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Joensuu Forestry Networking Week 2009 Fighting Climate Change: Adapting Forest Policy and Forest Management in Europe

Group Work Reports and Conclusions
Metla House Joensuu, Finland, 24.5.–29.5.2009

Timo Karjalainen, Marcus Lindner, Anssi Niskanen, Markus Lier (eds.)

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Abstract
This issue of Metla's Working Papers is a compilation of the group work reports of the Joensuu Forestry Networking Week (JFNW) 2009 – Fighting Climate Change: Adapting Forest Policy and Forest Management in Europe held in Metla House Joensuu, Finland from 24-29 May 2009. The main goal of the JFNW 2009 was to discuss the role of forestry in adapting to and mitigating climate change from the viewpoint of forest science and other scientific disciplines, with a special focus on forest policy and forest management. Priorities for actions at the local, national and European levels were made, and regional differences within Europe were described.

The group work was an important component of JFNW 2009. The objective of the group work was to improve participants' expertise and knowledge on how forest policies, forest management, forest research and forest extension can be developed for better adaptation and mitigation to climate change. As a result of the group work the participants wrote a short report on how climate change and forest interaction should be considered in the formulation of forest policy, forest management, forest research and forest extension.

JFNW 2009 was the first of what is planned to be an annual event. It was judged to be a great success and created a new research network to accelerate new research projects and activities in this field. Altogether 55 participants from 17 countries participated in the first event.

JFNW 2009 was organized jointly by the Finnish Forest Research Institute (Metla), the European Forest Institute (EFI) and the University of Joensuu, Faculty of Forestry in co-operation with the COST Action: Expected Climate Change and Options for European Silviculture (ECHOES). Metla acted as the responsible host organization for the first JFNW 2009. The event was sponsored by the COST Office, the Federation of Finnish Learned Societies (TSV), the Finnish Ministry of Agriculture and Forestry, the City of Joensuu, and the Regional Council of North Karelia. Metsämiesten Säätiö financed the release of this JFNW publication.

Keywords
Climate change, adapting forest policy, adapting forest management

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Contents

Preface

The idea to organize a yearly Joensuu Forestry Networking Week (JFNW) arose at a joint meeting between the Finnish Forest Research Institute (Metla), the European Forest Institute (EFI) and the University of Joensuu, Faculty of Forestry in November 2007. These three organizations wanted to intensify their collaboration at a local level and combine their specialized expertise with a specific joint event. The JFNW aims to be a discussion and group work forum featuring timely and important forestry related topics. The JFNW is seen as a new initiative connecting and increasing the interaction between young and experienced scientists, professionals and stakeholders in forestry from different parts of Europe. The aim is to engage the participants in discussions, lectures, group work and excursions in order to broaden their own expertise and contacts through active participation and networking.

The UN Climate Change Conference 2007 in Indonesia adopted the Bali roadmap charting the course for a new negotiation process to be concluded by 2009. The process contributes to the Copenhagen conference 2009 and leads to post-2012 international agreement on climate change. The possible role of forestry in the mitigation of climate change has been put forward in many discussions and their inclusion in a post-2012 agreement. The impacts of climate change on forests, adaptation to climate change and contribution to mitigation have been analysed and discussed in many reports and publications. These were among the reasons why "Fighting climate change: adapting forest policy and forest management in Europe" was chosen to be the topic of the first JFNW. Thus, the main goal of the JFNW 2009 was to discuss the role of forestry in adapting to and mitigating climate change from the viewpoint of forest science and other scientific disciplines, with a special focus on forest policy and forest management. Priorities for actions at the local, national and European levels were made, and regional differences within Europe were described.

Group work was an important component of *Joensuu Forestry Networking Week 2009*. The objective of the *Joensuu Forestry Networking Week 2009* group work was to improve participants' expertise and knowledge on how forest policies, forest management, forest research and forest extension can be developed for better adaptation and mitigation to climate change. As a result of the group work the participants wrote a short report on how climate change and forest interaction should be considered in the formulation of forest policy, forest management, forest research and forest extension. The reports are published in this issue of Metla's Working Papers.

The first *Joensuu Forestry Networking Week 2009* was a great success and created a new research network to accelerate new research projects and activities in this field. Altogether 55 participants from 17 countries participated in the first event. After receiving very positive feedback from the participants of the JFNW 2009 the three responsible organizations have agreed to organize more events in the future. Timely and important topics were chosen for the next two events, for 2010 "Forest-water interactions in Europe" and for 2011 "Forests and Energy". The preparations for JFNW 2010 are already underway.

The *Joensuu Forestry Networking Week 2009* was organized jointly by the Finnish Forest Research Institute (Metla), the European Forest Institute (EFI) and the University of Joensuu, Faculty of Forestry in co-operation with the COST Action: Expected Climate Change and Options for European Silviculture (ECHOES). Metla acted as responsible host organization for the first JFNW 2009. The event was sponsored by the COST office, the Federation of Finnish learned societies (Tieteellisten seurain valtuuskunta), the Finnish Ministry of Agriculture and Forestry, the City of Joensuu, and the Regional Council of North Karelia. Metsämiesten Säätiö financed the release of this publication.

We would like to take the opportunity to thank the keynote speakers, the participants and all the technical organizers and sponsors for their contribution and tireless efforts in making the JFNW 2009 a successful event.

Sponsors

Joensuu Forestry Networking Week – Introduction to the Topic of 2009: Fighting Climate Change: Adapting Forest Policy and Forest Management in Europe

Since the industrial revolution, anthropogenic emissions have perturbed the global carbon cycle and enhanced the greenhouse effect. As a result, changes in the global climate system are rapidly occurring (Solomon et al. 2007). For example, the 20th century experienced the strongest warming trend of the last millennium with average temperatures rising by about 0.6ºC (Jones et al. 2001). Latest climate change scenario projections for Europe suggest that by 2100 temperatures will increase by about 2°C in Ireland and the UK, up to about 3°C in central Europe, and by about 4–5°C in the northern Boreal and parts of the Mediterranean regions (Christensen et al. 2007). This development will certainly affect forest ecosystems as a substantial fraction of the existing forests will experience climatic conditions under which they do not currently exist. The many benefits that society and environment gain from the Europe's forests, just to mention wood, non-wood forest products, soil protection, water regulation, conservation of natural habitats and biodiversity, recreational functions might be seriously jeopardized.

The United Nations Climate Change Conference 2007 in Indonesia adopted the Bali roadmap charting the course for a new negotiation process to be concluded by 2009. An important milestone in the negotiation process is the Copenhagen climate conference in December 2009, which shall lead to a post 2012 international agreement on reductions of greenhouse gas (GHG) emissions to mitigate climate change.

Because of the complexity of the climate system and its feedbacks with the biosphere, climate change cannot be stopped even with a drastic reduction of GHG emissions. Current and projected impacts of climate change and vulnerability of forest ecosystems need therefore to be assessed accurately, and adaptation processes identified. On one hand, adaptation measures will become necessary if we want to continue benefiting from the many services that forest provide. On the other hand, climate change can be attenuated or mitigated by decreasing the human-altered atmospheric CO_2 concentration. These issues were discussed at the *Joensuu Forestry Networking Week 2009* from the viewpoint of forest science and other scientific disciplines, with a special focus on forest policy and forest management (see programme). The development of and priorities for actions at the local, national and European level were taken into account, as well as the regional differences in Europe.

JFNW 2009 Group Work

An essential part of the event was the group work. The objective of the group work was to improve participants' expertise and knowledge on how forest policies, forest management, forest research and forest extension can be developed for better adaptation and mitigation to climate change.

The goals of the group work were to:

- write a short report on how such climate change issues as impacts and adaptation, uncertainties and risks and mitigation should be considered in the formulation of forest policy, forest management, forest research and forest extension for fighting climate change; and
- develop follow-up actions for post JFNW 2009 that will continue the collaboration and networking activities started during the week.

Individual participants worked together in four separate groups that represented different focus areas that are directly impacted by climate change. The groups developed participants' ideas and theories into a short report for each of their assigned topics. Each group was provided with a draft outline to start the report. It was, however, the responsibility of the groups to develop the content further and write the report. Each group appointed a chairperson and a secretary.

The key question in the group work was on how forest policy (Focus group 1), forest management (Focus group 2), forest research (Focus group 3), and forest extension (Focus group 4) should be developed in the future for fighting climate change? The participants were asked to utilize materials and discussions from the lectures, information from the field trip, their own experiences, and any additional research or pertinent information for the group reports.

The lecturers participated in the group works when available as mentors. They were expected to bring their knowledge into the discussions and help the groups to formulate reports and plan the follow-up actions.

The groups worked on the reports during the week and presented results of the discussions on the last day of the event. Written reports were reviewed by the Scientific Organizing Committee, and are presented in this publication to be used by those who are interested in elaborating these ideas further.

Scientific Organizing Committee ***Joensuu Forestry Networking Week 2009***
Prof. Timo Karjalainen (chair), Finnish Forest Research Institute (Metla) Joensuu, Finland
Dr. Marcus Lindner, European Forest Institute (EFI)
Dr. Anssi Niskanen, University of Joensuu, Faculty of Forestry, Finland
MSc For. Markus Lier (secretary), Finnish Forest Research Institute (Metla) Joensuu, Finland

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Christensen JH, Hewitson B, Busuioc A, Chen A, Gao X, Held I, Jones R, Kolli RK, Kwon W-T, Laprise R, Rueda VM, Mearns L, Menéndez CG, Räisänen J, Rinke A, Sarr A and P Whetton (2007). Regional Climate Projections. In: Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M and HL Miller (Editor), Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 847–940.

Jones PD, Osborn TJ, and KR Briffa (2001). The evolution of climate over the last millennium. Science, 292, 662–667.

Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M and HL Miller HL (Editors), (2007). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Programme

Sunday 24 May 2009
Arrival to Joensuu

Monday 25 May 2009
Introductory and framework presentations **Fighting climate change: adapting forest policy and forest management in Europe** ***Chair: Dr. Jari Parviainen, Metla, Finland***
Keynotes 09:00–09:30 **Dr. Jari Parviainen**, **Chairman of JFNW Steering Committee, Metla** *The role of forests and forest based sector in meeting the European Union climate commitments* 09:30–10:00 **Dr. Roland Beck, European Commission, DG Agriculture** *EU policies and actions to fighting climate change* 10:00–10:30 **Prof. Tim Carter, Finnish Environment Institute** *Climate change, impacts and adaptation*
10:30–11:00 Break
Keynotes 11:00–11:30 **Dr. Jean-Luc Peyron, ECOFOR, France** *Chairman of the COST Action "Expected Climate Change and Options for European Silviculture (ECHOES)" Uncertainty in forest policy making* 11:30–12:00 **Prof. Manfred Lexer, Boku, Vienna, Austria** *How to manage forests under changing climatic conditions*
12:30–13:30 Lunch
13:30–17:30 Group Work

Tuesday 26 May 2009
Impacts of climate change and options for adaptation ***Chair: Dr. Marcus Lindner, EFI, Finland***
Keynotes 09:00–09:45 **Dr. Marcus Lindner and Dr. Marja Kolström, EFI** *Impacts of climate change in European forests and options for adaptation* 09:45–10:30 **Dr. Sigrid Netherer, Boku, Vienna, Austria** *Biotic disturbances under climate change and how to respond to them* 10:30–11:15 **Dr. Antoine Kremer, INRA, France** *Inherent adaptive capacity and how to use it in adaptive forest management*
11:15–11:30 Break
Contribution by participant 11:30–12:00 **Dr. Matteo Campioli, Department of Biology, University of Antwerp, Belgium** *Impact of drought on the C cycle of a temperate deciduous forest: a modeling analysis*

Keynote
12:00–12:45 **Prof. Seppo Kellomäki, University of Joensuu, Finland**
Climate change impacts and options for adaptation

12:45–13:30 Lunch

13:30–15:00 Group Work

15:00–16:00 Break with Poster session

Contribution by participant – Poster session
Darío Martín-Benito, CIFOR-INIA, Spain *Global change causes black pine growth divergence*
Dr. Eric Verkaik, CT Wageningen, The Netherlands *Potential impacts of climate change on Dutch forests*
Ignacio Barbeito Sánchez, CIFOR-INIA, Spain *Response of Scots pine natural regeneration to silviculture and small-scale environmental heterogeneity in a Mediterranean mountain forest*

16:00–17:30 Group Work

Wednesday 27 May 2009

How to deal with uncertainties and risks?
Chair: Dr. Heli Peltola, University of Joensuu, Finland

Keynotes
08:30–09:15 **Dr. Kirsti Jylhä, Finnish Meteorological Institute** *Uncertainties in climate scenarios*
09:15–10:00 **Dr. Heli Peltola, University of Joensuu, Finland** *More wind and other abiotic risks – what to do?*
10:00–10:45 **Dr. José Ramón González Olabarria**, **Technological Forest Centre of Catalonia, Spain** *Integrating forest fire risk in forest planning*

10:45–11:00 Break

Contributions by participant
11:00–11:30 **Dr. Lindsey J. Ellingson, Swedish University of Agricultural Sciences, Sweden**
Forest owners' perceptions of risk, climate change and the economic importance on their management decisions: A comprehensive review of Sweden's private forest owners

12:15–13:00 Lunch

13:00–18:00 Field trip
Site 1 Forester **Jussi Lappalainen**, **Forestry Centre North Karelia** *Forest management plans, guiding and helping forest owners in decision making*
Site 2 Forester **Urpo Hassinen, Energy Cooperative ENO, Forest Centre North-Karelia** *Forest biomass in energy production*

Thursday 28 May 2009
Mitigation ***Chair: Prof. Timo Karjalainen, Metla, Finland***
Keynotes 09:00–09:45 **Dr. G.J. Nabuurs, Alterra, Netherlands** *Forestry possibilities for mitigation in Europe* 09:45–10:30 **Prof. Antti Asikainen, Metla, Finland** *Role of forest biomass to meet emission reduction targets* 10:30–11:15 **Dr. Kim Pingoud, VTT, Finland** *What can substitution do?*
11:15–11:30 Coffee break
Contributions by participants 11:30–12:00 **Dr. Hannes Böttcher, IIASA, Austria** *Forest management for climate change mitigation: the challenge of projecting the regional forest carbon balance and accounting of activities* 12:00–12:30 **Christopher Reyer, Wageningen University (WUR), Netherlands** *Forest agencies' early adaptations to climate change*
12:30–13:30 Lunch
13:30–15:00 Group Work
15:00–16:00 Coffee break with Poster session
Contribution by participant – Poster session **Dr. Fabio Lombardi, University of Molise, S.T.A.T. Department, Italy** *Deadwood as a sink of carbon: tree rings used to assess deadwood permanence in beech forests in the Central Apennines (Molise, Italy) and in Magellan's beech forests in Navarino Island (Tierra del Fuego, Chile).* **César Pérez-Cruzado, Escuela Politécnica Superior Lugo, Spain** *Carbon sequestration in biomass, litter and soil in former agricultural land reforested with fast-growing plantations in north-western Spain.* **François Ridremont**, **Gembloux Agricultural University (FUSAGx)** *The trees' behavioural response to climate change. An applied study at the Walloon Region scale (Belgium).*
16:00–18:00 Group Work – finalization

Friday 29 May 2009
Future forest perspective: presentations of the group works and discussion on the future actions for fighting climate change ***Chair: Dr. Anssi Niskanen, University of Joensuu, Finland***
08:30–09:30 Finalizing the Group Work
09:30–10:15 **Anssi Niskanen, University of Joensuu** *The future strategy of the European forest-based sector*
10:15–10:30 Coffee break
10:30–12:30 Presentation of the group works and discussions
12:30–13:30 Lunch
13:30–16:15 Discussion and agreements on the discussion paper and follow-up (e.g. further research needs, project plans, workshops, seminars).

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Role of Forest Policy In Fighting Climate Change – Forest Policy Work Group Report

Group members

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Introduction

Urgent action is required to address climate change, mitigation and adaptation at the EU, international and national levels. As reports of the threats posed by global warming and climate change continually pour in, it becomes increasingly apparent that significant steps must be taken. The potential role of forestry in the related policy debate, both as a tool for mitigation and as an impacted resource requiring substantial effort at adaptation, is however not adequately addressed. Forestry in general has not been adequately incorporated into current mitigation efforts – neither in terms of fossil fuel substitution nor in terms of the carbon sequestration potential for forests. Moreover, the adaptation of forestry to climate change has been almost entirely neglected. The EU, for example, has only recently begun developing an adaptation strategy – still in its infancy – and national level efforts remain significantly underdeveloped. To date only eight out of 27 EU Member states have published official adaptation strategies, and the EU is only in the very early stages of developing its own Adaptation strategy – target date 2013.

Lacking a clear mandate for a common forestry policy in the EU, the general approach to forestry has remained piecemeal. Forest policy grows increasingly fragmented across EU institutions and across EU and national level institutions[10]. The fragmentation of forest policy is driven by at least two important factors: (1) the division of competence for forestry policy across frequently competing governance institutions (e.g. the Commission for Agriculture, the Environmental Commission and others) results in a lack of policy coordination and a high level of policy fragmentation; (2) the division of competence and the fragmentation of forest policy is further strengthened by the fact that there is no 'common' EU forestry policy agenda. The result is a lack of policy coordination, contradiction and fragmentation, both in a horizontal sense across EU-level institutions and in a vertical sense between EU and national level institutions. As a result, responses to climate change and climate impacts in the area of forestry are far too slow. While the existing institutional divisions of competence may have historical explanations – the focus on forestry as a specifically commercial trade chronologically precedes attempts to address the *multifunctional use* of forests and responses to environmental concerns (explaining both institutional divisions of competence and the institutional embeddedness of interests) – this should not preclude attempts to improve the nature and quality of forestry-related decision-making.

In order to solve this problem, ways must be found to increase the overall level of *policy integration* at the EU, national and regional levels. By increased *policy integration*, we mean a significantly increased level of coordination, alignment and cohesiveness of forest-related policy goals – in particular across horizontal and vertical institutional structures at the EU and national levels. Policy is a key tool for promoting rapid action on climate change mitigation and adaptation. Without policy intervention, markets are unable to resolve these issues on their own. And without more urgent, comprehensive and integrated policy solutions, the rate of mitigation and adaptation will be far too slow. Once an integrated policy strategy has been defined at EU and national levels, relevant elements of this strategy must then also be communicated at the international level in international bargaining rounds for a post-Kyoto agreement and possibly later agreements. In order to ensure that this integrated policy strategy is supported and responds to local level needs and interests, it should be formulated on a multi-stakeholder basis: i.e. via a decision-making process

10 For more discussion on the logic of policy fragmentation, see Mickwitz et al. (2009), Glück et al. (2009) and Ellison and Keskitalo (2009).

that includes and incorporates all relevant stakeholders and the local, regional, national and EU levels. Formulating an integrated policy strategy toward climate change and/or forestry would make the EU more effective and strengthen EU bargaining power at the international level.

The overall aim of this report is to present suggestions for integrating forestry policy strategy in Europe, in particular with respect to climate change and adaptation. This is done with the goal of making more rapid responses to climate change possible and in the hopes of being able to translate scientific knowledge more effectively into decisive policy action. This discussion paper aims at devising a general strategy for promoting greater policy integration and finding strategies for reducing institutional divisions in forest policy making at the EU and national levels. These aims will be reached through the following steps:

- Defining the problem areas of the current European forest policy approach and analyzing the context of forest policy making at the EU level;
- Understanding the key challenges forest policy is facing today in combating climate change;
- Presenting a framework for enhanced policy integration and making recommendations for forest policy actions at the European, regional and national levels; as well as
- Discussing some of the key policy elements – in particular with regard to climate mitigation and adaptation.

The paper is organized as follows. The first chapter explains why the current EU forest policy approach needs to be revised in order to address climate change effectively. This chapter also introduces the aims of the paper. The second chapter discusses the key challenges and flaws of forest policy at the EU and national levels. The third chapter proposes some options for more efficient EU policy making process, and makes some suggestions for new EU, regional and national guidelines. The final chapter concludes the key findings and recommendations, and makes some proposals for future action.

Key Challenges for Forestry Policy: Adaptation, Institutional and Policy Integration

At the EU level, two basic problems threaten the future of forestry policy: (1) there is a lack of policy integration; and (2) there is a lack of institutional coordination. The lack of policy integration is evident at many levels. For example, afforestation strategies and biodiversity goals are frequently contradictory to each other. Recent reports from FERN (2008a, 2008b) and BirdLife International (2009) point to serious coordination difficulties between these two forestry goals. [11] For the most part, these organizations conclude that afforestation strategies are generally pursued without attention to biodiversity goals and that inadequate resources are dedicated to biodiversity and the development and planning of Natura 2000 projects. Similar arguments are made by these organizations with regard to the development of National Rural Development Plans (NRDPs). Although most EU Member

11 See in particular the FERN report on Funding Forests into the Future (FERN, 2008a) and the BirdLife report Could Do Better: How is EU Rural Development Policy Delivering for Biodiversity (BirdLife, 2009).

countries have developed National Forest Programs (NFPs), these are rarely if ever consulted and no attempt is made to align NRDPs with NFPs. Since afforestation is primarily funded through the EU mechanism of rural development policy, this is an obvious problem.

Adaptation to climate change likewise deserves far more attention and discussion at the EU level. Yet currently, it is almost never even discussed or addressed by EU policy. Though it is possible to point to some EU Directives, for example, that appear to be more or less explicit responses to the challenges of Adaptation – in particular the Floods Directive and perhaps EU policy regarding Forest Fire Protection[12] – for the most part little has been done to integrate Adaptation into the EU policy structure. The EU has adopted something of a wait-and-see strategy, encouraging Member states to adopt their own adaptation strategies but holding off on the development of its own strategy and focusing above all on mitigation efforts[13]. Thus currently, the EU remains at the White Paper stage in the development of its own Adaptation strategy and has adopted a formal target date of 2013 for the introduction of an official EU Adaptation strategy[14]. Funding mechanisms to deal with the problems of Adaptation likewise remain underdeveloped. Though some funding has been available through the EU's structural and cohesion funds and rural development funding and research monies have been available in particular to study impacts, little direct funding of specific Adaptation measures has occurred to date.

In addition to the problem of policy fragmentation, there is likewise a considerable lack of institutional integration on forestry policy at the EU level (and also at the national level). In general, forest policy is not coordinated by one single EU-level institution. As outlined by Beck (2009), EU responsibility or competence for forestry issues is divided across nine different EU Commissions. Moreover, four of these EU Commissions deal with very substantial elements of forestry policy (e.g. DG Agriculture – afforestation; DG Environment – Natura 2000 and biodiversity; DG Energy and Transport – forest-related energy policy; and DG Enterprise and Industry – competitiveness and innovation in the forestry industry).

Presumably as a result of these institutional divisions, frequently embedded policy interests are likewise divided across these institutions. DG Agriculture, for example, serves both the agricultural community and afforestation. Stakeholders who benefit from this policy presumably prefer that DG Environment, for example, does not take over responsibility for the policy management and orientation. Similar divisions of embedded policy interest are again frequently duplicated at the national level. Institutional divisions at the EU level (and presumably also at the national level) likewise have an impact on the distribution of resources across different forestry policy areas. DG Agriculture, for example, has traditionally managed to retain competence over a very significant share of EU funding. Thus, for example, afforestation receives a significant amount of funding, while biodiversity or the development and management of Natura 2000 areas receive considerably less EU funding.

12 The Floods Directive acknowledges several different factors that result in flooding and acknowledges the potential role of climate change as one among these (see Directive 2007/60/EC). EU strategies to assist Member states with combating forest fires have a much longer history. But the attention to forest fire strategies has increased as a result of awareness of climate change and its potential impact on the increased incidence of forest fires – in particular in southern Europe (see also Ellison, Petersson and Keskitalo, 2009).
13 On adaptation strategies in EU Member states, see Swart et al (2009), Massey (2009) and Massey and Bergsma (2008).
14 See CEC (2009b).

Policy makers are well aware of the problems that arise as a result of these institutional divisions. For example, the European Economic and Social Committee (EESC), has in the past noted that the lack of coordination across EU level institutions responsible for forestry policy is a significant problem (ECA, 2004: 10) and EESC representatives continue to point out that forestry policy suffers from institutional divisions at the EU level[15]. Other EU bodies, for example the European Court of Auditors, have made similar observations and even argued that it is specifically the institutional divisions that represent the biggest problem for pursuing an integrated EU approach to some elements of forestry policy;

> … many different DGs and units are involved in the Commission's approval process of the RDP [rural development plans] and OP [operational programmes] (3) and thus in the approval of forestry measures. DG Agriculture was responsible for the analysis of the RDP. While the OP were mainly under the overall coordinating responsibility of DG Regional Policy. In total more than eight units within DG Agriculture and seven other DGs (e.g. Environment, Energy and Transport, Health and Consumer Protection) are involved in forest related issues. This division of forestry related matters amongst so many departments within the Commission threatens coherence and complicates decision-making (ECA, 2004: 10).

The Commission on the other hand argues that a stronger legal footing for forestry policy in the EU is not feasible without greater interest from the Member states. The Commission responds to requests for greater 'vertical' coordination – in particular in a single EU-level directorate general (DG) – by noting that a new unit has recently been established in DG Agriculture and Rural Development that is responsible for creating a stronger focus on forests and the forest industry. This unit – Unit AGRI F.6: Bioenergy, biomass, forestry and climate change[16] – addresses the combination of forestry and climate issues and was specifically responsible for coordinating work on the EU Forest Action Plan. Further, with respect to 'horizontal' coordination, the Commission points again to the role of the *Inter-Service Group on Forestry* and argues that this body has been "an effective tool of coordination and is working satisfactorily."[17]

While it is difficult for the European Commission to proceed with substantial reform without the support of the Member states, as suggested by a recent opinion on the role of forestry from the European Economic and Social Committee, all is not well with forestry policy in the European Union.[18] The EESC argues that forestry and its potential role in climate mitigation and adaptation could be utilized to a far greater and more significant effect than is currently the case. Moreover, the EESC argues that far more needs to be done with regard to developing responses to the need for adaptation – in particular in forestry. Whether the failure to emphasize and improve forestry policy is explicitly the result of institutional divisions is not discussed in the EESC Opinion.

15 This point was supported in a discussion with Seppo Kallio, Vice President of the European Economic and Social Committee (Joensuu Forestry Networking Week, Joensuu, Finland, May 24th–29th).
16 This Unit appears to have been renamed to Unit H.4. Bioenergy, Biomass, Forestry and Climate Change. The newer Unit H.4. was responsible, among other things, for writing the "Report on Implementation of Forestry Measures Under the Rural Development Regulation 1698/2005 for the Period 2007–2013", (CEC, 2009c).
17 See for example the "European Parliament Resolution on the Implementation of a European Union Forestry Strategy", (Feb. 16th, 2006: 3).
18 See EESC (2009).

The development of bioenergy crops in Europe provides a further example of policy fragmentation resulting in contradictory behavior and unintended consequences.[19] In 1997, the European Commission, in the White Paper on renewable energy (CEC 1997), projected that approximately 6.3 million hectares (ha) of energy crops would be planted by 2010. Kuiper et al. (1998) estimated that an additional 11.5 million ha would have to be dedicated to energy crops in order to balance the supply and demand for wood resulting from the White Paper projections and estimated the total area needed to fulfill the objectives of the European Commission at approximately 20 million ha. This would translate to about 25% of the total arable land of the EU25 (Helby et al., 2004). EU proposals and now the current Renewable Energy Directive (2009/28/EC) have encouraged the extension of these types of crops (e.g. CEC 2005, EEA 2006, CEC 2007a, CEC 2008 and now CEC 2009a). These objectives are not always compatible, however, with policy initiatives introduced at the national level to encourage farmers to cultivate energy crops in countries such as Sweden.

By the mid-1990s, Sweden was one the few countries with a strong emphasis on a cultivation of energy crops, mostly based on willow plantations. One reason for the success of this cultivation was the introduction of reforms in Swedish Agricultural Policy. These reforms on the one hand deregulated the sector and on the other implemented subsidies to promote the development of willow plantations. However, as a consequence of the regulations in the EU area subsidy system within the Common Agriculture Policy (CAP), Swedish membership in the EU required the reduction of the subsidies for willow plantations. In principle, the maximum level of government subsidy could not exceed 50% of the planting costs. This resulted in a drastic reduction of the land area dedicated to willow plantations (Johansson, 2002).

In addition, a second regulation introduced in 1999 established a limit on the total areas farmers could dedicate to willow plantations while still receiving subsidies. This limit was set at a maximum area of 50% of the total available farmland. The consequence of this regulation was that some farmers had to abandon willow plantations planted between 1996 and 1999 (Johansson, 2002). A final example concerns mandatory set-asides in land use. The amount considered in order to get area subsidies for grain and oil seeds has varied from between 12% in 1995 to 3% in 2000 (Johansson, 2002). This has resulted in a reduced willingness by farmers to establish long-term plantations (Helby et al., 2006).

Although in principle energy crops are broadly encouraged by the EU, the Swedish example illustrates that contradictory policies intended to fulfill different objectives can have a specifically negative impact when there is no or inadequate coordination across different policy levels. Though the previous development of the sector was quite positive in Sweden, contradictions between EU and national level policy goals were ultimately detrimental. If EU objectives in energy matters are to be achieved, more coordination is necessary across the different DGs and between the EU and national levels in order to avoid similar situations.

19 This discussion of bioenergy in Sweden draws substantially from Mola-Yudego and Pelkonen (2008).

The Climate Challenge: Adaptation, Mitigation, Uncertainty and Risks

Current research and assessment needs for adaptive management concern the following: climate change and vulnerability; sensitivities of forest and impacts of climate change; capacity of autonomous adaptation; vulnerability and planned adaptation (Kellomäki, 2009). At present, not all countries have adaptation measures and the ones that are in place can still be improved. The socioeconomic factors have rarely been analyzed for the EU27 for determining the ability to implement adaptation measures (Lindner, 2009). This could lead to significantly different outcomes and policy decisions compared to those made without these factors considered. In addition, uncertainty and risk need to be taken into account, which by definition are difficult to measure and formulate into adaptation and mitigation policies.

The current European Union climate strategy does not encourage countries to take advantage of the existing mitigation potentials. Mitigation potentials are not maximized in all countries and the incentives for taking advantage of different mitigation potentials are substantial. In addition, forestry (inventory and carbon) accounting methods are not harmonized, which makes comparison across countries difficult. Further, the EU Emission Trading Scheme (ETS) is really targeted and does not allow flexibility for mitigation strategies across countries. This lack of flexibility in policy strategies also makes it difficult to account for uncertainty and risk.

In terms of forestry, forest fuel and construction only account for 2% (each) of the gross inland energy consumption of the EU. The largest underutilized energy resource in the EU is forest biomass and energy. Forest biomass is among the cheapest available renewable fuels but is a limited energy source. Though forest biomass and energy cannot solve the energy problem globally, it can have a significant impact regionally (Asikainen, 2009). From a timber production perspective, mitigation recommendations result in longer rotation periods, where risk recommendations result in shorter rotations. The conflict of interests and management decisions make policy formulation difficult.

It is not possible to construct accurate predictions of the magnitude of climate change because of the uncertainty in future emissions, model formulation and natural climate variability. Regional uncertainties differ from model to model and there are uncertainties in climate projections (Jylhä, 2009). Due to the uncertainties surrounding climate change in terms of mitigation and adaptation strategies, more scientific research is needed. In addition, there is a need for more information on regional differences, such as across different bioclimatic envelopes. There is also a lack of knowledge concerning the value of non-marketed goods and services; the value of these goods and services needs to be known and taken into account in order to make well-informed policy decisions.

Forest owners do not consider climate change uncertainties and risks in their management strategies. Currently no policy and no economic incentives are in place to motivate forest owners to respond to climate change and they are unlikely to do this on their own given the degree of uncertainty. Due to the risks associated with climate change being regionally dependent and different policies across countries, forest owners' interests differ depending on the country or geographic region. Local and regional managers are waiting for national guidelines to share knowledge with forest owners. The lack of scientific research leads to a lack of information delivered to the forest owner to make sound forest management decisions in regards to climate change.

An Illustration of Mitigation Options

The challenge of developing an EU (blanket) policy is best demonstrated by the regional differences in the anticipated impacts of climate change which vary considerably across the EU, these regional differences are also present in the mitigation and adaptation measures. Consequently, strategies need to be and are being developed to address these impacts taking into account the regional situation. Different regions may therefore emphasize certain mitigation strategies more than others; therefore if attempts are to be made to achieve an EU wide policy then it must take into account local considerations, representing the interests and values not only on a national level, but also of the various stakeholders involved. To visualize these regional differences and to highlight the importance of policy, we have listed a number of mitigation options and tried to link them to the potential to store carbon and to substitute for fossil fuels (Figure 1).[20]

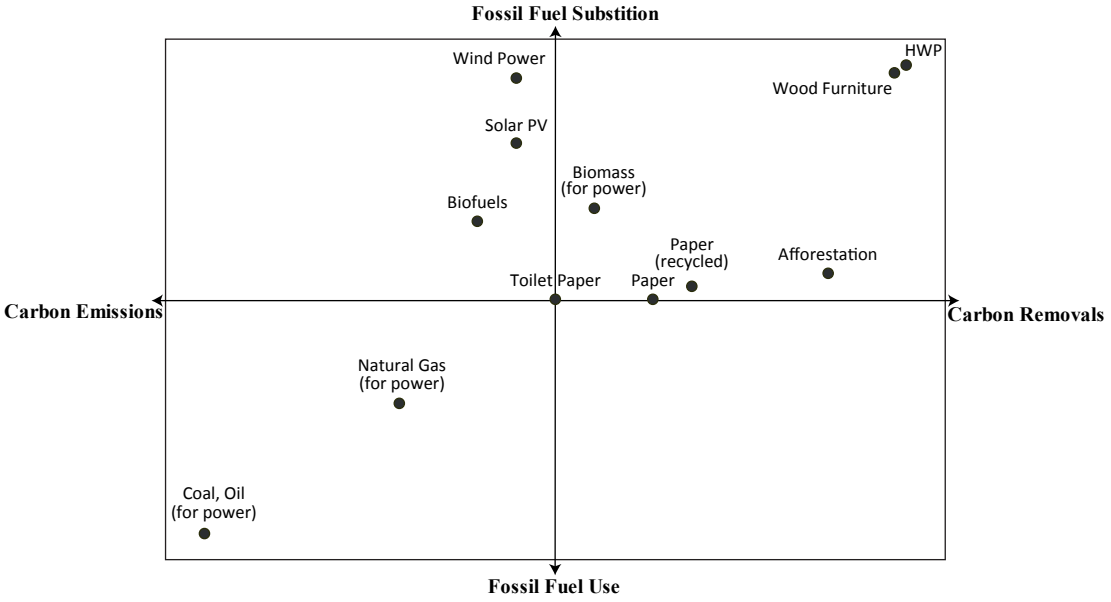

Figure 1: Fossil Fuel Substitution and Carbon Sequestration

Different and potentially competing mitigation options have been plotted in Figure 1 to demonstrate the potential of these options to either replace fossil fuels or remove/store carbon dioxide (CO_2). A number of important basic assumptions are made. For one, only the change resulting from a specific strategy choice is considered (thus for example standing forests do not appear in the graph). For another, for the purpose of convenience, we also assume that forests are managed sustainably. If this were not the case, then the position of different points – in particular the use of biomass for heat and power, harvested wood products (HWPs) and wooden furniture – would have to be placed in different positions on the graph.

20 The foundation for this exercise was provided by Ellison (2009), "Fossil Fuel Substitution and Carbon Removals, A Policy Exercise". The general concepts and their implications are more fully developed in Ellison and Keskitalo (2009).

Different mitigation strategies are placed on the graph in consideration of their ability to both substitute for fossil fuel use and to sequester carbon. For example, fossil fuel-based power plants have little potential to substitute fossil fuels and lead to emissions of carbon rather than carbon storage. Two other extremes are afforestation and HWPs. Use of HWPs lead to storage of carbon in products and also has potential to substitute fossil fuels, e.g. by substituting for more energy intensive building materials such as concrete and steel. While afforestation leads to carbon storage it essentially has no immediate effect on fossil fuel substitution. However, the effect of these measures depends of course on the time frame considered. For example, while afforestation does not immediately lead to fossil fuel substitution, after a long period harvested wood products and/or biomass energy may be produced from the afforested wood.

Figure 1 is also a starting point for analyzing the different interests and strategies between countries. For example, some countries (Spain, Italy) tend to put more emphasis on afforestation, while other countries (Finland, Sweden) tend to focus more energy and interest on biomass for energy and HWPs. These regional differences need to be considered in further policy making, again highlighting the difficulty in attempts at harmonizing forest policy at the EU level.

Finally, Figure 1 also provides a framework for asking both what ideal policies are with regard to fossil fuel substitution and carbon sequestration, and how well ideal policies are in fact reflected in current EU and national level policy strategies. For example, much of the EU effort is currently focused primarily on the promotion of biomass and biofuels – in particular through the EU's Renewable Energy Directive. The most recent version of the Renewable Energy Directive[21], approved in December 2008 as part of the EU's revised and 'integrated' *2020 Energy and Climate Change Package* and finalized in April 2009 requires the EU as a whole to increase the existing share of renewable energy to 20% of total energy consumption by the year 2020. The European Commission's *Renewable Energy Roadmap* envisions a large and significant role for biomass material in heating and power production[22]. The Renewables Directive also proposes a 10% increase in the use of renewables in transport by 2020.

While biomass for heat and power generation certainly represents a distinct advantage over the traditional fossil fuel-based resources, one can easily question whether other sources of sequestration and fossil fuel substitution potential receive equal weighting in the EU policy mix. Some organizations such as the Nordic Family Forest Owners association (NFFO) argue that measures supporting bioenergy – in particular those at the national and local level – not only strengthen the market position of the EU forest sector, but also facilitate the development of the bioenergy market (NFFO 2009). At the same time, however, considerable attention also needs to be paid to measures that balance the use of forest-based resources.

Left out of the EU's 2020 *Energy and Climate Change Package*, however, is any discussion of the potential role of either forest-based carbon sinks (or afforestation in Figure 1 above) or the potential benefits of emphasizing HWPs. Though afforestation as a strategy is supported in the context of EU rural development spending under the Common Agricultural Policy, forest-based carbon sinks are still not included in EU-level emission trading schemes and – at least to-date – will not be under the next accounting period from 2013–2020 covered by the recent EU

21 See Directive 2009/28/EC on the promotion of the use of energy from renewable sources (CEC 2009b).
22 See CEC (2007b: 11), as well as the earlier publication of the European Commission's Biomass Action Plan (CEC, 2005).

legislation. There is some room for maneuver, since the European Commission has promised to revisit the issue of forest-based carbon sinks and their possible inclusion in emission trading schemes in light of the conclusion of the international UNFCCC negotiations in Copenhagen (December 2009). If past experience is any guide, there may be inadequate support for greater emphasis on forest-based carbon sinks in the EU framework. However, given significant potential for additional carbon sequestration through afforestation[23] and for other significant fossil fuel substitution and carbon sequestration uses (biomass-based energy production and use of HWPs) further down the line, a failure to include these points and thus a failure to provide valuable incentives to exploit them represents a significant waste of valuable resources.

Most disconcerting of all perhaps is the fact that HWPs are still not counted in any way under current international UNFCCC and EU level accounting practices. Given the relative importance of HWPs – both as a means of sequestering carbon in such products as the construction of buildings and wood furniture and as a means of replacing fossil fuels by reducing demand for steel and concrete/cement[24] – it is difficult to understand why they still are not accounted for under today's accounting mechanisms. Some indirect effects from the current and future EU emission reduction strategy will lead to the promotion of HWPs. In particular the imposition of the requirement to purchase carbon allowances in high-emitting industries (e.g. steel and concrete/cement industries) and the power producing sector (leading to rising electricity prices) will ultimately favor the use of some HWPs. But their use could be much more strongly promoted with improved EU and UNFCCC accounting requirements that specifically account for HWPs. Strongly favored by at least some industry advocates[25], policies to enhance the use of HWPs represent an area of significant potential. Striving for harmonized and transparent carbon accounting methods in future international agreements is likewise something best pursued at a highly centralized EU level. However, while the improvement of accounting practices for HWP is also currently at the heart of discussions over current UNFCCC practices (see Petersson et al., 2009; Bache-Andreassen, 2009), this element of the negotiations is not even mentioned once in the EU's official Copenhagen bargaining position (CEC 2009d).[26]

The failure of EU policies to address a set of policy options that would adequately promote fossil fuel substitution and carbon sequestration – in particular through the promotion of forest resources – is conspicuous. Whether this can be explained as a result of competing interests across countries (with some countries favoring afforestation over the promotion of HWP or biomass), or as a result of the fact that the development of the EU climate strategy for promoting emission reductions was allocated to the Directorate General for Transport and Energy (DGTREN) as opposed to a DG that was more detached from the energy sector must remain open to question.

Other issues should also be considered in this general context, such as biodiversity, adaptation and the significant range of risks and uncertainties. It is the task of policy makers to include all of these dimensions, again illustrating the complexity of the situation on the EU and national levels.

23 Saikku, Rautiainen and Kauppi (2008) for example note that the planting of forests in the EU27 between 1990 and 2005 led to the absorption of an additional 11% of continental CO_2 emissions.
24 See Pingoud (2009) and Gustavsson, Pingoud and Sathre (2006).
25 See in particular the position statements of the Confederation of European Forest Owners (CEFP 2009) and the Nordic Family Forest Owners organization (NFFO 2009).
26 Though this issue will be discussed in Copenhagen in December, the EU does not have an open official position.

Given significant attention to fossil fuel substitution and carbon sequestration potential of forest-based resources, it is interesting to ask *Where do policy elements like biodiversity or adaptation fit in this general framework?* There is a significant need, for example, to explore the potential benefits of combining climate change and biodiversity strategies. Moreover, there is a need to ensure that climate change policies and targets are not pursued to the detriment of biodiversity (Slovenia 2008). One such example is the increased use of wood for energy in areas where this has a negative impact on biodiversity (Slovenia 2008). With respect to biofuels and the need to ensure that forest policy complies with environmental sustainability criteria, this particular problem has previously been highlighted by the European Council (2008).

Finally, one of the roles of policy is to ensure that the market is able to respond in an efficient manner. This point is true for many of the arguments raised above. The potential role and promotion of market-based and economic incentives for mitigation and adaptation should be carefully considered.

Many of these challenges require strategies that allow rapid temporal and spatial flexibility. One strategy does not fit all situations. Though some general strategies can be defined at the EU level, many of the specific implementation measures should be (further) developed and structured to adapt to the national, regional and local levels – in particular incentive systems for the promotion of renewable energies and other strategies for the promotion of green public procurement (GPP) may perhaps be best crafted at the national level. Regardless of the issue, greater communication and coordination between all levels is needed (top-down and bottom-up). Achieving the goal of aligning EU and national level goals is, of course, no simple matter. There is however a growing need to increase the degree of cooperation and coherence, whether as a response to climate change or simply in order to increase the competitiveness of the EU forest sector.

Forestry, Climate Mitigation and Adaptation: Priorities and Goals for Forestry Policy

As illustrated above, forestry is capable of contributing to a broad range of climate mitigation options: bioenergy (biomass and biofuels), HWPs and forest-based carbon sinks (afforestation). The potential role of forestry in the climate debate is too important to be left to chance. Intervention is required at EU and national levels in order to encourage the appropriate choice of strategies for climate mitigation and adaptation in forestry. These can and perhaps should include some or all of the following:

- The inclusion of forest-based carbon sinks in emission trading schemes such as the EU ETS or broader international (UNFCCC) trading schemes;
- Appropriate accounting mechanisms (in particular through the UNFCCC) for dealing with and encouraging the use of harvested wood products;
- Subsidies to promote but not oversell the appropriate use of bioenergy resources (biomass and biofuels).

In addition, in order to help preserve the viability of forestry, far more attention must be dedicated to the needs of adaptation to climate change. The EU urgently needs not only to acknowledge the integral role of forests and the forest sector in mitigation and adaptation to climate change, but also to develop further strategies for the meaningful use of forest-based resources.

At the same time, the EU also needs to ensure that its forestry resources are maintained, utilized and further developed. This objective needs to be pursued in a way that takes into account the different priorities of the diverse forest and forestry interests across and within the Member states of the EU. In part, this could be achieved by responding to a proposal from the Nordic Family Forest Owners association (NFFO 2009). Among their recommendations on forests and climate change was a proposal for a policy that encourages the acknowledgement and importance of sustainably managed forests as a key tool for climate change mitigation and adaptation.

A further area of common interest is in strengthening the research capabilities of member states. A good share of future research must be encouraged in areas related to mitigation and adaptation and in response to a diverse range of strategies need to be developed that allow rapid adjustment to new knowledge and circumstances. This is another way of saying that the problems of uncertainty must be more thoroughly considered in all policies related to climate change and adaptation.

Finally, far greater attention should also be paid to the external, international dimension in EU foreign policy measures. In particular, the EU needs to emphasize the importance of reducing deforestation, including continued efforts to combat illegal logging, reducing the loss of biodiversity and the overarching goal of promoting sustainable forest management on a global level.

Trade issues such as combating illegal logging are of particular importance for the longevity of forestry and forest-based industries and further have a significant impact on climate mitigation. In 2007, the Intergovernmental Panel on Climate Change (IPCC) estimated the total impact of deforestation on world emissions at 5.8Gt CO_2 per annum in the 1990s.[27] With total world CO_2 emissions at approximately 24Gt CO_2 in 2000, this amounts to almost a quarter of total world CO_2 emissions (and approximately 17.5% of world GHG emissions). [28] According to the IPCC, reducing or preventing deforestation is the single carbon mitigation option with the largest potential impact.

The basic EU FLEGT plan was adopted in 2003 and involves an effort to reduce the role of illegal logging in developing countries and to reduce trade in illegally logged timber. The principal FLEGT tool for promoting change in developing country practices is the voluntary partnership agreement (VPA). To date, the EU has signed VPAs with Ghana (2008) and the Republic of Congo (2009). The EU is further negotiating agreements with five other countries (Cameroon, Malaysia, Indonesia, Liberia and the Central African Republic). The basic intent of the VPAs is, while taking specific national characteristics of countries into account, to define 'legal timber' and verify compliance with this definition. VPAs also attempt to establish mechanisms for the monitoring and auditing of the timber trade in order to ensure that it fulfills these criteria.[29]

27 See the UNFCCC's background discussion of the REDD initiative.

28 World total CO_2 emissions were taken from the EIA's World Carbon Dioxide Emissions database. Total world GHG emissions were taken from the World Resource Institute data (cait.wri.org).

29 See also Ellison, Petersson and Keskitalo (2009). Further information is also available from the Commission's FLEGT webpage.

The importance of FLEGT VPAs should not be underestimated. The EU is a significant importer of timber products from countries with widespread illegal logging. In Ghana, with whom the EU signed a VPA in 2008, 70% of timber is illegally harvested (Hansen and Treue 2008). The EU has played a significant role in this illegal trade, importing as much as 60% of Ghana's timber exports (see Beeko 2009: 5). Based on the Ghanaian Timber Industry Development Division (TIDD) data that Beeko also cites, Ghana's timber exports to the EU have declined somewhat, from a relative high of 60% in 2002 to a somewhat smaller share of 42.9% in 2008. These figures have also declined in the total volume of EU imports from Ghana, declining from 257,830 m^3 in 2002 to a total of 181,090 m^3 in 2008 (though EU imports rose by some 20,000 m^3 between 2007 and 2008).[30] How EU imports from Ghana will develop in the future with the VPA in place remains open to question. Ghana's total exports of timber have ultimately risen over the same period, from 476,500 m^3 in 2002 to a total of 545,920 m^3 in 2008.[31]

Given the principal sources of GHG emissions, one of the main focuses of policy regarding mitigation lies outside EU borders, highlighting the importance of such developments as EU FLEGT. Reducing rates of deforestation and facilitating sustainable forest management in countries such as Ghana must remain high on the international and the EU agenda. The aim of FLEGT and the VPAs is to encourage good governance through political and market pressure and to reduce the incidence of trade in illegal timber. At the same time it is important to analyze and assess the true impact of the VPA with Ghana, in particular regarding social equity and poverty alleviation, before conclusions can be drawn.

There are explicit advantages to pursuing broader policies at the EU level and to eliminating barriers and constraints at the EU and national levels. For one, the EU and its Member states would presumably benefit from placing forestry and forest-based policy more firmly at the center of EU climate strategies. This is true both at the level of pursuing climate mitigation as well as adaptation. The development of strategies to deal with shifting bioclimatic envelopes (Kremer 2009), for example, requires a significant re-thinking of current national level policies that prohibit or restrict the use of plant species from different provenances. Given that this will ultimately be necessary on larger geographic areas, EU level intervention would be an explicit advantage. Promoting the adaptation of forests to climate change – in particular given the potential scale of required interventions – is perhaps best promoted at the EU level. Particular roles for the EU are the promotion of research on vulnerability, the promotion of research on appropriate regeneration and hybridization strategies.

National and/or Regional Strategies

In addition to the EU level, one must also consider more carefully the options for climate change mitigation and adaptation in national level strategies. In this context, national forest plans could be used as a means for greater integration of the goals of mitigation and adaptation. To-date, such goals are really only being integrated into the national forest plans of a select few countries. Swart et al. (2009: 40, 204, 245), for example, note that both Portugal (in particular with regard to protection

30 See for example the annual figures in TIDD (2003, 2008).
31 Much of the rise in exports goes to the regions of Asia/Far Asia and Africa (TIDD, 2003, 2008).

against forest fires and planning) and Finland have integrated at least some degree of adaptation strategies into their national forest plans. Roberts et al. (2009) likewise outline areas where countries have attempted to integrate some degree of adaptation planning into their national forest strategies.

Further, countries typically need to do much more to find ways of insuring that forest owners are incorporated more consistently into adaptation planning processes. While there is already considerable knowledge and awareness at the EU and national levels, efforts must be made to find ways of ensuring that such information is also incorporated in forest owner planning and practices. One way of achieving this goal is to develop guidelines and improve information provisioning on climate change mitigation and adaptation for forest owners and others at the local level. A further strategy is to provide incentives for involving the local level and forest owners in such planning. Finally, participatory frameworks that encourage interaction between the national and local levels are also important.

Options for Promoting an Integrated Strategy for Forestry Policy

A Special Commission?

At least one option for improving the degree of integration of forest policy is to create a special Commission at the EU and potentially also the national level in individual EU Member states. Though one strategy might be to create a new EU commission dealing only with forestry issues, it is not clear that forestry issues on their own rise to a level of importance that would justify creating a commission only for forestry. However, the current climate debate and the potential relevance of forestry within that debate in many ways opens up an opportunity for promoting the creation of a special Climate Commission that would also then take on a significant role with regard to forestry.[32]

Such a strategy would seem to make sense on a number of levels. For one, the EU's role in the pursuit of climate policy has been tremendously important in the international arena. Without the leadership role played by the EU, it is unlikely that the Kyoto Protocol covering the period up to 2012 or ongoing negotiations over a new agreement to cover the period 2013–2020 would have gone as far. The most important commitments to emission reductions under the Kyoto Protocol have been made by EU Member states.

Elevating EU climate strategy to Commission status would simply recognize and reinforce the EU's current leadership role in the climate debate. Moreover, it would make it possible to further mobilize both expertise and resources on a single climate agenda. Though there is currently discussion at the EU level about creating a Climate and Energy Commission, this strategy may not be the most advisable goal. This proposal has been strongly criticized by some, in particular for attempting to shift policy competence at a strategically difficult time (just prior to the Copenhagen negotiations).[33] Though such an institutional structure might lend too much weight to the Energy sector – too much of the EU policy focus is already on the energy sector – the elevation of the climate agenda to Commission status potentially has far greater appeal.

32 This point is further developed in Ellison and Keskitalo (2009).
33 See e.g.: "MEPs Angry at Plans for Energy Shake-up" (European Voice, May 14th, 2009), FERN's EU Forest Watch newsletter (June 2009, Issue No. 139) and the letter from EU GLOBE members (May 18th, 2009).

Assuming that the basic problem regarding the coordination of forestry policy is the fact that there is too much institutional division across relevant policy domains and thus ultimately poor coordination and fragmentation of policy output, then at least one relevant proposal might be to *coordinate forestry and forestry policy at the EU level under one single Commission*. Thus a more compelling alternative may be to create a *Climate Commission* and place principal competence for forestry within that framework. This would have the advantage of correcting the current degree of decentralization and fragmentation of forestry policy. Further, this would place the principal focus on forestry firmly within the context of climate change.

Though it may possible to argue that this institutional framework could still potentially lead to the neglect of biodiversity issues, the opposite may be more likely. In particular since much of the research on biodiversity suggests it is fundamental to the survival of forests – in particular in the context of forest resilience and afforestation strategies – placing this knowledge in a more centralized decision-making framework may give it greater prominence. To some degree, the institutional division across DG Agriculture and DG Environment may itself explain why some issues receive less attention than others. Both DG Environment and DG Agriculture currently have strong vested interests in this policy area. Moreover, if the principal rivalry is really across these two institutions (including perhaps also DG Energy and Transport), placing competence in an institution that can more easily weigh competing policy options independently of these vested interests could potentially improve upon current policy outcomes.

In order for such a strategy to work effectively – in particular concerning its ability to reconcile biodiversity and afforestation interests – it may be necessary to push adaptation in the EU policy-making arena far more strongly than has been the case to-date. The EU as well has tended to treat adaptation as a secondary strategy and is so far only at the White Paper stage in terms of adopting an official policy framework. Mitigation has so far received the lion's share of EU and also national level attention.

However, creating a *Climate Commission* may again help to resolve some of these issues. The specific role of a climate commission should ultimately be defining strategies for responding to the challenges of global warming and climate change. Since these of course also involve adaptation, the creation of a climate commission might also heighten the degree of attention dedicated to the adaptation side of the debate, both in the context of forestry and in other adaptation-related policy areas.

Improved Communication Across DGs?

A second alternative that would not involve such a radical shift in the political decision-making structure at the EU and other levels of governance is to promote improved communication across the different EU Commission units and also potentially between the EU and other national and local levels of policy-making. At least two authors involved in the current discussion promote models along these lines. Mickwitz et al. (2009) recommend a number of instruments to bring about greater policy integration (communicative, organizational and procedural instruments that ultimately attempt to give greater place and prominence to the climate debate in national agendas, institutional arrangements and assessment and consultation procedures) (Mickwitz et al., 2009: 49). On the other hand, Glück et al. (2009) highlight and promote the advantages of multilevel governance, decentralization and participatory decision-making processes.

This less radical alternative for promoting greater policy integration may have some advantages. In particular, given the fact that many of the problems countries face with regard to forestry, biodiversity preservation and the problems of adaptation are local in character, too great a degree of policy centralization – in particular at the EU level – may lead to significant policy mismatch across the EU and national levels. This is essentially what Pekka Pesonen, a former state secretary at the Finnish Ministry of Agriculture and Forestry, had in mind. Warning against the dangers of an overly aggressive degree of centralization in forestry policy, he argued that policies should remain national in character due to national-level variation in approaches to forest policy. The adoption of common rules could potentially lead to contradictions of national policy strategies (Euractiv.com 2007).

At least two organizations currently exist at the EU level responsible for increasing the degree of policy coordination.

> (1) the EU-level *Inter-service Group on Forestry* ("established in 2002 to facilitate cooperation and coordination of forestry-related work between relevant Commission services") is technically responsible for insuring that forestry policy is coordinated across some 11–13 EU-level DGs. Chaired by DG Agriculture, this body has two main purposes: (i) to ensure the flow of information and (ii) to seek agreement across departments. There is also an Inter-service Group on International Forestry Issues responsible for the preparation of Commission positions on international issues.
> (2) some have argued that the Standing Forestry Committee (SFC) should also be seen as a body responsible for promoting greater coordination. Composed of 25 members nominated by the Member states and headed by a Commission representative (from DG Agriculture), the SFC is responsible for acting as a discussion forum on forestry issues, as an advisory and consultation body with specific forestry expertise and as a medium for information exchange between the Member states and the Commission.[34]

Finally, one must consider the somewhat fragmented nature of the EU, in particular with regard to enlargement and current attempts to revise the Treaty of European Union. These points apply in some ways to the proposal for an EU level forest policy. Achieving this degree of unity is difficult given the competing forestry interests of Member states.
Exact models for how increased communication across the various bodies that make forestry policy at the EU and national levels must still be explicitly developed and proposed. However the work of Glück et al. (2009) and Mickwitz (2009) provides important initial steps in this direction.

Something In-Between?

Alternatives to the *Climate Commission* or Increased Coordination models might involve something in-between these extremes. Assuming that increased coordination is not enough, but that the creation of a climate commission goes too far, one might also consider alternative ways of elevating forestry policy at the EU level. This could involve granting greater policy responsibility to one or the other of the Commission units currently responsible for forestry policy.

34 For more general information on the SFC, see the Commission's website:
http://ec.europa.eu/agriculture/fore/sfc_en.htm

How easy it would be to increase the degree of forestry policy competence of one EU Commission over that of another is not immediately clear. The current EU Commissions that already have strong interests in their policy role with regard to forestry – in particular DG Agriculture, DG Environment, DG Energy and Transport, and perhaps DG Enterprise and Industry – likewise tend to have important vested interests behind their policy role. Attempts to increase the prominence of one over the other could potentially just lead to increased institutional competition and rivalry.

On the other hand, most actors involved in forestry policy at the EU and national levels tend to agree that greater policy coordination would be beneficial. In this sense, it may be possible to gain the support of the existing bodies responsible for forestry policy-making to collaborate on specific models.

Implications

Two key messages can be taken from the above discussion. The first concerns the notion of *adequate flexibility* between different levels of governance (EU, national and local). The second concerns the notion that a stronger, more centralized and more cohesive focus on forestry policy may be necessary in order to drive more coordinated policy action on specific issues. These two seemingly contradictory concepts are not of course mutually exclusive. And the EU has in the past frequently pursued very general policy guidelines (and even Directives) at the EU level, while at the same time permitting significant national and even local level variation. Recent examples are the water framework Directive and the floods Directive. Both of these EU legislative efforts have set only very general guidelines at the EU level and have permitted national, regional and local levels to figure out implementation strategies among themselves.

In order for action to occur on specific issues such as water quality, flood protection or the broader and more general issue of adaptation, it may be necessary for the EU to step in and set the basic framework for action. Where transboundary issues such as water quality or flood protection strategies may require and simplify EU level community action, the urgency and relative importance of action on adaptation to climate change – in particular in forestry – may also facilitate EU efforts. Where institutional reform at the EU and national levels can facilitate action on such issues, it should be given adequate and focused attention.

Conclusions

Perhaps the first and strongest conclusion is simply that more research is needed. The overall degree of uncertainty regarding the potential impacts and adaptation requirements of climate change is daunting.

Beyond this simple recognition, it is also clear that the EU and presumably also national-level decision-making frameworks need significant revision and improvement. Though there is somewhat widespread recognition that there is an inadequate degree of policy integration across the various institutions and levels of forestry governance, to-date little has been done to substantially change this fact. As a result, forestry policy continues to be conducted in a significantly fragmented way at the EU and national levels. Given the overall importance of forestry and good forestry policy – in particular in the context of defining and implementing good strategies for climate mitigation and adaptation – this problem needs considerable and concerted effort. A first step in this process is presumably reform of the existing institutional structure in such a way that a far greater degree of policy integration at the EU level and across the EU, national and local levels can be achieved.

Given the overall urgency of the climate dilemma and the relative scale and magnitude of the policy efforts required to respond to these challenges, developing ways to achieve far more effective and rapid decision-making on forestry policy and its important role in climate change, mitigation and adaptation is essential. Moreover, policy efforts at the EU level must focus on a relatively broad policy framework while allowing for considerable flexibility across the EU, national and local levels. This is above all the case because the impacts of climate change will vary dramatically across the EU, requiring quite varied responses from location to location. This fact requires great flexibility in the legislative approaches chosen at EU level. In this regard, policy efforts must recognize and be adaptable to the diverse interests and potential mitigation strategies of individual states.

Finally, as continued reports of the urgency of climate change and global warming continue to pour in, it becomes increasingly clear that we can wait no longer. We must act now!

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Role of Forest Management in Fighting Climate Change – Forest Management Work Group Report

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Introduction

Climate change and forests are intrinsically linked. On the one hand, changes in global climate are already stressing forests through higher mean annual temperatures, altered precipitation patterns, and more frequent and extreme weather events. On the other hand, growing forests store carbon dioxide and may play an important role in mitigating climate change. However, when degraded or removed, forests turn into additional sources of carbon dioxide.

Forests are managed for various purposes. Aims of management vary depending on forest owner objectives, region or country and also over time. Managing forests for climate change adaptation and mitigation purposes is a quite recent aim in forest management and faces many challenges. Some of them are discussed in this report.

Timing of forest management under climate change is very important. Decisions made now will affect forests many decades into the future. Thus, it is important for managers to take into account how forests may respond to future climatic conditions. The future climate at specific locations and times is very uncertain. Even less clear is the picture of how organisms will respond to that, how fast they will adapt. Consequently, management actions to address climate change must be flexible in a way that they do not compromise forest productivity and sustainable production of all forest services.

Aim of the Report

The aim of this report is to summarize key messages, lessons learned and conclusions of the Joensuu Forestry Networking Week (JFNW) that relate to forest management and climate change.

The following questions document the group's discussion of the topic. They were also used to structure the report. However, not all of the questions were answered in the course of the discussion. Here is a summary of these questions:

How does climate change affect forest services?

- How vulnerable are forests (and their services) to climate change?
- How can measures lower vulnerability?
- Carbon storage adds to a long list of services already provided by forest ecosystems. How can an appropriate balance be assured?
- Adaptation versus/and mitigation? Do measures compete and what are potential trade-offs?
- At which scales can measures protect multi-functionality of the forest? Can, for example, the notion of multi-functionality be sustained at stand level?

What is the effect of forest management on the climate?

- What will be the carbon sink/source of European forests (regional differences)?
- Do we need to introduce new species?
- What measures should be accounted for?

How can measures be implemented?

- How to implement forest management schemes (addressing the various levels, especially legislation)?
- What will be the costs of a certain change in forest management?
- How to set incentives for forest owners?
- How can monitoring of forests (for forest management) for mitigation be effectively done?

How can forest management deal with the high level of uncertainty?

- How to deal with uncertainty of regional climate projections?
- What is the time dimension of measures? How has forest management to be timed?
- Where do we set system boundaries (e.g. include substitution effects, etc.)?
- What are implications for climate effectiveness of measures?

Definition of Forest Management

This report uses the Food and Agriculture Organization (FAO) definition to narrow the term of forest management down to the following:

> *The process of planning and implementing practices for the stewardship and use of forests and other wooded land aimed at achieving specific environmental, economic, social and/or cultural objectives. It includes management at all scales such as normative, strategic, tactical and operational level management.*

Measures that address climate change adaptation and mitigation add additional challenges for forest management as they imply additional services but also additional uncertainties to be considered in decision making. To address all aspects of forest management the report aims to cover, the definition has to be extended by the following points. Forest management:

» *Can include different management systems:*
  - ranging from unmanaged to 'close-to-nature' and intensive plantations;
  - including the full forest 'life-cycle' from establishing a forest to harvesting.

» *Operate at various scales:*
  - spatial: from stand level to watershed and region;
  - time: scales from day to full rotation (e.g. 100 years).

» *Follows a plan and legislation.*

» *Involves decision making and interaction of authorities, forest owners, managers and workers.*

» *Needs to address the multi-functionality of forests: planning and execution of activities in forests related to economic, ecologic and social functions to ensure continuous services (e.g. timber supply, recreation, wildlife habitat).*

» *Includes decision on products (first order until the end of the product's lifetime).*

» *Includes (in a broader sense) also wildlife management as wildlife situation might facilitate some forest management options and inhibit others.*

» *Costs money and allocates a scarce resource. It therefore has to set priorities.*

» *Examples of forest management activities include species choice, planting, choice of rotation, regeneration, silvicultural system, afforestation and forest protection.*

Climate Change Impacts on Forest Management

Future climate conditions are estimated based on global emission scenarios and climate projections which are both associated with uncertainty. More relevant for forest management are regional projections that are even more uncertain. Currently they provide reasonable results for a couple of decades. Climate models that are used to derive global and regional climate projections are improving in accuracy all the time. However, detailed projections will always remain uncertain as uncertainty is inherent to the climate system (Roe and Baker 2007). Forest management needs regional and long-term (more than 50 years) forecasts. But these are the most uncertain projections. Thus one of the most important questions of forest management is how to deal with uncertainty of climate scenarios in decision making and how to respond in practice?

Short-term effects of climate change may be seen in increased rates of disturbance. Such an increase in damage of storm incidents has been lately observed, but these increases are NOT necessarily due to climate change, i.e. more frequent storm events, but due to better and more detection, higher volumes in forests, change in forest management (more intensive), forest (over-) aging especially in unmanaged forests and/or more fuel load in forests because it is often too costly to remove small trees. The question of whether even-aged stands are in general more susceptible to wind damage is hotly debated.

While wind damage and their connection to climate change are thus less clear, another aspect of regional climate change is the change of snow conditions. Although snow cover will be shorter in the future (e.g. Finland) there is an increased risk of wet snow events that are responsible for the greatest damage (especially in combination with wind and less frozen soils).

The projected increase in temperature in general and higher summer temperatures in many places in particular might lead to the conclusion of more frequent fire events in forests in the future. More structured forests as currently considered as management goal might even increase the risk of forest fires (e.g. pine stands with a lot of understorey and medium sized trees enable the fire to jump in the canopy and cause more severe fires). Moreover, many regions with no fire events today are likely to become fire regions in the future. These areas are most vulnerable because they are less prepared, e.g. they have a lower infrastructure density and fire management

experience. In some regions water availability during the growing season will probably become more limited although total precipitation will increase (additional rainfall in winter but higher summer temperatures). An important part of forest management – harvesting – will become more difficult in the north where frozen soils are thawing earlier or frost does not occur anymore.

In general, a better understanding of the vulnerability of forest management systems at various locations is required to include climate change considerations into forest management planning.

Options for Mitigation

General Introduction

Mitigation is an intervention to reduce the anthropogenic forcing of the climate system. It includes strategies to reduce greenhouse gas (GHG) sources and emissions and enhancing GHG sinks (IPCC 2007a). There are different ways to achieve mitigation goals through forestry and the forest-based sector. Besides afforestation, reforestation and silvicultural activities which enhance and protect sequestered carbon, mitigation measures in forestry can also target the protection of existing carbon stocks through the reduction of disturbances (e.g. wild fires) and avoidance of deforestation and degradation. The Kyoto Protocol requires the report of emissions (deforestation) and removals (afforestation, reforestation and forest management) by industrialized countries (UNFCCC 1997). Carbon emissions can also be reduced by the forestry sector through the substitution of energy intensive construction materials with wood and fossil fuels with forest biomass (IPCC 2007a).

Sequestration and Stock Protection

Specific measures suggested for carbon sequestration in forests by the IPCC Third Assessment Report (TAR) (IPCC 2003) include: afforestation, changing rotations in existing forests, controlling stand density, enhancing tree growth e.g. through increasing nutrient availability, managing logging residues, and increasing the efficiency with which forest products are manufactured and used. Sequestration options have to be tailored and planned according to regional conditions. Mitigation potential in forest management through sequestration in Europe exists but it is rather limited compared to large potentials of afforestation and avoided deforestation in the tropics. This opens a question whether adaptation measures in Europe (to protect high stocks accumulated over the last decades) are more urgent than further sequestration.

Specific measures suggested for carbon stock protection in forests by the IPCC TAR (IPCC 2003) include: protection against fires, protection from disease, pests, insects, and other herbivores, controlling the water table, selecting useful species and genotypes, using biotechnology, reducing regeneration delays, selecting appropriate harvest methods such as reduced-impact logging, and establishing, maintaining, and managing reserves.

Bioenergy – Energy Substitution

Reducing GHG emissions through fossil fuels substitution by the use of wood for energy, can increase the self-sufficiency in energy production of rural areas, may promote good silvicultural practices, and improve the employment situation. The demand for biomass from forests for bioenergy will increase in the future and the renewable energy targets (such as those set by EU or individual member states) will have implications for forest management. The bioenergy potential from forests in Europe is high at a per hectare level. However the total potential is rather moderate. This is also due to high competition over wood as a resource. This competition can be lowered by a more efficient use of energy along the wood product chain, e.g. from forestry and wood processing residues. Co-benefits have to be taken into account. For example, bioenergy use can also make the removal of small trees more economically viable in the Mediterranean region and in this way lower the risk of fire ignition and influence the fire intensity (in this way mitigation can also achieve synergies with adaptation). Activities for biomass production may threaten soil fertility as well as non-wood forest functions. Therefore forest management has to take those issues into consideration. Bioenergy production is most efficient when the distances between supply and demand are short. Also economies of scale are important and need to be considered when choosing the best size for wood bioenergy plants.

Product Substitution

Using wood for construction can substitute energy intensive materials, if the energy or fossil fuel required to produce and transport forest products is less than the energy needed for alternative products such as concrete and steel. In that case CO_2 emissions will be avoided by the use of forest products. Wood is a low-energy renewable and carbon-neutral building material throughout its entire life-cycle. Harvested wood products (HWPs) have mitigation potential if the carbon stocks in the harvested wood product pool are increased but there are limitations. However, potential mitigation effects of HWPs are currently not accounted for in the climate treaty. Substitution effects can be large but uncertainty about the long-term effect and the permanence of the storage persist. Effectiveness of substitution effect depends on the substitution factor that is variable over regions depending on the region's energy portfolio. Substitution also affects rather the energy and carbon balance of other sectors than forestry (e.g. energy sector or industry).

Implementation Issues and Remaining Uncertainties

Due to the ownership structure and the low importance of forests for the livelihoods of small-scale private forest owners in Europe, forests are already managed very extensively and often in a close-to-nature silvicultural system which is beneficial to mitigation. However, forest management planning is more difficult with many small forest owners living far away from their forests.

Mitigation has to look at the entire land use system to be climate effective which holds for the system boundaries (sectors) and the spatial application (include all forests to avoid leakage). Estimated potentials have to be considered carefully in forest management plans. The mitigation potential of single sectors is often over-estimated because experts in sectoral groups tend to be too

positive about realizable potentials (Nabuurs 2009). Also there are different levels of potentials, namely theoretical, technical, economic, and ecologic potential down to the implementation potential. These describe the potential for bioenergy supply, e.g. from forests, as a staircase, getting narrower with additional constraints. The theoretical potential of a forest area might be large. However, when costs of harvest are considered the potential might become relatively small because of the remoteness of the biomass source. Similarly constraints related to biodiversity and conservation issues might narrow the theoretical potential. All of them need to be defined carefully to allow comparison.

Options for Adaptation

General Introduction

Since the world is already committed to climate warming (Carter 2009, IPCC 2007b) merely mitigating climate change is not enough and forest agencies are proceeding at different paces in adapting their forest management practices and recommendations (Eastaugh et al. in press). Dealing with the unavoidable change, also adaptation in forest management is essential to avoid negative impacts for the forestry sector and to ensure the continuation of the mitigation effect that forests have. Adaptation can be defined as "adjustment in natural and human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC 2007b) and adaptation in forestry is sustainable forest management from a climate change and risk management perspective (Spittlehouse and Steward 2004). In addition to the term adaptation, it is important to define the following related terms (as defined in Lindner et al. 2008):

- **Impact factors** are climatic, physical, and biological variables that are influenced by climate change and cause the impacts in the system.
- **Exposure** specifies the projected change of climate that is affecting the system.
- **Sensitivity** describes the degree to which a system is affected, either adversely or beneficially. The effects of climate change may be direct (e.g. changes in forest growth in response to a change in temperature or precipitation) or indirect (e.g. damages caused by an increase in the frequency of fires or a new biotic pest species).
- **Impacts** are the consequences of climate change that are likely to affect forests and forestry activities, as a function of exposure and sensitivity to changes. For example, a decrease in rainfall during summer is likely to impact forest growth in Mediterranean areas.
- **Adaptive capacity** describes the ability of a system to adapt to changes in climate. It consists of two components: **Inherent adaptive capacity** is the evolutionary mechanisms and processes that permitted to tree species to adjust to new environmental conditions. **Socio-economic adaptation capacity** is the ability of human sectors, like forestry, to implement planned adaptation measures.
- **Vulnerability** can be defined as the degree to which a system is susceptible to be affected by adverse effects of climate change. The vulnerability of a given system is a function of the climate variation to which this system is exposed (exposure), its sensitivity, and its adaptive capacity.

Adaptation strategies should aim at increasing the flexibility in management of vulnerable ecosystems. Adaptation should enhance the inherent adaptability of the species and ecosystem processes and reduce trends in environmental and social pressures that increase vulnerability to climate change (Lindner and Kolström 2009). Adaptation measures in forestry are taken at different levels; there are adaptation activities at stand, forest management and policy levels (Linder et al. 2008). Stand level measures include measures like forest regeneration or tending and harvesting of stands and forest management level measures are activities like forest management planning and forest protection. Policy level measures include issues like infrastructure or nursery level decisions about mixing seedlings from different provenances. There are theoretical and practical evidences that the vulnerability of a forest can be reduced by adopting adaptation measures (Millar et al. 2007; Lexer 2009; Reyer et al. 2009).

Overall, policy recommendations and incentives are needed to guide or steer adaptation because economic benefits might only materialize at a later stage.

Choice of Species and Provenances

The choice of the tree species is the basis for an adaptive management when aiming at maintaining the productivity of the forests also under changing climate (Kellomäki et al. 2007, Spittlehouse and Stewart 2004). Some species are more vulnerable to climate change than others; e.g. in some areas in Central Europe Norway spruce (Picea abies) is expected to suffer from decreased precipitation in the future. Since natural migration is too slow for adaptation (Kremer 2009), measures are needed in anticipation of the future climate. Forest regeneration provides an opportunity to select tree species or provenances that are better adapted to changing climate conditions (Lindner et al. 2008) although it is also the most vulnerable to changes in climate (Spittlehouse and Stewart 2004).

Increase Species and Genetic Diversity

Since the future climate projections are uncertain (and will also remain uncertain), diversity (genetic, species, structural) is an important support for adaptation. Natural regeneration allows natural selection to take place and is thus recommendable if the gene pool of available seed trees is suitable for the site and for the changing environmental conditions (Lindner et al. 2008). In artificial regeneration seedlings from different seed stands could be mixed at the nursery stage to increase the genetic diversity. Another option would be to introduce plants with different genetic characteristics to naturally regenerated stands. Natural selection would then generate a new, better adapted population. However, more experiments are needed about enriching the gene pools that will help populations through natural selection.

Adaptive Harvest and Thinning

In the future more attention should be paid to avoid increasing the vulnerability to disturbances by harvesting operations. Open stands and forest edges are exposed to prevailing winds and direct sunlight (Lindner et al. 2008). The risk of wind damage could be reduced by appropriate forest management. For example, appropriate tending of seedlings, type and intensity of thinning, shorter rotation length and appropriate temporal and spatial pattern of final cuts will prevent wind damages related to harvesting under changing climate (Peltola 2009).

In the future, infrastructure and transport need adaptation to the changing conditions. Shortened frost periods and wet soils require development of harvest and transport technologies (Lindner et al. 2008) and improved infrastructure will be needed to prevent secondary biotic damage after abiotic ones.

Strategic Planning, Monitoring and Policy

Forest management planning will be more challenging in the changing climate. Although the future conditions are not known, forest managers need to make long-term decisions. That creates a need for new decision support systems – forest planning tools for decisions under uncertainty of climate change. Also forest policy needs to be assessed to ensure that it encourages adaptation (Spittlehouse and Stewart 2004). Although this report does not deal with forest policy, there are certain policy level measures that are essential for the adaptation of forest management to the climate change and thus worth mentioning. Improved monitoring of disturbances will also be needed in the changing climate since the probability of damaging effects by biotic agents will increase (Lindner et al. 2008). Furthermore, the need for increased level of diversity should be taken into account in nurseries; mixing of seedlings from different seed stands of the same provenance and also the seeds from neighbouring provenances could be added to increase the diversity. Currently, mixing provenances is not allowed, but since these rules were based on assumptions that neither environments nor climate were changing, changes are needed in seed transfer regulations (Kremer 2009, Millar et al. 2007).

Autonomous adaptation by single countries is not optimal at a global perspective and has to be conceived at larger scales. However, vulnerability differs between the regions and adaptation measures have to take the local situation into account. Furthermore, implementation will happen very locally and consequently it is important to include local knowledge into account when planning the adaptation measures.

Remaining Challenges and Uncertainties

All measures need to be considered in a complex system of options and feedbacks. When planning the adaptive management, trade-offs of measures need to be considered when evaluating different options and their costs. For example, to decrease the risk of disturbances shorter rotation would be favourable. However these would lower the sequestration potential in forests (see mitigation section). If the amount of deadwood is increased to enhance the biodiversity, this may also increase the fire and pest risk.

It is also important to take into account that there are windows of opportunity. The forest age structure in Europe is going to lead to more mature forests in the near future. These are more vulnerable so there is more need for adaptation but the closeness to the end of rotation also offers opportunities for a more rapid adaptation, e.g. species change. Adaptive management has to cope with these management legacies. To find the appropriate measures, regional vulnerability assessments have to be undertaken.

Although forest management cannot prevent damage in extreme catastrophic events (century storms) it can lower damage in general. Still, adaptation is useful and uncertainty about future climate should not be an excuse not to act.

So far little attention has been brought to potential benefits from climate change impacts such as increased growth. Scientifically these have been studied (e.g. Boisvenue and Running 2006), but the implications for forest management and the role of forest management to gain the benefits the climate change are unclear.

Table 1: Synthesis of forest management measures and options for mitigation and adaptation (adapted from various sources (Spittlehouse and Stewart 2004; Ravindranath 2007; Hemery 2008; Lindner et al. 2008; Innes et al. 2009; Lexer 2009; Lindner and Kolström 2009; Netherer 2009; Peltola 2009; Peyron 2009; Reyer et al.

Measure	**Aim**	**Potential applicability for:**	
		Mitigation	**Adaptation**
Gene management			
Breeding	Increase genetic diversity	Increase carbon sequestration rates	Reduce vulnerability of trees to climate stresses
Mixture of provenances	Increase genetic diversity	Increase carbon sequestration rates	Introduce or favour species or genotypes better adapted to a wider range of conditions
Forest protection			
Fire management	Decrease fire risk	Preserve carbon stocks	Reduce vulnerability to fire
Pest management	Decrease pests and pathogens risk	Preserve carbon stocks	Reduce vulnerability to pest and pathogen risk
Soil and water conservation	Reduce vulnerability to climate change	Preserve carbon stocks	Reduce the adverse impacts of drought on forest growth
Control invasive species	Control undesirable species	Increase carbon sequestration rates	Decrease competition for remaining trees, increase stability of individual trees
Forest regeneration			
Planting	Installation of desired species/ promotion of native species	Preserve and increase C sequestration	Species best suited to future climate (e.g. drought resistance)
Natural regeneration	Reduce vulnerability to climate change	Increase carbon stocks	Species suited to (current and ontogenetic development) site conditions
Afforestation, reforestation	Creation of new forests	Increase carbon stocks	Increase stability and diversity

Table 1 cont.: Synthesis of forest management measures and options for mitigation and adaptation.

Silvicultural management			
Forest and biodiversity conservation	Halting deforestation, adopting sustainable harvest practices	Preserve carbon stocks	Reduce vulnerability of forest ecosystems
Thinning regime, intensity	Decrease stand density	Use for bioenergy, timber	Reduce occurrence of pests and diseases, increase stability of trees
Choice of rotation length	Timing of forest management activities	Increase carbon stocks	Create stable stands, forest conversion
Choice of silvicultural system	Assist declining and disturbed stands	Preserve and increase carbon stocks	Determine forest structure (Even- vs. uneven-aged stands)
Forest operations			
Road maintenance/ construction	Improve access to forest, minimise sediment runoff	Increase carbon stocks	Improve access under altered climatic conditions (earlier thawing, more rainfall…)
Maintain/enhance water regimes	Reduce carbon loss from soils, increase biomass growth rate	Increase carbon stocks	Reduce vulnerability to climate change (e.g. adaptation to drought)
Multi-purpose use			
Agro-forestry	Increase adaptation and mitigation measures beyond forested areas	Increase carbon sequestration rates	Reduce vulnerability to climate change (e.g. adaptation to drought)
Urban-forestry	Increase adaptation and mitigation measures beyond forested areas	Carbon sequestration in trees and soils	Adaptation to heat stress (e.g. reducing needs of air conditioning)
Bioenergy plantations	Increase use of forests for biomass energy	Use for bioenergy	Reduce the vulnerability of plantations (e.g. shorten rotations)
Landscape management			
Watershed management	Improving hydrological conditions	Preserve carbon stocks (especially soils)	Reduce vulnerability to climate change (e.g. adaptation to floods)
Forest structure	Improving forest structure	Preserve carbon stocks	Reducing forest risk, enhancing diversity, increase stability
Connectivity	Minimise fragmentation	Preserve carbon stocks	Connectivity of forest areas

Discussion

From the discussion of single measures above it can be concluded that climate change leave forestry with both, challenges and opportunities. For the implementation of mitigation and adaptation measures the importance of rural development and employment has to be taken into account. Forest management is to a large degree economically driven and this implies the need for clear financial incentives for mitigation and adaptation measures, especially in privately owned forests. Whether an inclusion of HWPs in a future accounting scheme could provide incentives is debatable. It would increase system boundaries (what was identified to be necessary). But it would also change, for example, incentives for mitigation in forests (biomass and soil). The sum of these feedbacks could easily be a zero game.

It is obvious that there is an imbalance in mitigation potential globally versus domestic and EU policy measures. While mitigation potential is rather moderate for European forestry, avoided deforestation in the Tropics is key for successful climate policy. Thus, there should be more focus on those areas where the potential is greatest, and the role of European forest management for realising these potentials (knowledge transfer, increased domestic supply, etc.).

Forest managers need clear instruction on how to organize adaptive management. Rather theoretic tools like bio-climatic envelopes are not very helpful for forest management practice. They describe a rather statistical relationship; they are static and include only few parameters. More applied and dynamic decision tools are needed to translate scientific knowledge into manager advice.

Given the high uncertainties of regional climate projection and also market behaviour, in general, management should always aim at increasing diversity and aim at keeping later options open if conditions or responses change. Diversity is the key to (natural) adaptation and gives forest management more options in the future. By ensuring more options to choose from, diversity can also have economic benefits in a changing future. There should be support for forest management measures (e.g. for diversification) that might be associated with economic losses in the first place but will eventually result in better adapted forest structures in the long term. An insurance of forests against climate risks can help to prevent major economic losses in case of extreme events that cannot be prevented. There might be insurance models that reward forest owners that have taken early adaptation measures.

The mutual influence of adaptation and mitigation measures should be taken into consideration. This requires an integrated assessment of adaptation and mitigation measures (Millar et al. 2007). It has become clear that mitigation projects also require climate change adaptation in order to maintain carbon sinks. Forest management should therefore be part of an integrated assessment framework that helps to evaluate the optimal portfolio for certain regions and different scenarios. However, optimal solutions from models have to be used carefully, especially for suggested “no regret” options.

Forest management is in many cases driven by economic decisions. The question of mitigation and adaptation costs has not been addressed by this report. However, the financial crisis will surely have an effect on the measures and their overall implementation potential. The crisis will most likely limit the options in forestry to respond to climate change because of a lack of investment (FAO 2009).

Conclusions

In the following the group lists the ten most important issues that should be followed up on in future workshops and in discussion with experts. They are based on the key findings and the discussion above so they cover only the group discussion.

1. Mitigation has to look at the entire land use system to be climate effective. This holds for system boundaries (sectors) and the spatial extent of measures (leakage).

2. Mitigation potential in Europe in forest management exists but is rather limited compared to large potentials of bioenergy, material substitution, afforestation and avoided deforestation in the tropics.

3. Forest management implies decisions on HWPs and their lifetime and can therefore also indirectly influence mitigation in the wood product sector (by increasing carbon stocks in products). However, the market situation has to be considered when potentials for this measure are estimated.

4. European renewable energy targets and general increasing demand for bioenergy will have implications for forest management through market shifts due to competition, changes in silviculture and through biodiversity issues related to bioenergy.

5. Detailed regional projections of climate change (which are most relevant for forest management decisions) are more uncertain than global projections and will always remain uncertain. Forest managers have to find ways to include uncertainty in forest management and planning decisions.

6. Diversity (genetic, structural, species) is an important support for (natural) adaptation in forest management. Diversity can also have economic benefits in a changing future through more options. Therefore forest management should always aim at increasing diversity.

7. Adaptation in forest management cannot prevent damage in extreme catastrophic events (century storms): even so adaptation lessens damage and is therefore useful. Uncertainty is not an excuse not to act.

8. Adaptive management and mitigation have to cope with management legacies. Past practices define future options.

9. Trade-offs and conflicts between adaptation and mitigation measures to be considered (e.g. bioenergy use could make removal of small trees more economically viable in the Mediterranean and hence prevent fire).

10. Forest management decisions are getting (even more) complex in the future and therefore need to be assessed in a wider integrated assessment framework including other land use decisions.

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Role of Forest Research in Fighting Climate Change – Forest Research Work Group Report

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Introduction

Since the industrial revolution, anthropogenic emissions have perturbed the global carbon cycle and enhanced the greenhouse effect. As a result, changes in the global climate system are rapidly occurring (IPCC 2007). For example, the 20th century experienced the strongest warming trend of the last millennium with average temperatures rising by about 0.6ºC (Jones et al. 2001). This development will certainly affect forest ecosystems. Forced by a doubled atmospheric CO_2 concentration, global models project that a substantial fraction of the existing forests will experience a change in climatic conditions. As a consequence, large forested areas will disappear and changes in species composition or to new vegetation types will occur. The many benefits that society and environment gain from the world's forests (e.g. natural resource and materials, soil protection, water regulation, conservation of natural habitats and biodiversity, recreational functions) might be seriously jeopardized.

Because of the complexity of the climate system and its feedbacks with the biosphere, climate change cannot be stopped even with a drastic reduction of CO_2 emissions. Current and projected impacts of climate change and vulnerability of forest ecosystems need therefore to be assessed accurately, and adaptation processes identified. On one hand, adaptation measures will become necessary if we want to continue benefiting from the many services that forest provide. On the other hand, climate change can be attenuated or mitigated by decreasing the human-altered atmospheric CO_2 concentration.

Forest Research and Climate Change

Research on the observed and expected impacts of climate change on human societies and ecosystems have received great attention since the 1990s, when the first report of the Intergovernmental Panel on Climate Change (IPCC) was released. At the same time, awareness about climate change started to grow among the world's governments and led to the international agreements to fight climate change, e.g. the United Nations Framework Convention on Climate Change (UNFCCC). Research on impacts of climate change on European forests and the development of adaptation and mitigation strategies also started in the early 1990s (Seppälä et al. 2009).

Scientific research can be classified in fundamental and applied research. Typical tasks of fundamental research are the identification of impacts of climate change on forest and their associated risks. On the other hand, the study of the effect of different forest management practices on mitigation is a typical example of applied research. We can separate two kinds of end users for the research on forest and climate change. The first ones are the policymakers who are responsible for the optimal allocation of resources for fundamental research and the implementation of any operation towards adaptation and mitigation. The other set of users is labelled as actors and it covers any agent of the forest sector whose operating environment is

likely to be affected by climate change. Examples of such actors are private forest owners and managers, public environmental agencies, institutions responsible for the recreational functions of forests, NGOs for nature conservation as well as scientists themselves. In this report, we have divided the currently most imminent research needs in forestry to fight climate change into three sections: (i) impacts, (ii) adaptation, and (iii) mitigation.

(i) Forests functions and structure are intimately shaped by the environment, which provides the basic resources for the tree life, such as energy (light), CO_2, water, nutrients and support (soil), and for the other organisms which interact with the trees, as herbivores and pests. Therefore, substantial a change in environmental conditions will surely have an effect on forests. Research on 'impacts' is focused on the modifications that changes in environmental conditions, caused by changes in climate, will trigger on forests.

(ii) Research on 'adaptation' should be bidirectional. On one hand, direct measures of adaptation, which evaluate land use, land-use changes and forestry under changing climate, should be performed. On the other hand, the vulnerability of the forest ecosystem and the processes that hamper adaptation (e.g. introduction of new pests, changes in soil structure or water balance) should be identified.

(iii) Forests crucially influence the global carbon cycle by taking up carbon through photosynthesis, accumulating it in vegetation biomass, and releasing it through respiration. 'Mitigation' research focuses on measures to increase carbon accumulation and storage in forests and wood products and reduction of CO_2 emissions.

We are still lacking the experience of how forest ecosystems respond to rapidly changing climate conditions. Uncertainty about the full extent of climate change impacts and the suitability of adaptation and mitigation measures creates a need for monitoring and further research taking into account regional differences. The forestry research community needs to evaluate the long-term effects of climate change on forests and determine what the community might do now and in the future to respond to this threat. For example, models based on climatic variables and present plant distributions predict massive displacement of species across latitudinal and elevational gradients. This trend may be limited by different phenomena such as fragmentation of the landscape, long plant-generation cycles, disruptions in the populations of seed-dispersing animals, or decreased reproductive output of trees under stress. Thus, research on the possible impacts of climate change on forests and the development of adaptation and mitigation strategies needs to be carried out for different scales and topics.

In this report, crucial research on impact, adaptation, and mitigation needs are mentioned at the start of each section and briefly discussed afterwards. At the end of the report, recommendations are made.

Impacts

The main issues on impact of climate change on forest on which research should focus are: (1) insect pests, (2) species distribution, and (3) uncertainty of predictions.

(1) The impact of insects might become of major importance in Europe as it has already been recorded in other regions as North America (e.g. Logan et al. 2003). Research on insects should distinguish between: (i) those insects that are already considered as pests; (ii) those that are pests in certain locations but might change in their geographical distributional range; and (iii) those species that have not been reported as pests but that under new climatic conditions might become pests. On such targets, fundamental research is particularly needed on the following topics: (i) infestation thresholds (e.g. air temperature thresholds); (ii) plant-insect interactions (e.g. food web); and (iii) their responses to increased atmospheric CO_2 concentration and temperatures.

(2) Climate plays an essential role on plant establishment and plant survival (Woodward 1987). Therefore, climate change might cause shifts in plant distributions (Lenoir et al. 2008). However, many other non-climatic environmental conditions greatly affect plant establishment and survival (e.g. soil conditions, inter-species competition, geographical barriers for species dispersion). Therefore, further research on the future distribution of species has to carefully account for both climatic and non-climatic factors. In other words, the concept of 'potential climatic envelope' in which species would be able to live, should be treated with caution (Pearson and Dawson 2003).

(3) Any experimental and modeling method inherently contains approximations that impart uncertainty to the results. Whereas uncertainties in experimental data can be generally described in detail and strategies to reduce them are known, uncertainties in model simulations are generally more difficult to estimate and reduce. In fact, uncertainty in model simulations can originate from many causes (e.g. model assumptions, computational techniques, model parameters, initial system values) whose weight and level of interaction are commonly unknown. Reducing model uncertainties is one of the most important research goals for producing projections of climate change impacts on forests. This will both advance scientific knowledge and support policy makers and practitioners in their decision making. For instance, an impact predicted with high level of certainty will surely deserve more attention than other impacts predicted with low level of certainty. The joint use of several models, the comparison among models and the collection of large validation datasets will likely reduce model uncertainties.

Climate change impacts are and will likely continue to be substantially different among regions. For example, in southern Europe an increase in drought stress, forest fires and a general decrease of forest growth are expected, whereas in northern Europe an increase in wind damages, a decrease of snow cover but also an increase in forest growth are likely to occur. Furthermore, the level of knowledge vary among regions, with, in general, more detailed information for northern, central and western Europe and significant knowledge gaps in southern and eastern Europe. Therefore, research plans need to be region-specific and focus on less studied areas.

Adaptation

Adaptation of forest management practices and plans will most certainly need further research on both (1) the use of new forest species better adapted to the new climate conditions, and (2) the development of new management treatments.

(1) The use of new species or the introduction of different provenances of the current species might offer great opportunities for the adaptation of forests (Schmidtling 1994). However, it also might pose a threat to the genetic diversity of tree species. Precautionary principles should guide the practitioners if long-term research on the effects of these species substitution or genetic enrichment is not feasible.

(2) Adaptation through optimal forest management should include further research on the reinforcements of those existing practices that will likely be advantageous under future climate (e.g. shorter rotation times, heavier thinning) and on new practices such as the close-to-nature approach (Lindner 2000, Karjalainen et al. 2002). Forest research on adaptive management should always consider the effect of management on the forest services, e.g. timber production, carbon sequestration, soil protection, provision of drinking water, conservation of biodiversity, and recreational functions.

Owing to the aforementioned differences in the climate change impacts among regions, research needs will differ from region to region. Furthermore, in planning and executing research the regional differences in adaptive capacities should not be neglected. For instance, because of socio-economical, historical, and cultural reasons, southern and eastern Europe have in general a lower adaptive capacity than northern and central Europe. The full elucidation of such different regional adaptation capacity might be a promising line for further social and economical research related to forest and climate change.

Mitigation

The most important forestry related mitigation measures arise from (1) land-use change, (2) forest management (FM) to optimize both the carbon sequestration rates and the carbon storage in the forests, (3) carbon storage in the harvested wood products (HWPs), and (4) substitution of fossil fuels with forest-based bioenergy. All these measures constitute a carbon chain, where e.g. carbon sequestration potential is improved by afforestation and maintained by FM and HWP constitutes an additional long-term storage. Additionally, after any stage in the chain, one can use wood as such, or in forms of process residuals and demolition waste, as a climate neutral energy source. Below, we discuss these options separately.

(1) Promoting afforestation or preventing deforestation might have large mitigation potentials in tropical regions where currently large forested areas are being logged. The fight against illegal logging should be reinforced in European countries, where it can be of importance locally.

(2) FM can yield considerable increase carbon sequestration rates and carbon storage in the forests. Therefore, research in this direction should be strongly promoted. For example, in countries with abundant forest cover such as Switzerland, Sweden or Finland, scenarios where forests are managed to obtain the highest possible carbon storage and increase in structural wood have shown that forests might sequester 10-15% of the national carbon emissions in the short term and 5-8% of them when the situation is stabilized in the long term (see e.g. Valsta et al. 2006, Taverna et al. 2007).

(3) The key advance of HWPs as carbon sink is in the use of timber as construction material. A huge potential exists in timber construction and carbon storage in HWPs because in Europe wood usage in buildings is relatively low compared to other regions such as Northern America (Matthews et al. 2000). For example, the potential storage in HWP in Finland was estimated as 18.6 Mt C in 2005, approximately the national anthropogenic emissions during that year. Besides the fact that construction timber can store carbon for centuries, it can also substitute construction materials whose industrial production process result in high CO_2 emissions (e.g. steel, aluminium, concrete) (Pingoud et al. 2003). Furthermore, the cascade use of wood demolition waste as an energy source will result in even stronger mitigation effects. Finally, although at a shorter time scale, pulp based products also store carbon. Therefore, by increasing recycling of e.g. paper products, the time of carbon storage is also lengthened to some extent. Because these mitigation potentials are not yet generally known, all the aforementioned aspects deserve future research. Apart from technical research, further research on these topics should deal with consumer and public preferences to encourage the use of construction wood.

(4) An important and innovative aspect for mitigation through forestry is the substitution of fossil fuels with forest-based bioenergy. The use of forest based bioenergy may account for considerable reductions in fossil fuel emissions with good economical returns at a local scale. For instance, when the whole life cycle of the residential house is considered, the carbon emissions due to heating and cooling are far larger than the carbon sequestration obtained through material substitution in construction elements (Werner and Richter 2007). Thus the use of biomass as a carbon neutral energy source can reduce remarkably the carbon emission of residential areas, giving the research on this topic a high scientific and policy relevance. At European level, the potential to use forest-based bioenergy is highest in Scandinavia and the northern part of central Europe, where extended land area is available for forestry at a relatively low cost. In southern Europe instead, the profitable energy use of forest-based products is more demanding, particularly due to logistic problems of exploiting forests mostly confined in mountainous regions. In southern Europe, however, research on mitigation might focus on the establishment of new forests and coppices, producing bioenergy with short-rotation cycles. In general, increasing energy wood harvesting will however require more research efforts to assess the complex effects of such intensive harvesting on the forest nutrient cycle and the future growth of trees.

It is important to keep in mind that mitigation possibilities through forestry are limited for a given area of forest land and an absolute limit for total carbon accumulation and storage exists. However, because of the long life of trees and the long rotation cycles, it is likely that important mitigation possibilities can be exploited at least until the next century.

Recommendations

When developing forest research plans for fighting climate change, four general guidelines should be kept in mind:

(1) Impacts, vulnerability, adaptation and mitigation capacity of forests differ remarkably among different regions within Europe, and even more at the global scale. This regional dimension increases the complexity of the research tasks. Therefore, even though reducing negative effects of climate change is the main global goal in climate change research, the key forest research areas must be defined on a regional basis.

(2) Successful adaptation and mitigation strategies require an optimal biophysical knowledge of the environmental system, but also of the socio-economic factors that so crucially affect them. This requires a continuous cooperation between researchers of different disciplines (e.g. physics, ecology, social sciences, and economics), between basic and applied research and between policy makers and the other actors of the forest sectors (e.g. forest managers, scientists, public institutions, NGOs).

(3) Transferring information and knowledge within the society is crucial for fighting climate change. Research outputs should be openly accessible and, in particular for applied research, scientists should translate their findings in forms understandable and usable by the all actors of the forest sector. The development of decision support systems (DSSs) might be a way to address this need. Basically, DSSs are large datasets, information, and models obtained by research and developed into ready usable tools. If a DSS on forest and climate change integrates multidisciplinary information (e.g. data on forest ecology, vulnerability, management practices, adaptation strategies, regional specificities, socio-economic dynamics, current legislation), correct hypothesis and expert knowledge, it might be able to address simultaneously and coherently various questions of the different actors of the forest sector which face actual case studies e.g. which management practice increases most the wood production in a certain climate change scenario, how much carbon will be sequestered in one rotation in a certain region and whether biodiversity will be maintained following the actual forest practices. In other words, DSSs constructed by scientists can convert research results into information of practical use for the non-scientific sectors of the society.

(4) An important question in suggesting adaptation and mitigation strategies is their sustainability. Any action suggested by research has to be evaluated against environmental, social, and economical criteria. These are not necessarily conflicting but are likely to differ regionally.

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Role of Forest Extension in Fighting Climate Change – Forest Extension Work Group Report

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What is Forest Extension?

Forests are managed for the benefit of their owners and the society. In addition to the current knowledge of professional people, users and consumers, scientific results are used for that purpose. In the public debate forest owners are represented by forest managers, scientists by scientific experts, and the general public by non-governmental organizations (NGOs). Public policies are interacting with all of them.

Forest extension, in a broad view, aims at bridging forest managers and forest owners associations, scientific experts, NGOs and policy makers. The goal is to make information more accessible for target groups/stakeholder in the society. Another goal of forest extension is to encourage networking.

The following pairs of groups of forest extension work can be identified (Figure 2):

- Managers/forest owners associations – Forest owners
- Scientists – Policy makers
- NGOs – Society (General public)
- Scientists – Education
- Scientists – Scientists
- NGOs – Policy makers
- Scientists – Forest managers (directly)
- Scientists – Society (General public

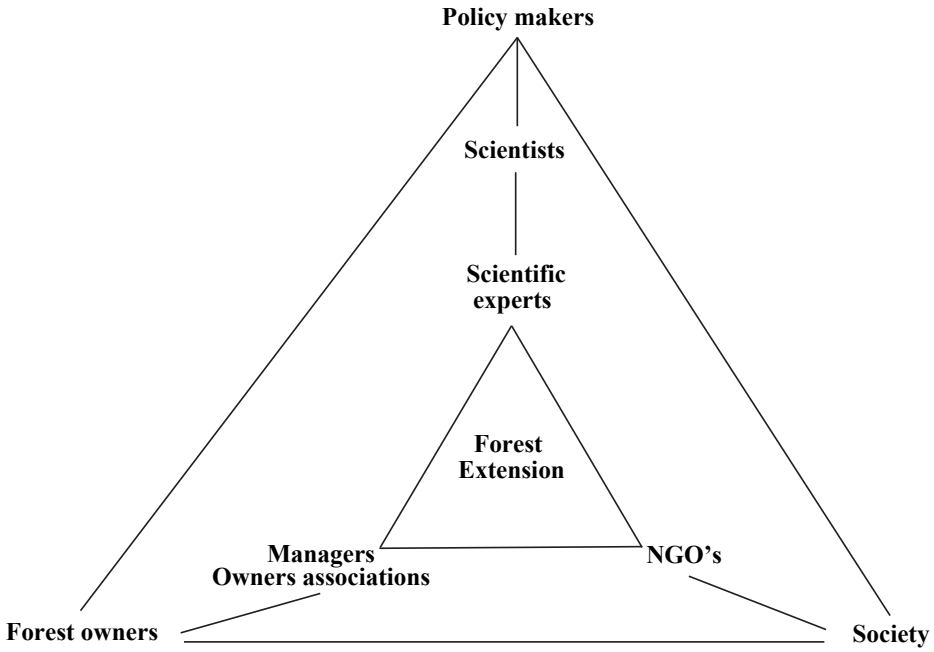

Figure 2: The role of forest extension between different groups of the society.

Why is Extension Important?

Communication between different people or groups in the society is important, though not always easy. As is very often the case, there are differences in what was said and what was understood. As a consequence, planning and management can differ considerably.

Forest extension can promote communication on forests and forest management between responsible groups and target groups as pointed out in Figure 1. It can show the importance of the ecological, social and economic functions of forests and might help to fight climate change by raising awareness on the role forests can play in mitigation and adaptation, for example. There is a need for increased awareness on the topic climate change and forests, as was made clear by many of the keynote speakers of the Joensuu Forestry Networking Week (JFNW) in 2009 (see JFNW 2009 programme, page 10).

It seems, according to the discussions during the JFNW, that especially the communication between scientists and forest owners needs improvement. For instance, nowadays, the clear evidence of climate change and the role of human influence in this change is evident (IPCC 2007, Carter 2009). Despite the existence of this evidence, still 22% of the private forest owners in southern Sweden do not yet even acknowledge climate change (Ellingson 2009). Extension can play a role by convincing forest owners that climate change is really happening.

It is essential that forest owners, managers and the general public are aware of climate change, since it will have considerable impacts on the European forests. These impacts will vary considerably between the different regions within Europe (Lindner et al. 2008). Examples of these impacts are the migration of many tree species which will be too slow to keep up with the changing climate (Birks 1989, Lindner et al. 2008, Kremer 2009) and insect pests which will probably form an increasing risk in the future (Lindner et al. 2008, Netherer 2009). It is important that these impacts of climate change and their regional differences are known by forest managers and owners, since only then they can start thinking about potential adaptive measures.
Sound communication between scientists and forest owners is also important while developing adaptation strategies (Lindner et al. 2008). This same conclusion was drawn from a case study in Austria (Lexer 2009), which illustrated that input by practitioners can provide very useful knowledge resulting also in a better acceptance in practical forestry.

Besides communication between scientists and forest owners and managers, communication between scientists of different disciplines is also important to fight climate change and its consequences for forests. Adaptation to climate change not only requires research information from natural sciences but also information from social and political sciences are important (Kellomäki 2009). A similar message was presented regarding the risks of climate change. To deal with these risks, economic sciences should also be included (Peyron 2009).

Another example for the need of good communication in general is demonstrated by Presas (2009) in annex 4.

How to Achieve the Goals of Forest Extension?

Table 2 presents different tools aimed at making group-specific information more accessible for other groups. The tools differ in scale (stand level, regional, nationwide, EU-region or EU) and according to specific target groups. In general, information regarding the public society is on a larger scale than information for forest owners. In this respect, the teacher (= responsible group) has to be aware of the specific knowledge that different target groups can handle.

The first tool listed in the table is 'network'. Network refers to an extended group of people with similar interests or concerns that interact and remain in informal contact for mutual assistance or support. This tool for instance, can be applied among policy makers, scientists, and scientific experts at an EU level or a national level. For example, Cost Action Echoes is an intergovernmental framework supported by the European Commission (http://www.cost.esf.org/domains_actions/fps/Actions/ECHOES). Its main objective is to mobilize and integrate existing scientific knowledge on expected climate change for European forest policy makers and managers (see annex 1 for more).

Another example is AFORCE, a multidiscipline network among policy makers, scientific experts, forest managers, forest owners, NGOs, and society including schools and industries (http://www.foretpriveefrancaise.com/who-are-we-461517.html). It aims to coordinate actions to adapt forests concerning climate change and to provide practical tools for forest managers (annex 2).

The second tool listed in the table is courses in forest stands. The main target groups of courses are forest owners and managers. Forest owners are often unreceptive to web-based information. A questionnaire survey carried out in Sweden, for example, indicated that forest owners would mostly like to receive information with the help of excursions (Mattson et al. 2003); this phenomena is observed in other countries too. However, a recent project on forest utilization in very small-scaled forest properties in Kanton Luzern/Switzerland shows that this attitude can change. Here, the option to organize management operations together with other forest owners simultaneously via internet resulted in financially positive outcomes and considerably increases the proportion of well managed and more stable forests (Schaffhauser 2008). Regarding forest extension work, these examples underline the importance of information media and give an impression of how perception and acceptance can vary depending on regional conditions and the topic itself.
In general, forest owners and managers are easier to convince in the forest. This is especially the case in topics like mixed stands or continuous cover forestry. Courses in forests are also promising for school classes regarding their curiosity and awaken interest.

Remote teaching is a tool for more general information aimed at the public. It can cover a range of topics from nature protection (meaning of deadwood and biodiversity to ecological functioning of the ecosystem) to forest utilization (demand of society in products originating from the forest as paper, clothes, furniture, etc.).

Lectures for journalists are meant to provide very specific and up-to-date information by researchers for people who are well trained in transforming this information into more easily accessible information for the public, and also putting pieces of a puzzle into a large and easily communicated picture. This should be organized in more open discussions than ex-cathedra teaching.

Table 2: Forest extension tools, with the scale of information, the responsible group, the target group and examples.

Tools	Scale	Responsible Group	Target group	Examples
Network	EU National	Scientists Policy makers Scientific experts Policy makers Scientists Scientific experts	Scientists Policy makers Scientific experts Policy makers Scientific experts Forest Managers Forest owners NGOs Society	COST Action ECHOES AFORCE
Courses in forest stands	Regional Stand	Scientific experts	Forest managers Forest owners	Risk Management
Personal communication	Regional Stand	every group	every group	Consultants of forest owner associations
Remote teaching	EU National	NGOs Society	Society	How does climate change affect our life?
Lectures for journalists	National	Scientists	Society (journalists)	Why is it necessary to cut trees?
Lectures for teachers	National Regional	Scientists	Society (teachers)	How many energy/ timber do we need?
Lectures in general	EU EU-Regional National Local	Scientists Scientific experts	Policy Makers Scientific experts Society	JFNW 2009: Fighting climate change
Theme weeks/ days	EU National Local	NGOs Society (e.g. school teachers)	Society	ENO Forest Week
Public media	National	Society (journalists)	Society	TV program: (e.g. Green Gold in Finnish TV4)

Table 2 cont.: Forest extension tools, with the scale of information, the responsible group, the target group and examples.

Tools	Scale	Responsible Group	Target group	Examples
Professional journals	National Regional	Scientific experts	Forest owners Forest manager	Forst & Technik (in German)
School books on forests and forestry	National	Society (Scientists, NGOs, and teachers together)	Society (pupils)	School book on forestry by WWF Russia
Lobbies	EU National	Society	Policy makers	Timber mobilization
Round table meeting + ideas call	EU	Policy makers	Society	CEN Energy Center
Questionnaire survey	National EU	Scientific experts Scientific experts	Policy makers Scientists Scientific experts Forest owners Forest managers NGOs Policy makers Scientists Scientific experts Forest owners Forest managers NGOs	Forest owners' perceptions of risk, uncertainty and climate change (Ellingson 2009) Forest agencies' early adaptations to climate change (Reyer 2009)
Consultancy	Regional	Forest owners' association	Forest owners	Forest management plans, guiding and helping forest owners in decision making (Lappalainen 2009)

In lectures for teachers, given by scientists, the scientist has to prepare his presentation as more easily understandable with clear messages. In the preparation work, teacher associations should be involved. During the lectures, enough time for discussion should be given.

Lectures in general are listed here as a tool, because many forms of education and communication between different groups of the society are possible. An example from China is presented as an illustration in annex 3. It is a good and broad approach to make scientific knowledge and research findings more accessible to everyone.

Theme weeks or theme days are a widespread tool in many countries. One example from Germany are games for the youth in the forest (Waldjugendspiele), organized by a NGO and several state

forest administrations. School classes visit the forest for one day with their teacher and a forester. The program is elaborated by professional environmental educators and pedagogically trained foresters (see an introductory video on http://www.wald-rlp.de/index.php?id=5469 or http://www.sdw.de/waldpaedagogik/waldjugendspiele.htm, both in German). Similar activities are organized in Finland, Austria and other countries. These theme days are considered as a successful tool for achieving long-term impacts. From the forestry perspective it seems important, that the public state forest authority is involved and present during these events, because the forest is the authentic place to explain forest management regarding pros and cons of nature protection and decarbonization.

Public media uses a similar scale like remote teaching with the same target groups. However, political messages like above, that the use of forest resources is necessary as well as their protection, for example, can probably be more easily stated and explained in newspapers.

Professional journals differ very much from public newspapers. They provide very detailed information for a very specific group, using the professional terminology. Most of the people in the society would get bored reading such journals. On the other hand, this particular group can be more easily convinced of the need for a climate adapted forest management.

School books are an investment for the long-term knowledge development, and are incredibly important for the future! It would be very good, to include at least a chapter on forests and forestry in biology school books. That may awaken even more interest in ecological issues in general for some pupils.

Bringing lobbyists together can result in endless arguing due to different philosophies behind them. However, if these people are professionals aiming for some progress, it can be a powerful approach. One positive example is the initiative of timber utilization by a German timber factory (Pollmeier), working together with a German state forest enterprise (Thüringenforst) and a German university (Georg-August-University Göttingen). Another example could be stated by inviting nature conservation and timber production lobby groups together with neutral politicians and experts into the forest to discuss specific options for forest management options.

Round table meetings with idea calls in advance is a new means of generating new ideas. The potential of practically feasible ideas by ambitious individuals might have been underestimated in the past.

Questionnaires are a method used by politicians and market economists. It is not a tool of extension work, but it can be used to evaluate extension work that has been done.

Consultancy is a widely used tool in large forest companies and in state forest agencies. It refers mostly to solving specific problems at stand level.

Besides the spatial scale of forest extension work regarding climate change impacts, the temporal scale is also important. Political implications depend on the time scale. It is really worth communicating these differences, because implications differ dramatically if one refers to the year 2020 or 2100! For example, a total protection of European forests would result in higher carbon sequestration over the next 20 years, while we would expect much greater storm damage after 40 years under this scenario. Including forest management and wood utilization will result in a higher carbon sequestration in the long run as presented by Böttcher (2008) or the model for Sweden by Gustavson (2009).

Recommendations to Improve Forest Extension Work

During JFNW 2009 many issues on forest and climate change were raised which have links with extension. The following two topics were mentioned by many of the keynote speakers and seem most important to developing extension work in the future:

- Communication is needed, within the research community and the society! Many ecological but also economic factors affect climate change. It is not only the forest system itself that affects greenhouse gases and is affected by greenhouse gases, but it is also the society surrounding the forest which is affected by forest and which affects the forest. Therefore the topic climate change cannot be handled by one kind of science only. Communication between natural and other e.g. social sciences is essential.
- Pay more attention to varying scales! The different actors shown in Figure 1, like forest managers, forest owners, politicians and scientists, often operate and think on different scales (both spatially and temporally). These different scales on which people operate complicate communication and it is therefore important that people are aware of these differences.

The knowledge of forest ecologists and forest managers is a very important and valuable part of information. However, the question can be raised, of whether these specialists are able to manage forest extension efficiently. Especially taking emotions into account, when people with different philosophies meet each other, it can be difficult to use rational arguments. For that reason, pedagogical knowledge should also be used.

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Annex 1

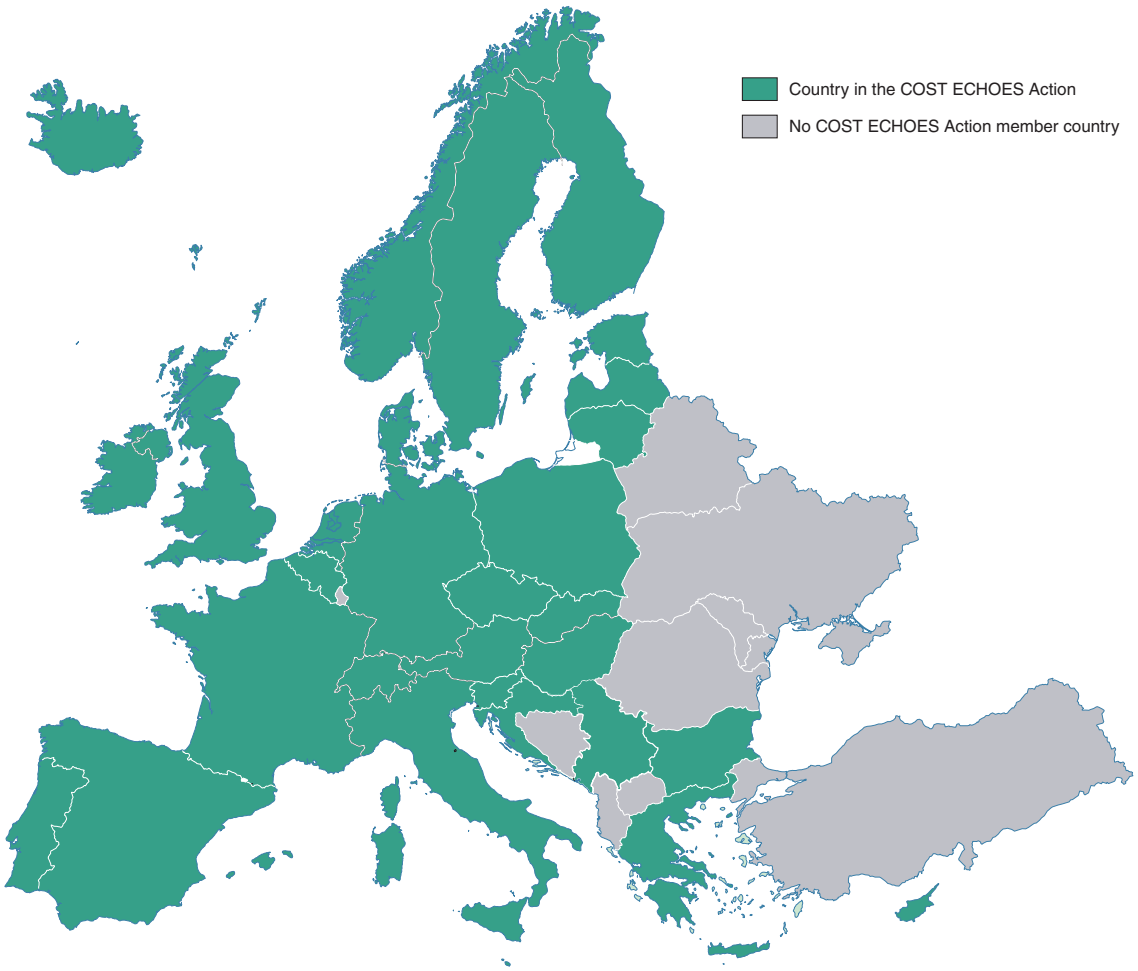
Cost Action ECHOES – Expected Climate Change and Options for European Silviculture

Network origins

The forests vulnerability to climate change depends on the potential impacts of this latter and the forest adaptation abilities (natural and anthropogenic abilities). If the impacts of climate change can be limited, at least in the short term, the forest must be able to adapt but also play a role in mitigating the effects of global climate change over the long term (the forest as carbon sinks). Aware of gaps and questions about these topics, Ecofor has decided to propose a way to reflect on these issues through cooperative action at a European level.

Participants' origins

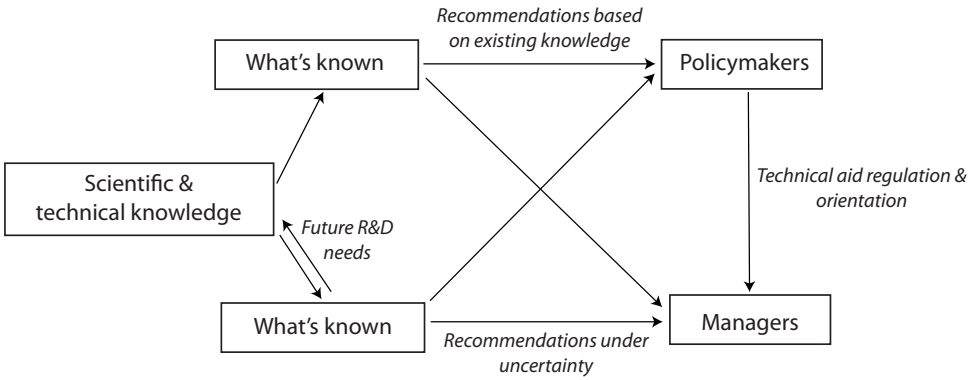
26 countries



Network goals

Main objectives:

To mobilize and integrate the existing scientific knowledge for European forest policy makers and managers.



Secondary objectives:

- Suggesting ways to improve the capacities of prediction about the future of the forest and measuring the importance of unavoidable uncertainties and adapting to them;
- Elaborating the IPCC objectives concerning the European forest context and supplying a European forest contribution for the next assessment report;
- Supplying a European forest contribution in the frame of the Kyoto Protocol's second commitment period;
- Identifying the needs on future research and development projects.

Network topics

The network is organized in three connected working groups: Impacts, Adaptation, and Mitigation of forests to climate change; each group is managed by a selected leader.

Expected results

- A regular newsletter to involved scientists;
- A biannual information letter to policy makers;
- Country Reports organized according to the three topics (impacts, adaptation and mitigation) and concerning the progress of research in each involved country;
- Decision making tools for European forest policy makers and managers.

Network actors

Scientists from involved countries organized around the following actors:

- Jean-Luc Peyron, Chairman;
- Klaus Seeland, Vice-Chairman;
- Heinrich Spiecker, coordinator of the Working Group Impact;
- Manfred J. Lexer, coordinator of the Working Group Adaptation;
- Gert-Jan Nabuurs, coordinator of Working Group Mitigation.

Technical information

Duration: 4 years (2008–2012)

Economic dimension: €20 million

Link: http://www.cost.esf.org/domains_actions/fps/Actions/ECHOES

Annex 2

AFORCE - Technological Mixed Network: Forests adaptation to climate change

Definition

- Network: facilitate collaborations inside and between fields.
- Mixed: prompt exchanges between actors from research, management, development, teaching and formation sectors.
- Technological: provide operational tools.

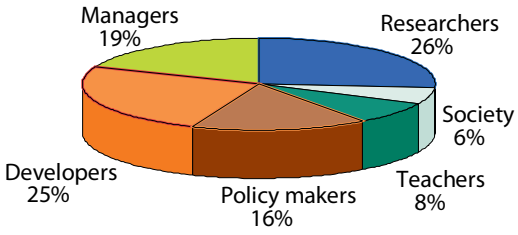
Network origins

Recent and collective awareness of the substantial influence of climate change on forest ecosystems, which resulted in several important needs:

- multidisciplinary expertise to improve the diagnosis;
- clear recommendations for managers;
- accelerated transfer of information; and
- regular update of the knowledge.

Participants' origins

- Teaching
- Research
- Society
- Management
- Politics
- Development



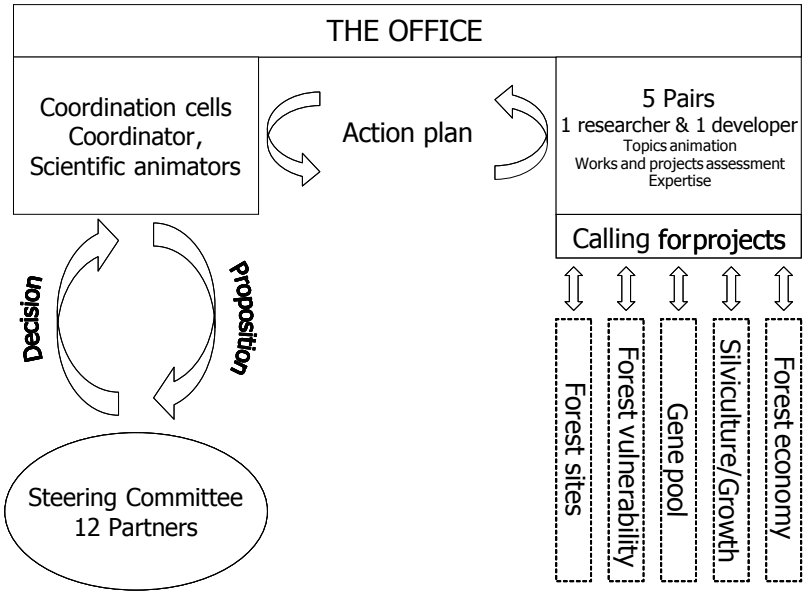
Network goals

- Quickly provide decision making tools to managers;
- Mobilize, structure and circulate information to managers;
- Coordinate initiatives which contribute to get, spread and experiment knowledge;
- Structure abilities networks on the topics of climate change; and
- Promote the emergence of collective projects.

Network topics

- How to characterize forests sites in a dynamic and evolutionary way?
- How to define, explain and map forest stands and ecosystems vulnerability to climate change?
- How to manage, promote and keep gene pool of forest trees?
- How to model forest stands growth subjected to climate change and to adapt their silviculture?
- How to take into account climate risks in the economical assessment of management decisions?

Network actors



Technical information
Duration: 3 years (2008–2011)
Economic dimension: €300 000
Link: http://www.foretpriveefrancaise.com

Annex 3

Example from China to make scientific work and findings more accessible to everybody

Institution

Division of science and technology extension, Northwest Agriculture and Forestry University, Yangling, Shaanxi, China

Main aims

- Responsible for science and technology promotion, technology demonstrations, base construction, transformation of science and technology achievements, help the poor with science and technology, and introduction of foreign science and technology.
- Responsible for the project establishment, demonstration, approval, and management of any projects and for the promotion of funding for any projects.
- Responsible for the collection, propaganda, and report for the agri-science technology information. Responsible for dissemination of the scientific and technological knowledge, bring the science and technology to rural China.
- Responsible for coordination of science and technology promotion in the basic unit.

Achievements

- Experimental stations: Kiwi, tea, melon, apple, grape, etc. (not only in Shaanxi province, but also established in other cities, such as in Shanghai).
- Demonstration sites: flower seedlings, dairy farming, fruit, agriculture, strawberry, etc.
- Experts database
- Experts telephone advisory service

Technical information

Link: http://en.nwsuaf.edu.cn/

Annex 4

An example for the need for good communication (Presas 2009, EFI News 1/2009).

Network Speaks

Good communication – a strong weapon

Communication is the only way we can give a face to our industry and disseminate the forest based sector's messages. It gives us the opportunity to talk with authority and become trusted and valued.

We all have a responsibility to explain and educate about the role of our industry as forests are very close to people's hearts and carry very emotional connotations. "Working" on forests, is currently perceived as destroying them, or at least damaging them. We must convey the message that it is by working in the forest that they are better preserved and that forest based products, such as wood and paper, are essential in our everyday life.

We must also recognise that the people we need to influence and inform are not sitting next to us in our offices or plants but may be quite divorced from our daily operations and activities and as such unaware of our working language. We must always keep communications simple and short.

Our opponents excel in targeting the right audiences with the right messages and we need to learn from this. But we have a great story to tell and many misconceptions to correct. Our raw material for example is a living material, constantly regenerated and in constant growth but this natural and renewable element is ignored while competing materials that are using non-renewable resources are accepted without question.

We must recognise that most people are ignorant to the real situation regarding our industry and our products and we are the only ones who can act to change perceptions.

We must also look to the future and the next generations and understand how they communicate and learn. We underestimate, at our peril, the power they have in influencing decision making and in changing behaviour.

Good communication is the strongest weapon we have in our armoury. Let's use it well.

Teresa Presas
Managing Director, Confederation of European Paper Industries (CEPI)

2 • EFI News 1/2009

Summary and Conclusions of the Joensuu Networking Week 2009 – Key Findings of the Work Group Reports

The four previous chapters of this Working Report present the group work reports of the *Joensuu Forestry Networking Week 2009*. Those reports discuss how climate change issues such as impacts and adaptation, uncertainties and risks and mitigation should be considered in the formulation of forest policy, forest management, forest research and forest extension for fighting climate change. The group reports were prepared during the networking week and presented for discussions on the last day of the event. Written reports were then reviewed by the Scientific Organizing Committee, and according to its comments, the participants finalized the reports for this publication.

The group work reports raised a number of valuable observations and recommendations for fighting climate change. Some key issues of the group work reports and discussions are collected for the summary below.

In discussing the potentials of *forest management* for mitigation, the following options and frame conditions should be understood, among other things:

- Mitigation has to look at the entire land use system to be climate effective. This holds for system boundaries (to cover land use related sectors) and the spatial extent of measures (to avoid leakage).
- Forest management has potential for mitigation in Europe, but is rather limited compared to large potentials of bioenergy, material substitution, afforestation and avoided deforestation in the tropics.
- Forest management implies decisions on harvested wood products and their lifetime and can therefore also indirectly influence mitigation in the wood product sector by increasing carbon stocks in products. However, the market situation has to be considered when potentials for this measure are estimated.
- European renewable energy targets and general increasing demand for bioenergy will have implications for forest management through market shifts due to competition, changes in silviculture and through biodiversity issues related to bioenergy.

Research is an important field of action to enable understanding of the consequences of climate change as well as efficient measures for fighting it. One should, however, understand the role of research, which cannot be efficient if implemented in isolation or without proper communication:

- Impacts, vulnerability, adaptation and mitigation capacity of forests differ remarkably among different regions within Europe. Therefore it is important to define key forest research areas at the regional level.
- Successful adaptation and mitigation strategies require an optimal biophysical knowledge of the environmental system but also of the socio-economic factors that so crucially affect them. This requires successful multi-disciplinary cooperation between researchers between different disciplines, between basic and applied research and between policymakers and the other actors of the forest sectors (e.g. forest managers, scientists, public institutions and NGOs).

- Transferring research based information and knowledge within the society is crucial for efficient fighting against climate change. This requires information and knowledge distribution to non-scientists to support their decision making.
- Proposed adaptation and mitigation strategies should be evaluated in terms of their impacts on sustainability measured with environmental, social, and economical criteria. Research can help in estimating the overall consequences of different strategies.

Many issues on forests and climate change have links with *forest extension work* which can be defined as promotion of communication on forests and forest management among and between different groups of the forest sector and the rest of the society. Especially the following topics are important for developing forest extension work in the future:

- It is not only the forest system that should be considered with impacts, adaptation and mitigation of climate change, but also the society surrounding them. Communication is needed to build a bridge between the research community and the rest of the society.
- Many ecological but also economical factors affect climate change. Therefore the topic of climate change cannot be considered as a property of one kind of science alone. Communication between natural and other e.g. social sciences is needed.
- Forest managers, forest owners, politicians and scientists often operate and think on different scales (both spatially and temporally). These differences are necessary to understand before communication between different interest groups can work.
- When people with different backgrounds or ways of thinking meet it is hard to use rational arguments alone. Pedagogical knowledge should be applied for efficient communication.

Forest policy has a significant role in fighting climate change as it, in principle, defines the objectives and targets for forest use and coordinates the efforts for forest management. In the EU, the lack of a common forest policy has led to a situation where policy has grown increasingly fragmented across EU institutions and across EU and national level institutions. This has consequences also on the aim for fighting climate change: the EU has few options to directly coordinate decision making in forestry that would lead for better adaptation or mitigation to climate change in the member states. Key recommendations for action to improve the situation include:

- The degree of policy integration across the various institutions and levels of forestry governance at the European level should be improved. A greater degree of policy integration at the EU level and across the EU, national and local levels should also be achieved.
- At the same time as higher policy integration is needed, the policy efforts must allow for considerable flexibility for actions across the EU, national and local levels. This is because the impacts of climate change and options for adaptation or mitigation vary dramatically across the EU, requiring quite varied responses from location to location.
- As continued reports of the urgency of climate change and global warming continue to pour in, it becomes increasingly clear that EU policy efforts can wait no longer. Actions are needed now!

Three most interesting themes for JFNW 2009 follow-up actions

A workshop was organized on the last day of the JFNW 2009 aiming to find 2-3 themes for follow-up actions for the event. The workshop was organized following the common structure of innovation workshops. The principle idea of innovation workshops is to list as many ideas as possible, discuss which are the most promising and interesting ideas, and in this way work to find the best ideas for implementation.

The workshop was implemented in five steps. Steps 1 and 2 were carried out in the working groups. Steps 3-5 were implemented with all groups together:

Step 1: The long list of ideas
- The individual working groups had a task to create a list of at least 10 ideas for follow-up actions that would continue networking and make fighting climate change possible.

Step 2: The short list of most promising themes
- Next, the working groups discussed to agree 2-3 detailed ideas for follow up actions, based on the original long list of 10 ideas from step 1.

Step 3: Introduction
- Working groups presented their 2-3 ideas for follow-up actions to the other groups.

Step 4: Voting
- Each participant had five votes to be distributed between the ideas that she/he thought would be most effective or necessary as follow-up activities. The votes could be spread across five different ideas, or all five votes could be given to one theme if the participant so desired. Any combination in between these extremes could be used as well.

Step 5: Agreeing the next steps for the three most interesting themes
- All votes were calculated, and the top three themes were brought up for continued discussion by the entire group of participants.

The three best ideas for follow-up actions were:

Web-site (35 votes):
The most effective or necessary option for follow-up action was to create a JFNW web-site. It could be used for distributing information relevant for the organization of the JFNW as well as the files distributed during the week. The web-site could also work as a discussion forum for the participants, as a platform for developing short-term projects, papers or joint works (e.g. carbon footprint of the JFNW), for developing models of the climate change and for raising up various bioenergy themes and issues. The web-site would be important for keeping the network created during the JFNW alive.

The web-site could also include information on job offers, projects, project proposals under planning, interesting links and discussion on interesting papers or articles. If established in a Wiki style, the maintenance of the web-site would be easier as the participants could also update the information.

The web-site could be developed on expanding the existing JFNW web-site. Participants could provide some content as well as give feedback for developing the site.

Joint scientific papers (25 votes) and defining a research agenda (16 votes):
The participants considered that it would be important to use the JFNW network to prepare joint research papers and reports, discussing research needs and agendas as well as for proposing new research topics for funding. Writing and publishing research papers would be simplest if just utilizing the network; first defining gaps in the research information and then finding other researchers to work for joint research papers. Discussion on research agendas and proposals for research projects could be developed via the web-site. It could form a platform for proposing new ideas, discussion and network building necessary for joint proposals.

Feedback from the participants

Sixteen participants named personal growth and development as the main reason for attending the JFNW 2009. Other reasons included the program (14) and networking (11).

Question 3. Please specify the main reason for attending the JFNW:
Program content: 14 answers
Networking: 11 answers
Personal growth & development: 16 answers
Possibility to meet the keynote speakers: 4 answers
Supervisor recommended: 4 answers
Other, please specify: 2 answers (also location (here in Joensuu), chance to visit Joensuu)

Of the respondents, nearly all thought that the JFNW fulfilled the reasons for attending the event. The most beneficial aspects of the JFNW included "networking and information exchange", "good lectures", "interaction of speakers and participants" and "workshops were an excellent idea".

Some improvements were also suggested including: "the keynotes were quite general and similar"; "presentations could have been focused to special issues"; and "too much information". Also the "format of final document" and the "mentors' role" should have been better defined in advance. Some participants were not fully convinced about "what is the usefulness of the final report".

Question 4. Did the JFNW fulfill your reason for attending?
Yes absolutely: 16 answers
Yes, but not to my full extent: 6 answers
No: 1 answer

Considering the pros and cons of the JFNW, the participants were asked if they would recommend their colleagues to participate in the coming JFNW events Forests and waters in 2010 and Forests and energy in 2011. Notably many, 22 out of 23 respondents chose the option: "Yes-absolutely".

Question 23. Would you recommend the JFNW 2010 "Forests and Waters" and 2011 "Forests and Energy" to your colleagues?
Yes – absolutely: 22 answers
No: 1 answer

1 JFNW 2009 group picture in front of Metla House in Joensuu, Finland (Photo: JoY/Varpu Heiskanen). 2 JFNW 2009 forest research group work. 3 JFNW 2009 Poster session. (Photos: Metla/Markus Lier)

4 JFNW 2009 Forest management group work. 5 JFNW 2009 field trip. 6 JFNW 2009 discussions during the coffee break. (Photos: Metla/Markus Lier)