplinarity for sustainability research. *Ecol. Econ.* **2006**, *60*, 119-128.
11. Naiman, R.J. A perspective on interdisciplinary science. *Ecosystems* **1999**, *2*, 292-295.
12. Water Framework Directive—WFD Implementation in a European Perspective. *KSLA Tidskrift* 8; KSLA: Stockholm, Sweden, 2006; p. 40.