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22 December 2006

Background Paper for the Workshop

Mobilizing Wood Resources

Can Europe's Forests Satisfy the Increasing Demand for Raw Material and Energy under Sustainable Forest Management?

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This background paper has been prepared with the sole objective of stimulating discussion at the workshop. The themes, which the workshop addresses, are surrounded by uncertainty and are in some cases controversial: no comprehensive, accepted data and analysis exist, although many elements are available in different sources.

Rather than using weak data quality as an excuse to avoid meaningful analysis of the situation, the authors have preferred to make estimates and assumptions, as openly as possible. They are well aware of the weaknesses and dangers of such an approach, but ask workshop participants to use the arguments and data in a constructive manner. In any case, they hope it will be possible to make more detailed and solid analysis in the future.

Furthermore, very little time was available to complete this paper in time for the workshop. It is hoped that it will be possible to revise and improve the paper, possibly through a wider review process, later.

In any case, comments, suggestions and corrections are welcome.

The opinions expressed in this background paper do not reflect the positions of any of the sponsoring organizations.

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Abbreviations

BAP	Biomass Action Plan
BIOFRAC	Biofuels Research Advisory Council
CEPI	Confederation of European Paper Industries
CIP	Competitiveness & Innovation Programme
ECE	Economic Commission for Europe
EFI	European Forest Institute
EFSOS	European Forest Sector Outlook Study
EU	European Union
EC	European Commission
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GPS	Global Positioning System
IEA	International Energy Agency
LULUCF	Land Use, Land Use Change and Forestry
LUW	Liaison Unit Warsaw (from MCPFE)
MCPFE	Ministerial Conference on the Protection of Forests in Europe
Mtoe	Megaton of oil equivalent
PPP	Public Private Partnerships
R&D	Research and Development
RTD	Research and Technological Development
RES	Renewable energy source
SFM	Sustainable Forest Management
SRA	Strategic Research Agenda
TP	Technology Platforms
UNECE	United Nations Economic Commission for Europe
UNFCC	United Nations Framework Convention on Climate Change
WRME	Wood Raw Material Equivalent

1. Outlook for supply and demand for wood [1]

For several decades, the harvest from Europe's forests has been lower than the sustainable level and the sector's concerns in most regions have been more with finding outlets and remaining economically viable than with preventing over-cutting or mobilizing scarce wood supplies. However, the rapid increase in demand for renewable energy, including wood energy is profoundly changing the balance of the sector: concern has been expressed about increasing harvesting over sustainable levels to meet the demand for energy wood. Are such fears founded in reality?

Is there an imbalance between supply and demand of wood? Does such an imbalance exist now, or is it developing? And if so, where and how large? To answer these questions requires quantitative scenarios of supply and demand, and a good understanding of the assumptions on which these scenarios are based.

This section analyses separately the supply-demand balance for industrial wood and for energy wood, as the data quality and driving influences are very different. Then it assesses the outlook for wood supply as a whole, as industrial roundwood and energy wood are, at least in part, substitutes: all wood can be burned, and technical advances mean that lower quality wood, formerly only suitable for energy wood, can be used for panels, pulp and even sawnwood.

A crucial factor for both industrial and energy wood is the use of residues and recovered wood, which must be fully integrated into complex balance calculations.

This section does not present once again basic data on the forest resource or forest products markets, which are easily available in other ECE/FAO publications.

1.1. Supply and demand for industrial wood

The European Forest Sector Outlook Study (EFSOS), published in 2005, prepared a baseline scenario for 2000-2020, based on assumptions of moderate economic growth (1.3% p.a. in Western Europe, and around 4% p.a. in Eastern Europe and CIS), unchanged competitivity of forest products and stable prices for roundwood and products. The basic developments, for Western Europe, are summarised in the two graphs (Fig 1 and 2). For full information on methods and assumptions and more detail, readers are referred to EFSOS and its accompanying documentation. In very broad terms EFSOS foresees steady growth of consumption and production of forest products (faster for paper and panels, slower for sawnwood) and a corresponding growth in all the components of fibre supply: recovery of paper and use of residues are expected to grow faster in Western Europe than removals from the forest. The latter are however expected to grow steadily.

[1] Chapter prepared by Kit Prins, UNECE/FAO Timber Section

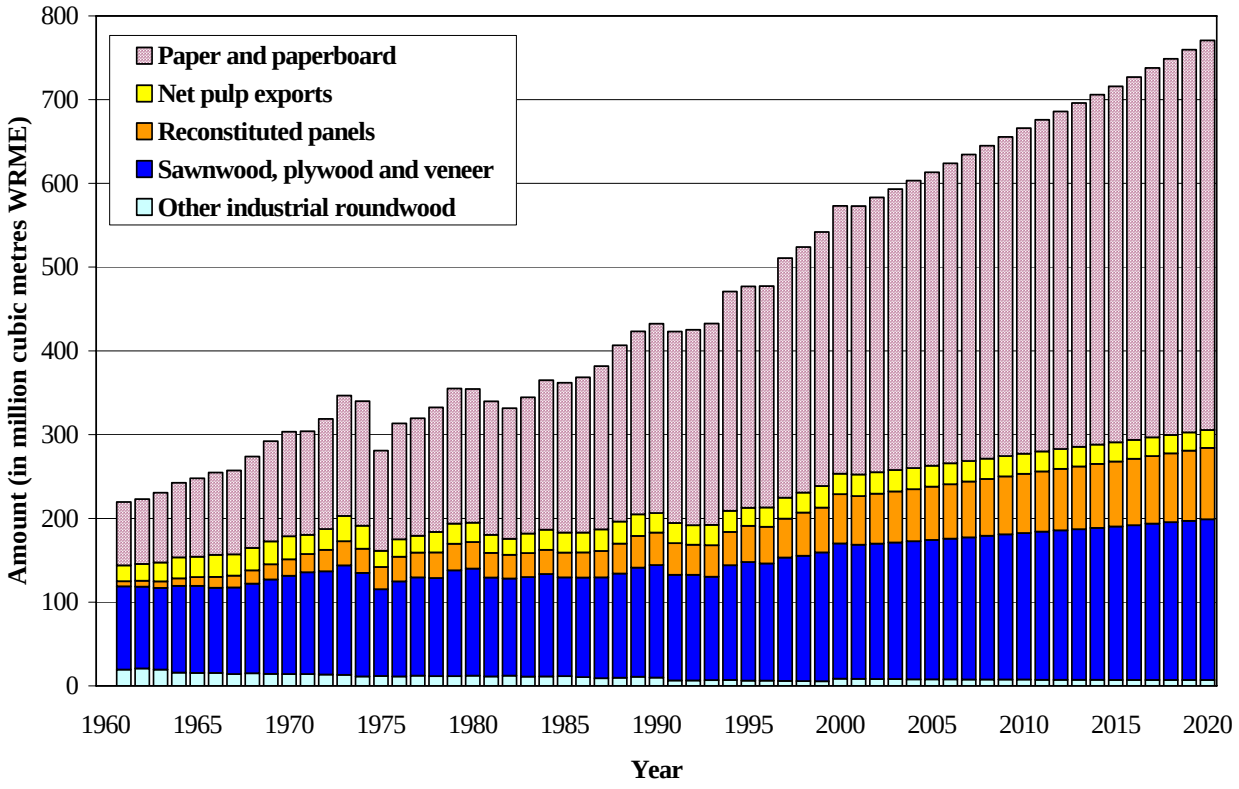

Figure 1: development of wood consumption in western Europe until 2020, (Source: EFSOS)
WRME: wood raw material equivalent

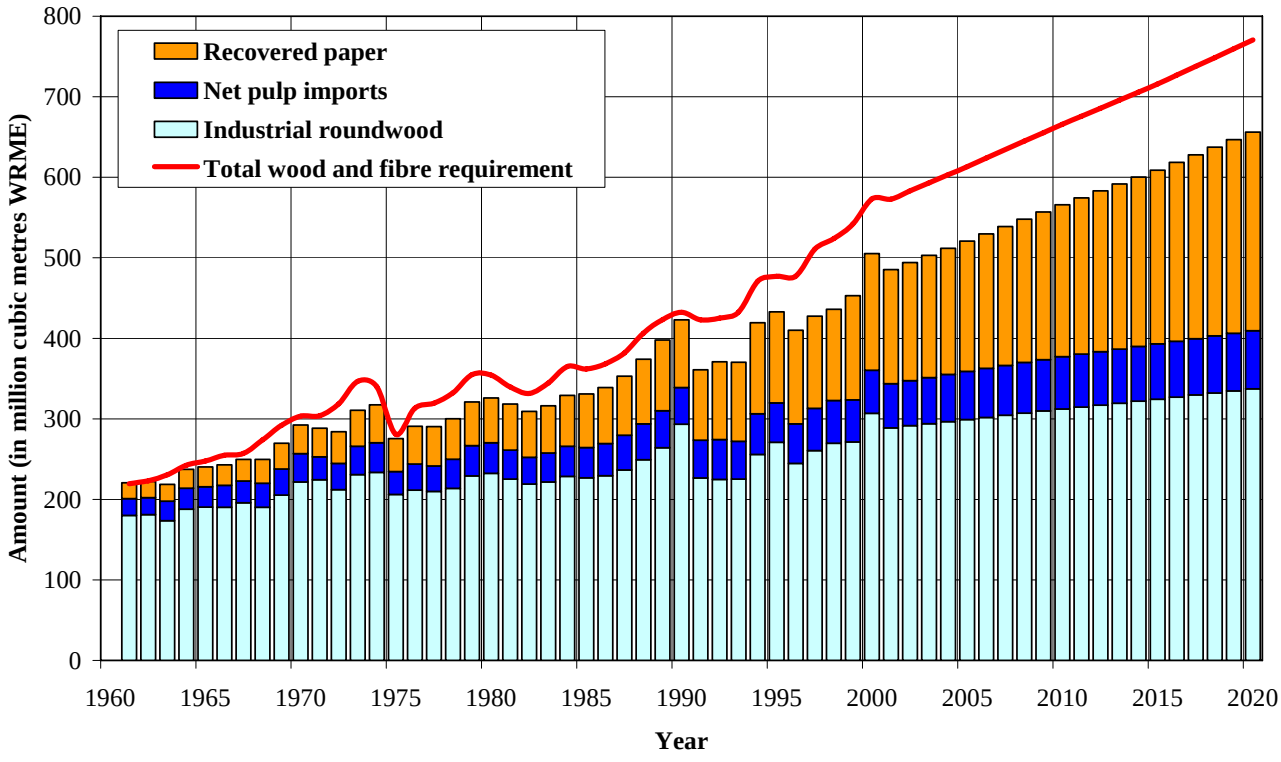

Figure 2: Development of wood and fibre requirement in Western Europe until 2020 (Source EFSOS)
WRME: wood raw material equivalent

Recently, developments between 2000 and 2005 have been compared with the EFSOS scenarios (analysis to be published shortly as an ECE/FAO Discussion paper): this confirms that for production and consumption of industrial wood and forest products, real developments have been broadly in line with the EFSOS projections. One exception has been the gradual but steady rise in prices of roundwood and processed products, since 2000, whereas EFSOS assumed constant prices, and a long term decline in real prices has been observed for several assortments

1.2. Supply and demand for wood energy

The situation and outlook for wood energy is less well understood and has far greater uncertainty, for at least three major reasons:

- The volumes and types of wood used for energy at present are not well measured;
- The factors determining trends are not well analysed or understood;
- The factors determining long-term trends appear to have changed radically with the rise in the price of fossil fuels, and the policies for climate change and renewable energies, all of which tend to encourage the consumption of wood for energy.

The questions facing the international community in Europe are therefore:

- How much wood is used for energy at present, from what sources, for what purposes? And how much of this comes directly from the forest resource?
- What is the future demand for energy wood, taking account of the policy goals?
- Can the forest and wood resource supply the expected demand and under what conditions?

A detailed and comprehensive quantitative study, along the lines of EFSOS, but with more robust scenarios for wood energy, would be desirable to answer these questions. Nevertheless, certain elements of a reply are now becoming available, which are presented and discussed below.

1.2.1. Present situation of wood energy

A study under way by a group of international agencies (ECE, FAO, IEA, European Commission) estimates the current pattern of supply and use of wood energy in 12 major European countries, accounting for 63% of European roundwood consumption (excluding Russia and CIS countries).

[million m^3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (S1+S2+S3)	%
S1 Direct	3,7	1.4	81.5	86,6	44
S2 Indirect	18.2	71,8	6,5	96,5	49
S3 Recovered	12.9	0.4	0.1	13,3	7
Sum (U1+U2+U3)	**34,8**	**73,5**	**88,1**	**196,4**	100
%	**18**	**37**	**45**	**100**	

Table 1: Source of wood energy and users for 12 European countries (Source Joint Wood Energy Enquiry, under preparation)

Source of wood energy:

S1 Direct, essentially wood used for energy directly from the forest

S2 Indirect, which is mostly residues from wood processing industries

S3 Recovered, which is wood products, which have been used for their original purpose (e.g. pallets, construction wood, furniture) and are then used for energy

Use for wood energy:

U1 Power and heat, which refers to the generation of electric power for the grid and heat for sale, outside the producing (forest) companies (industries).

U2 Industrial, which refers to energy used internally by the forest industries

U3 private households

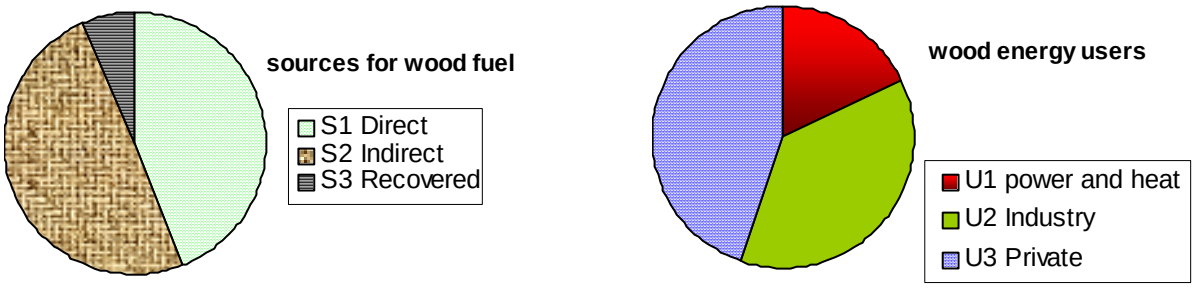

Figure 3: source for wood fuel and wood energy users (see also Table 1)

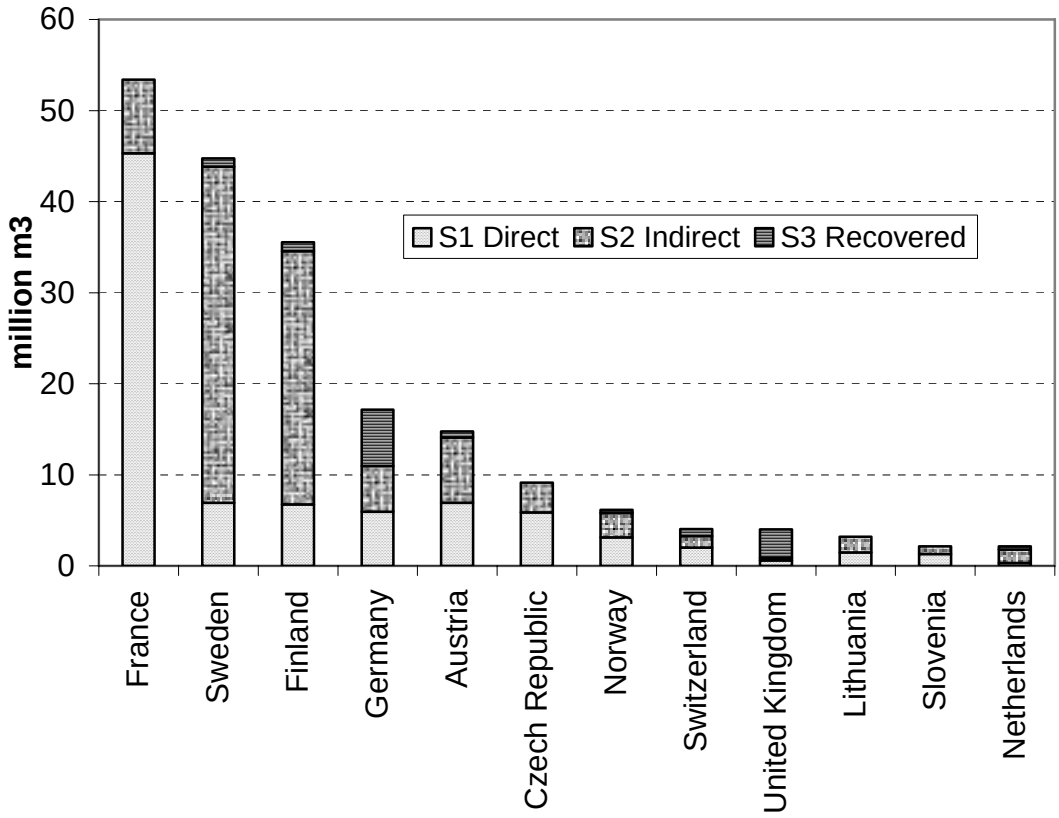

Figure 4: Sources of wood energy in 12 European countries

This shows, among other things, that wood energy supply and use is much larger than previously recorded, and that in most countries ”indirect” wood energy (i.e. by the forest industries) is the major component of

wood energy supply. An exception is France, which estimates its direct wood energy supply (from forests and trees outside the forest) at over 40 million m^3/year.[2]

Extrapolating from the 12 countries studied to Europe (without Russia) as whole[3] gives a very rough estimate of the *direct* supply of wood energy of about 250 million m^3/year, as opposed to the figure used by EFSOS of about 60 million m^3. The higher figure appears to be more realistic. The complex, local, sometimes non-recorded, pattern of use of wood energy has developed over many years and is suited to local conditions, although those conditions have changed significantly over the past 10 years with the arrival of larger scale district heating and combined heat and power units.

1.2.2. Future demand for wood energy

The future level of supply, consumption and price of wood energy will be determined by a multitude of factors, but especially by:

- The price of competing energy forms, notably fossil fuels
- The nature and level of policy support for wood energy, whether for reasons of renewability, security of energy supply or other reasons (see chapter 2 and 4)
- Competing demands for wood, notably from the "traditional" wood using industries
- The composition, needs and attitudes of forest owners
- degree of constraint on intensity of forest management set by biodiversity conservation and/or protection requirements (see chapter 5)
- The ability to mobilize the resource: marketing and logistical infrastructure, at present, in many regions, is extremely weak and inflexible. (see chapter 3)
- The behaviour of forest owners and managers and their willingness to harvest/supply

The strongest motors for change are undoubtedly the energy price and energy policy objectives. The present high energy prices are already causing investment in wood burning equipment and a rapid, even if unmeasured, increase of wood used for energy.

To assess the strength of future demand for wood energy, it is necessary to examine the multiplicity of targets and plans at national and international level for renewable or biomass energy. Unfortunately for the calculation of the supply demand balance for wood, few of these specifically identify wood biomass, which is included alongside agricultural residues and crops, municipal solid waste and other types of biomass, all with very different supply characteristics. (In the EU, up to 2004, wood has consistently been recorded as providing about 80% of the biomass used for final energy consumption) Within wood biomass, little distinction is made between wood from the forest, from industry or recovered wood. The EU Biomass Action Plan estimates the potential for biomass energy as shown in Table 2,and provides an order of magnitude of what policy makers for the energy sector expect from wood. Although, the plan refers to "potential", these figures coincide roughly with the overall biomass targets. The supply of direct wood energy (not including the expected contribution from industry residues or recovered wood) may therefore be expected – by policy makers - to increase from about 160 million m^3 in 2003 to about 260 million m^3 in 2010, an increase of 100 million m^3 (60%) in 7 years.

Can the European forest expand its supply by such a large amount in such a short time? To obtain a preliminary response it is necessary to look at the overall wood supply/demand balance, while bearing in mind not only the considerable uncertainties but also the major local and regional variations.

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[2] It is not yet clear whether France is a special case in its wood energy supply pattern or whether there are other countries with similar under estimations which have not yet "discovered" the size of rural wood energy use, as well as wood from urban and amenity trees).

[3] Assuming an average of 1.5 m^3/year of direct energy supply per rural inhabitant.

	Consumption 2003 [Mtoe*]	**Potential 2010** [Mtoe*]	**Potential 2020** [Mtoe*]	**Potential 2030** [Mtoe*]
Wood direct from forest (increment and harvest residues) (converted into million m^3 WRME**)	27 (= 160)	43 (= 260)	39-45 (=240 - 270)	39 - 72 (= 240 - 450)
Organic wastes, wood industry residues, agricultural and food processing residues, manure	40	100	100	102
Energy crops from agriculture	2	43-46	76-94	102-142
TOTAL	**69**	**186-189**	**215-239**	**243-316**

Table 2: potential for biomass energy as estimates in the EU Biomass Action Plan (conversion to WRME and breakdown direct wood/organic wastes estimated by ECE/FAO)

* Mtoe: million tonnes oil equivalent ** WRME: wood raw material equivalent

1.3. Supply and demand for roundwood as a whole

Bringing together the estimates from the previous sections, gives the greatly simplified, picture in table 3.

It is necessary to bear in mind that:

- 2010 data for industrial roundwood are EFSOS baseline projection
- 2010 energy estimates for western Europe are based on the EU Biomass Action Plan (there is insufficient information on non-EU countries to make a corresponding estimate for eastern Europe)
- much of the wood used for energy comes from non-inventoried sources (tops, branches, stumps, small trees, hedgerow and amenity trees, orchards etc.), so the net annual increment on forest available for wood supply is not sufficient to estimate the sustainable harvest level.
- The table only covers wood supply direct from the forest, not the use of residues and recovered wood, for energy or raw material.

	Western Europe[2]		Eastern Europe[2]	
	2000[1]	**2010**[1]	**2000**[1]	**2010**[1]
Industrial roundwood consumption	271	312	81	107
Energy targets (direct wood energy only)	139	210[3]	114	?
Total direct wood supply for industry and energy	411	522	195	?
Net annual increment on forest available for wood supply	515	505	230	219

[1][million m^3WRME/year]

[2]EFSOS country groups (new EU members are in eastern Europe)

[3]Very rough estimation on basis of EU25 Biomass Action Plan potential

Table 3: Direct wood supply scenarios (forests and trees outside the forest only, excluding residues and recovered wood)

Table 3 shows that according to the assumptions set out (i.e. steady growth of forest products markets, ambitious programmes to develop wood energy), supply of both raw material and energy from wood would rise, especially wood energy. Biomass energy plans call for a near doubling of the use of wood for energy in less than 10 years.

It appears that the forecast levels of demand for industrial wood with the **present** levels of wood energy supply can be supplied sustainably from the existing forest resource, with the existing level of management However, achieving the **target** levels of wood energy supply (for instance those in the EU Biomass Action Plan) would involve significant changes:

1. Volumes of wood significantly greater than the EFSOS baseline would have to be supplied, from industry, recovered wood, directly from the forest and trees outside the forest, hence potentially putting at risk SFM..
2. Schematically, the main options for increasing the volume of wood made available, whether for energy or raw material, are:
    a. Ensuring that no forest industry residues are wasted
    b. Developing the use of recovered post consumer wood for energy or raw material to high levels (as in countries like Germany, the UK, Switzerland or the Netherlands)
    c. Expanding harvest from existing forests: increased harvesting, recovery of more parts of the tree etc. (see also chapter 3)
    d. Expanding harvest of trees outside the forest
    e. Expanding the area used for wood/fibre production (these may not be conventional “forests”) (see also chapter 5)
3. If the ambitious biomass energy targets are to be met, all the above may be necessary unless the increase in biomass energy comes exclusively from non-wood sources, such as agricultural energy crops.

4. Large volumes of forest industry residues are already used for energy, so the potential for developing this resource may be limited (and dependents on levels of industry activity)
5. The availability of recovered wood is also limited, notably by the volumes of products consumed.
6. Thus any significant increases in wood supply, if they were considered necessary , would have to be generated from the existing forests, trees outside the forest and an expanded forest area.
7. In any cases, market conditions and prices are bound to be affected.

Is wood supply sustainable?

At present, information is not sufficient to say whether the figures tentatively suggested for 2010 (i.e. with a considerably higher level of wood energy supply) are sustainable or not. Certainly net annual increment on forest available for wood supply is an inadequate indicator because of the many dimensions it does not cover (trees outside the forest, harvest residues, stumps etc.) and the multiplicity of unrecorded and unmonitored sources. There is also a need for better monitoring information on use of residues and recovered wood products, both for raw material and energy.

However, the emerging situation would require consideration of sustainability more detailed than the simple question of physical wood availability. All the dimensions of sustainability, as listed for instance in the MCPFE criteria and indicators should be taken into account.

Questions about compatibility of sustainable forest management and increased wood supply are further discussed in chapter 5.

2. Relevant policies and framework conditions[4]

2.1. Regional and Pan-European level

Within Europe, national forestry policies are the most important statutory instruments directly determining the goals and principles of forest management. Nonetheless, other policies may have a greater indirect influence on the forest-based sector as a whole, thus having an impact ion forests themselves.

At the Pan-European level, some elements of forest policy based on common national interests is formed at "Ministerial Conference on the Protection of Forests in Europe" (MCPFE) through ministerial declarations, several non-binding resolutions and relevant tools for sustainable forest management (SFM) implementation. Key messages from the MCPFE resolutions should be kept in mind when discussing about wood mobilization and intensified forest management.

In the resolutions of the Second Ministerial Conference in Helsinki (1993) the signatory states commit themselves amongst others to follow guidelines for sustainable forest management and conservation of forest biodiversity.

At the Third Ministerial Conference in Lisbon (1998), the states put special emphasis on socio-economic aspects of sustainable forest management - focusing on the relationship and interaction between forest and society.

The principal goals of the Fourth Ministerial Conference in Vienna (2003) include protecting the biological diversity of forests in Europe and further, creating an awareness of the value of forest goods and services and encouraging their marketing, as well as clarifying the cultural significance of the forest. Multiple roles that are played by forests and SFM in relation to climatic changes are addressed in the Vienna's commitments as well.

2.2. EU level

2.2.1. Introduction

This part is focussing on existing and emerging EU policies relating to energy from biomass and their effects on forest based industries, based on a presentation given by Jeremy Wall (EC DG Enterprise) at the "International Seminar on Energy & the Forest Products' Industry" in October 2006 in Rome.

As elsewhere in Europe, forestry policy in the EU is essentially a national, member state responsibility. Without provisions for it in the treaties establishing the EU, the scope for common forestry initiatives and activities is limited and mostly occurs within the margins of other policies for which there exist distinct legal bases or other mandates. Several EU policies concern forests and the forest-based sector directly or indirectly, in particular: Agriculture, Environment, Energy, Regional and Research policies. These policies as well as some others at European level have either a direct influence on the forest or an influence on the wood market. For example the promotion of wood as an alternative and renewable energy source on the one hand, and the need for security and diversification of EU energy supplies on the other hand, have combined to given energy policy a greater impetus.

Other EU policies (including those for industry, internal market, competition, industry, employment, information society and research and development) also concern the forest sector. Recently, their influence has been focused together in the Lisbon Agenda to revitalise the competitiveness of the EU economy through generating more growth and jobs. Given that forest-based industries alone represent 9 % of

[4] Chapter prepared by Sebastian Hetsch, UNECE/FAO Timber Section, based on a presentation by Jeremy Wall, EC DG Enterprise and Industry.

manufacturing jobs and 8 % of the manufacturing GDP in the EU, the potential impacts of the Lisbon Agenda are far-reaching.

In recent years, forests have featured as potential “carbon traps” and wood has gained attention as a carbon neutral energy source to replace non-renewable energy sources, each in the framework of international climate change discussions. However, the extent to which forests and forest-related issues can be included in international carbon accounting has so far been rather limited.

2.2.2. EU Legislation and other policy elements

Energy Legislation

Green Electricity Directive (Directive 2001/77/EC)
Directive on Electricity from Renewable Energy Sources: establishes a framework to increase the share of green electricity from 14% to 21% of gross electricity consumption by 2010.

Directive on Transport Bio-fuels (Directive 2003/30/EC)
This provides that EU Member States shall ensure by the end of 2005 a 2% and by end 2010 a 5.75% minimum proportion of bio-fuels of all gasoline and diesel fuels sold on their markets.

Directive on Taxation of Energy Products and Electricity (Directive 2003/96/EC)
This allows Member States to apply exemption or reduced rates of taxation on “bio-fuels and other products produced from biomass”

Combined Heat and Power Directive (Directive 2004/8/EC)
This directive on the co-generation of heat and power seeks to create a framework for the promotion and development of the high-efficiency co-generation of heat and power

Biomass Action Plan

The renewable energy progress report (COM 366/2004) indicated that most renewable energy sources – especially biomass - were not fulfilling their 2010 targets. To help redress this situation, the Commission foresaw to produce an EU Biomass Action Plan which appeared in December 2005 (COM (2005) 628 final). The “BAP” as it is known, seeks to work towards a proposal for European Community legislation to encourage the greater use of biomass in a number of end-use applications, including those already enshrined in existing legislation as well as a possible new directive for heating and cooling.

Bio-fuels Strategy

Simultaneously with the BAP, the Commission produced the EU Bio-fuels Strategy (COM (2006) 34). This report will address the issues of bio-fuel targets, bio-fuel obligations, minimum sustainability requirements, etc., all in the context of a possible revision of the Bio-fuels Directive, which itself would follow later.

Sustainable, Competitive & Secure Energy Strategy (COM (2006) 105, SEC(2006) 317): prompted by the newly formed high-level Group on Competitiveness, Energy and the Environment, this report addressed the more strategic (global and long-term) aspects of the EU’s increasing dependence on energy imports and its impact on competitiveness of the EU economy, including social and environmental aspects.

In follow-up to this and encapsulating other policy and legislative work already in the pipe-line, a Strategic Energy Review has been foreseen by the Commission to cover all major fields of energy supply, distribution and use. The first part of this is to come as a package early in 2007, including a “Renewable Energy Road Map”, together with other elements on nuclear power, clean coal, gas and electricity markets, energy technology and the internal energy market. The road map will include new renewable energy targets for the period 2010-2020 and a further report on bio-fuels, with the likelihood of a revised directive at a slightly later stage, together with a proposal on heating and cooling. In the meantime, the following item has already be announced:

Action Plan for Energy Efficiency (COM (2006) 545): this action plan seeks to help save 20% of EU energy consumption by 2020.

EU Forest Action Plan (COM 2006, 302 final)

The overall objective of the Action Plan is to enhance sustainable forest management and the multifunctional role of forests.

The four main thematic objectives are:

- To improve the long-term competitiveness of the forest sector
- To maintain and enhance biodiversity, carbon sequestration, integrity, health and resilience of forest eco-systems
- To contribute to the quality of life by preserving and improving the social and cultural dimensions of forests and forestry
- To improve coherence, co-operation and communication in forest related matters

More specifically, the Forest Action Plan has proposed 18 key actions to be implemented jointly with the Member States during the five-year period 2007–2011, including:

Key action 4: Promote the use of forest biomass for energy generation, notably by means of:

- support for implementation of the EU Biomass Action Plan
- investigate mobilization of small/low-value timber and residues for energy
- gather information wood and residue availability and use for energy
- assess energy feasibility of using tree biomass & forest residues from sustainable forest management
- support research and development for heating and cooling, green electricity and bio-fuels.

EU forest based industries

The Commission is due to produce in early 2007 a communication document on the “Innovative and sustainable forest-based industries in the EU”. Its overall principles and objectives are:

- To enhance competitiveness by taking care of the advanced know-how and competences that the EU forest-based industries possess while also taking into consideration related competences in the chemical industry and the machinery industry.
- To recognise the forest-based industries strategic role in mitigating climate change, enhancing a sustainable energy supply, promoting sustainable forest management and in supporting generally a sustainable development.
- To support an enhanced level of innovation and research and technological development.
- To facilitate the forest-based industries’ access to a sufficient raw material supply, both new fibres and recovered, at reasonable costs.
- To facilitate an energy supply at competitive prices.

Research and Technological Development

The main instrument for EU Research and Technological Development (RTD) policy is the 7th RTD Framework Programme, adopted on 18/12/2006, with a first call for proposals soon afterwards. In concert with the “Framework Programme 7” are technology platforms (TPs). These are sectorial vehicles for stakeholder co-operation to develop Strategic Research Agendas. SRAs set R&D goals and priorities (based on long-term vision).

Examples of TPs relevant to the forest-based sector (forest resources, ownership and forest-based industries) are:

- Forest-based Sector Technology Platform Web-site: www.forestplatform.com
- Bio-fuels Technology Platform, seeking inter alia an increased profile for biomass research e.g. bio-refineries. This TP also incorporates the "Biofuels Research Advisory Council" (BIOFRAC), launched in June 2006

As a further complement to Framework Programme 7 there is also CIP (Competitiveness & Innovation Programme), under which specific projects can be developed.

2.2.3. Outlook and open questions

- How can the overall 2010 biomass "targets" best be met?
- How much wood should be used as RES and how can that best be managed? i.e. at national, regional and local (and company) levels
- Which other kinds of biomass should be developed to fulfil the remaining biomass needs and how can that be done rapidly on a commercial scale?
- EU-level figures hide: complex market structures; national & regional variations related to extent, intensity and location of forest resources, population density, financial and fiscal régimes giving rise to several identifiable regions within Europe (NB cross-border effects in Central Europe)
- There are both risks and opportunities for the forest-based sector, esp. industries
- Scale and costs need to be assessed, esp. in context of national biomass plans
- The use of high feed-in tariffs for the production of "green electricity" can raise wood energy demand
- How to determine optimal use/full added value is from wood and achieve it?
- There are other new business opportunities from current and new technology e.g. "bio-refineries" (bio-fuels (m)ethanol-based on cellulose and gasification of black liquors)

3. Approaches and Strategies to mobilize additional wood resources in the Europe's forests[5]

3.1. Forests and Wood: The underused European natural resource

The European forests are significant forest resources in the world. Key parameters like absolute and relative forest area, forest area per capita, standing volume and possible sustainable annual cut show all upper ranking in the world wide context. The European solid wood and pulp and paper industry and the related manufacturing industries, which are world leaders, show high and competitive potential, and future perspectives in the forest-wood area are positive. Sufficient wood supply becomes a crucial issue for the future development of both wood industry and rural areas. National inventories and statistics show, that the European forest resources are growing and that there exists a substantial positive gap between the possibilities of sustainable use and the actual annual cuts within the European forests. However there are significant regional differences: Northern and North-Western Europe (Scandinavia, UK) actually tend to use their forest potential to the actual limits of sustainability. Eastern and Central Europe including the mountain areas show significant under-utilization, while the Mediterranean countries (perhaps excluding Northern Portugal and North-West Spain) have only a smaller under-used potential due to climatic and historical reasons.

To expand the utilization of the forest areas that are underused today is only one strategy to expand the wood supply. An additional approach would be to intensify the utilization of wood in the framework of existing cutting and management schemes by using small trees and / or using also those parts of bigger trees, which remain in the forest until now. The third aspect is the utilization of trees and other woody material which grows outside the closed forests, f. e. in parks, agriculture land, parallel to roads, railways etc. Mobilizing the harvest in underused forest areas, intensify the cutting in already managed areas and utilizing wood from outside the forests are three alternatives, which can be implemented in a short-term approach (1-5 years).

Medium terms strategies (5-20 years) would include the establishment and management of new short rotation plantations on land, which has former been used for agriculture. The products may be energy wood, but also fibre production for pulp and paper is an option.

In a long term perspective (over 20 years) a more intensive classical, forest management may also contribute to enlarge the forest resource, f. e. by replacing low productive tree species by species with higher productivity or the introduction of genetically improved material, but also more intensive silvicultural treatment of existing stands.

The following chapters concentrate on the short term to medium term approach of mobilization, but will also touch long-term options to enlarge the European forest and wood potential.

3.1.1. Mobilization of wood from currently underused forest areas

Four elements are necessary to form and implement successful strategies for mobilization of wood from forest areas which are underused so far: **Information, Motivation, Legal Framework Property Rights, and Technical Instruments**.

[5] Chapter prepared by Gero Becker, University of Freiburg, Germany

Information about the wood resource

There has been conducted a series of national and European forest inventories, which give a sufficient general overview on the status of the existing forests and the possibilities to use these resources. Based on statistical sampling with a relatively wide grid, these inventories can only give reliable results for relatively big areas (countries, major geographical or administrative units like provinces, departements, cantons, Bundelsänder etc.). This information is helpful to outline general or regional policies, but does not support mobilization as an operational activity. To inform decision makers (forest enterprises, wood industry, forest administration) and stake holders about a concrete area, where forests with a significant underused wood potential are located, a much denser survey and analysis is necessary, but the national inventories do not provide this kind of information.

In many countries there exist management plans for bigger single forest enterprises and holdings, but these management plans are often not consistent in space and time, and many, especially small and private forests holdings, where the wood reserves are supposed to be concentrated, do not have such management plans at all.

Therefore new concepts and tools for a quick and up to date assessment of the existing forests are needed, which cover all forests and give rough, but well localized information about the status of the actual forest resource and the possibilities of additional utilization. The minimal data set for such a rough forest resource assessment would be tree species or group of tree species (conifers, broadleaves), height of the stand, density of the stand, accessibility (road network) and basic terrain information (slope). By this data a first estimate about the locally existing volumes are possible. Wherever possible or appropriate, this data can be linked for verification with existing grid points of national or European inventories, and can also be ground checked and verified with existing management plans.

Technical solutions for this type of inventory are high-resolution satellite images, air photography, air borne laser scanning, etc. If this data is geo-referenced and linked to a GIS-system (preferably including a digital terrain model and the vectorized road network), this information is an excellent basis for operational activities to mobilize wood from existing, but underused forests.

Information about ownership and legal constraints

Because mobilizing wood means contacting and convincing forest owners to cut trees in their forests, detailed information about ownership is as important as information about the forest itself. This includes not only legal ownership (name, address, profession, age of the owner and / or person to contact), but includes also background information about family and neighbours, the motivation of the respective forest owner including the size of his property, his willingness (or un-willingness) to utilize his forest and to cut trees etc.. Without this information, a targeted motivation of the forest owners is not possible.

There is a big informational and knowledge gap about these aspects. Only a few regional studies exist about the social structure of public and private forest owners. Many forest owners do not live anymore close to their forest, and it might be difficult to find them and to come into contact with them. In many (especially Eastern) European countries in transition, land tenure and property rights are not clear, borders of forest areas are uncertain and the legal framework of the sustainable utilization of the forest is changing. Without the knowledge about the ownership and the owners, and without a clear legal framework and secure property rights, the mobilization of the potential of these forests is doubtful. Policy makers as well as associations and companies need this information to focus their mobilization policy and activities.

Not only the lack of valid information about ownership, but also legal constraints may limit efforts to mobilize more wood in areas, which are up to now underused. Forests do not only produce wood, but also supply society with a wide range of goods and services. Watershed erosion, wild life habitat, recreation and aesthetic values of the landscape are only some examples. Furthermore forests are in many cases regarded as areas which high ecological value due to a management, which follows closely natural dynamics. There is a whole set of local, regional, national and European types of protection, which has been established to secure the delivery of these mostly appreciate goods and services for the society. Depending on the objective and degree of protection, forest management activities can be restricted in type, intensity and area.

Actual enquiries and surveys show, that more than 50% of the total forest area in central Europe are influenced by at least one of more or less several restrictions due to their status of protection forest. A more intensive management will in many cases raise conflicts with the protection purpose, and it can be doubted that mobilization will be possible.

Motivation

Physical information about the forest resource, social information about the ownership and a stable legal framework is not enough to mobilize effectively additional potential in European Forests. In the majority of the cases, it is necessary to convince those who are the owners or are in charge of the forest management on behalf of the owners, that more intensive utilization is possible, advantageous and desirable. This is especially true in areas, where the forest ownership is highly fragmented and a large proportion of the forest is owned by private individuals. National inventories for several, especially Central European and West European countries show clearly, that the small forest holdings, which are owned by private individuals i.e. farmers, have by far the most significant additional potential which could be used within the framework of sustainabilty. Research results and practical experience in several mobilization projects show, that economical considerations alone (i. e. an acceptable market price for round wood) is not sufficient to mobilize "automatically" those under-used forests. Often the situation is more complex: Many private forest owners do not regard their forest property as a source of continuous income, but manage them as a set aside resource for future needs. Other owners do not see any rationality in using their forests at all, because they are too small and the possible additional income is relatively insignificant, compared to the major income of their family. Other forest owners do not live anymore in the area, where their forest is situated, but in big cities (urban forest owners) and do not have the knowledge and the mentality to utilize and manage actively the forests. On the other hand many rural forest owners use the forest for own purposes, namely fire wood, so the cuttings are not reflected in the official statistics, even if the potential of these forests is used internally. And last not least many forest owners do not think at using their forest at all, because they believe in nature conservation, recreation or other non-wood values of the forests. They simply do not like to manage actively the forest resource as the rationale of forest professionals would suggest, and they often believe, cutting trees is against nature and ecology.

The variety of these different motivations makes it difficult to convince the forest owners with one single approach. It is absolutely necessary to classify these forest owners into groups with similar background and motivation, and develop customized approaches to convince them, that the utilization of the forest is a good thing, and the mobilization is not only of individual, but also of societal and ecological benefit. There are some scientific studies, i. e. in Austria, Germany, France, Finland, where this motivational aspect is addressed and encouraging first results are available for further activities in both, research and practical forest policy.

It is obvious, that motivational aspects and the individual attitude of the forest owners is also an important part of an integrated forest information system. Only if the basic natural information about the forests is linked (preferably on the basis of GIS) to the attitude and motivational background of the respective owner towards utilization, consistent strategies and operational programs to motivate the owners and to mobilize additional forest resources can be successful.

3.1.2. Intensified Forest Management – short term strategies

Even in intensively managed and harvested forests, the extracted volume is in many cases lower than the sustainable allowable cut, mainly due to technical and/or economical reasons: Compared to the market demands and market prices, the dimension and / or the quality of these trees or parts of trees which remain in the forest today are too low and / or the costs are too high to justify a processing and marketing of this part of the resource. There are estimates that this volume of not harvested trees / part of trees may easily add up to 20% of the volume which is actually cut. In the actual situation of rising wood prises, it can be observed, that the minimum requirements of the wood industry in dimension and quality are lowered to attract a bigger part of the resource for the mill. Higher market demand and higher prices also encourage the development

of adapted techniques to use these additional trees / part of trees in a more economic way. Chipping and bundling are only two possibilities, and even stump harvesting for energy use is implemented as a possibility in some areas, like Finland.

Ecological constraints

To use more trees, even if they are small or of lower quality, and to use a bigger part of the trees which are harvested today (mostly off cuts at the bottom of the log with rot, and the upper crown included branches) can create ecological concerns. Especially on poor sites, the nutrient export, which is linked to whole tree or full tree harvesting, may be higher than the natural nutrient supply from the soil and the subsoil. Careful soil and nutrient balance analysis on a short term and long term basis is needed and may lead in some cases to the result, that the more intensive utilization is not in line with long term sustainability of the soil. Fertilizing and recycling of ash from wood energy plants back into the forest may be an option and is tested, but still raises technical and economical questions.

A more intensive utilization compared to the actual level of harvest may also raise concerns about the question of biodiversity. Standing dead trees (snags) and lying dead trees contribute significantly to the biodiversity of our forests. To leave back a certain amount of this material in the forest is required by all certification standards. Appropriate strategies and clear guide- lines must be developed and implemented on the local basis to solve this conflict.

3.1.3. Wood resources from outside the forest

On the basis of the existing European and national forest inventories there is a quite clear overall picture about the forest resource and the possible sustainable annual cut in these closed forests, but there exist a significant amount of the trees, shrubs and other woody plants outside the forest: parks, alleys, hedges, wooded land parallel to streets, channels and railways are only some examples. Because these wood resources outside of the closed forests are very variable in size, structure, species composition and quality, there is practically no general information available about the magnitude of this part of the resource, and even less knowledge about the question, to what degree this resource might be legally, technically and economically utilizable. On the other hand this type of woodland is often managed regularly and intensively for many different reasons and according to different objectives: Safety aspects along roads, railways and in parks and suburbs, or nature conservation aspects in urban and rural areas, are only two options. Mostly the harvesting costs linked to these specific management activities are high, and paid by various public bodies. Because it is unclear to which extent and under what legal organisational framework this material could be used to expand the wood resource, methods for assessing these wood lands in terms of quality, quantity and accessibility have to be developed. Some projects have been carried out recently in Germany on the basis of remote sensing and GIS, which allow an assessment of both, quantity and economy of a systematic management of these wood lands with the aim to provide the additional wood material for industrial or energy use. The project results show, that costs do not really matter, but legal and environmental restrictions limit an intensive use of this resource in many cases, but it is still a significant contribution to the local wood supply is possible in many cases.

3.1.4. Short rotation plantations (for wood and fibre as well as fuel wood)

Facing increasing pressure on the existing forest resource, the possibility to expand the wood resource by establishing short rotation plantations on agricultural land is widely discussed in Europe today. The consequence of the new agriculture policy of the European Union will be, that millions of hectares will fall out of the traditional food production. Vice versa, there is a growing demand for bio-resources for both, cogeneration energy plants and BTL-projects. Already today, short rotation willow and poplar plantations are established namely in Scandinavian countries, where they contribute to produce electricity and heat in biomass power plants. These plantations are still not economic without financial incentives from the public, but in the framework of the actual Scandinavian programs to replace a significant part of fossil energy by biomass, these short rotation plantations will play a significant role, and are supposed to become economical soon.

Short rotation plantations in Central and Southern Europe have an even a bigger potential for wood production due to favourable site and climatic conditions in the areas. Annual biomass production of 25 tons/dry per ha and year seem to be feasible with the existing genetic material of poplars and willows, and genetic improvement will increase this productivity further. Nevertheless there are many obstacles which until today prevent the investment in this new type of plantations: For many farmers the steady annual yield of conventional annual food crops which is at least partly guaranteed by the agriculture policy of the European Union, seems to be more attractive than the still uncertain yields of wood biomass, which can be cashed only periodically after every 5-7 years rotation period. Many studies and experiments started on margin agriculture lands, where the fertility is not very favourable for fast grown tree species too. Furthermore these margin lands are often on steeper slopes and have a fragmented ownership, so the necessary large scale management of short rotation plantations meets organisational and technical obstacles. At least there is up to now no clear commitment of the wood industry and of the energy companies to buy this material at the end of the rotation time at a fixed price, so the economical calculations of short rotation plantations are at least uncertain.

A special situation is given in South-West Europe (Portugal, Galicia / Spain) where mild climate and higher precipitation allows growing subtropical fast growing tree species like eucalypts, which have a well established utilization in the pulp and paper industry. It can be foreseen, that genetically improvement programs will develop clones, which are even better adapted than today to the specific climatic conditions of southern Europe, (and maybe show also certain resistance against occasional frost events), so that the growth area of eucalypt could be enlarged in the future.

Ecological aspects of short rotation plantations

Compared to traditional forest management systems, short rotation plantations are more “artificial” than conventional forests. Uniformity, a greater demand for nutrients and water, a higher export of biomass, the need to use herbicides and fertilizers are only some aspects. At least at younger plantation ages, biodiversity tends to be lower compared to conventional forest ecosystems. If it comes to the large scale operations, the consequences for landscape aesthetic and recreation have also to be taken into account. On the other hand, compared to the conventional agricultural production of annual crops, which is on many sites the alternative to short rotation plantations, the impact tree plantations is far less intensive. All these aspects have to be taken into account, if the public acceptance and the ecological sustainability of these plantations is discussed.

3.1.5. Intensified forest management – long term strategies

In the long-term (over 20 years) perspective, also traditional forest management tools offer some options to increase the forest and wood resource:

Replacing less productive species by species of higher productivity (which very often means replacing broadleaves by conifers) has already been practiced since decades with great success. There is a wide range of low productive forests namely in south-west, south-east and southern Europe (very often with shrubs or coppice) which could be transferred into forest of higher productivity by planting Douglas fir, Sitka spruce, Eucalypt and other exotic or native species. In these cases productivity will typically increase by more than 30-50%. The next step would be to use genetically improved material, which promises another 10-20 % gain in growth with every new generation of trees. Despite of the fact that this systematic change of tree species is practiced successfully, there is also a lot of criticism, mostly from the ecological and nature conservation side. Exotic species may not be adapted to the regional and local conditions, so that the whole ecosystem including fauna will be influenced. Major negative impacts from so far unknown diseases can not be denied, even if there have not been many of such catastrophic events since today. Change of landscape, higher water consumption and negative impact on soil fertility are other concerns.

Fragmentation of forest ownership may also prevent the change to more productive species, because the transition is technically and economically only feasible on larger areas.

A practical and economical problem is the mode of financing the conversion: Clearing existing forests of low quality and productivity and replacing them by planting species of higher productivity means a substantial financial investment and long term commitment, which many private (and also public) forest owners are not willing or able to take. Subsidies can help to restrict the risk and are in place in many European countries.

Intensified silviculture

Another option to improve forest productivity is to apply more intensive silviculture. This includes wider spacing and heavy and repeated thinning operations in young stand combined with shorter rotations. Thereby, tree growth is stimulated and the volume production is concentrated on a smaller number of trees, which grow faster into merchantable dimensions. Site adapted variation of this management practices and can contribute to make optimal use of the respective site conditions and may prevent risks.

These more intensive management regimes are already standard in some areas of Central Europe (Germany, parts of France, Austria), but there are many countries / regions, where far less intensive management systems are still practised. Regards, Information and education, and the actual raising wood prices may help to stimulate the switch to these new management practices in these areas. To avoid negative reactions in the public, stakeholders and the society have to be informed about the possibilities and limits of such an intensifying management policy.

An indispensable precondition for a more intensive management practice is the technical access to the forest. Stand management as well as harvesting and transport activities heavily depend on an all year round accessibility of the forests. Only with a dense forest road network of acceptable quality is it possible to harvest trees at low cost and with low environmental impact, and to market those trees to a variety of customers. Because investment in forest roads is both, costly and environmentally sensitive, this becomes a bottle neck for many, especially small forest owners on the road to more intensive management. Public financial support (subsidies, long term loans) may be appropriate instruments to stimulate forest road construction and maintenance especially in remote areas and mountainous regions.

3.2. Successful Implementation of Mobilization Activities

The analysis shows, that mobilization of additional wood resources for industry and energy is a complex issue. The following chapters indicate which scientific, technical, financial, organizational and political measures and instruments have to be developed and implemented to make mobilization possible and successful.

3.2.1. Inform actors and the public

Forest areas, which are owned by wood industry, play only in some regions of Europe a significant role (Sweden, Finland, Portugal). Only in this case, a direct “grasp” from the industry to the forest is possible. The experience shows, that most of these forests are already today used to the limit of sustainability. The wide majority of the forests in Europe are owned by different institutions (State, communities) or private owners, and wood industry, which needs the additional resource, has no direct access to the forest, but has to negotiate and convince the forest owners about mobilization measures. The wood price is for sure a major component of “economical pull”. However practical experience and research results show, that the price-elasticity of wood supply is quite low, sometimes even inverse. This is especially true for small and very small forest owners. Consequently a higher price is an important, but not the only key to a higher degree of mobilization. Motivation (convincing people to cut) is equally important. This needs general information efforts on the societal and political level through all means of public relation, targeted to forest owners, stakeholders and the public opinion. On the basis of this general information approach, regional and local efforts to inform people about realistic ways and means to mobilize the wood of their forests can be organized as a follow-up activity. All kinds of local networks (family, neighbourhoods, hunting organisations, clubs and other existing social structures) are useful as platforms to bring forward the idea of mobilization. GIS and media supported background material which shows the local environment of the areas where

cuttings should take place, are very useful. Even though forest owners are typically of higher age and of conservative attitude, email contacts an websites have proved to be valuable, too.

3.2.2. Access to data and information

Because mobilization and harvesting need a minimum size of operation to be technically and economically feasible, the usually high degree of fragmentation of the private forest owners is very often a serious drawback. Consequently this fragmentation has to be overcome. A first step is to get the necessary information about the forest owners and their forest holdings (parcels). Depending on the legal situation in the respective European countries, this information is very often not easy to get. Cadastre information is not public and data protection laws and practices make the access to this data difficult. Normally forest owners are reluctant to give their data to someone else, especially directly to the wood industry. In this situation, there are two alternatives: In some countries, the State forest service has access to the necessary data by law, and the legal question has to be solved how, in what format and under which conditions this service is authorized to forward this data to the wood industry or to other interested groups. The other solution are forest owner co-operatives, which act on behalf of their members, who trust that there will be no abuse of the data. Typically it is easier to get personal owner information for a restricted area than for a whole region or country. Therefore it is recommended to plan mobilization step by step, defining areas where the next cutting activities would take place and getting the data for this restricted area, and after this convince the respective owners that harvesting would be advantageous. Such a typical “mobilization area” would have a minimum size of 10-20 ha depending on terrain and forest conditions, which delivers a volume between 300-700m³, which gives working time of one week at minimum for a harvester-forwarder operation.

3.2.3. Establish a comprehensive forest information system

Information about both forest and their owners are crucial for successful mobilization. A consistent forest information system should be based on GIS, where every single parcel of all forest owners should be identified. Similar systems only exist in some areas of Europe, namely the Nordic countries. Because the system is GIS-based, also environmental and other legal restrictions can be registered visualized if it comes to the planning of harvesting activities. The database should contain one set with forest information (species or group of species, age, height, standing volume, silvicultural necessity to harvest, risks, forest access) and on a set with forest owner information. This information system should be installed on a regional level, preferably on a server under the supervision of a forest owner association or a “neutral” State agency. The access to the data of this information system must be in line with national legal restrictions and controlled by representatives of the forest owners. The whole system – or selected part of the system – can be put on the web and serve as a platform for sellers and buyers of wood. The architecture of the information system should be dynamic and allow producers, which means, that all contacts to owners, harvesting activities and other events are immediately fed into the system, otherwise a periodical data check and update (owners data: every year, forest data: every 5 year) must be guaranteed. The information system is the basis to organize operational mobilization activities in defined areas. It can help to bring supply and demand together on a “virtual market place”. On separate parts of the system, contractors could offer their services, and forest owners who want to sell or buy their parcels could put these demands / offers on the web. All this makes the situation more transparent and allows to localize areas and volumes, which could be mobilized and allows easier access to the respective owners.

3.2.4. Building trust through service quality

Because most small forest owners do not have own machinery and work force, the harvesting would typically been carried out by contractors. Two systems are in place:

The contractors work for and are paid by the wood industry, which buys the wood on the stump; or the contractor work for the forest owners (or forest owner association) who sell the wood at road side or mill gate to the wood industry. Both cases have their advantages and disadvantages. To convince forest owners to harvest, it is in both cases of great importance, that the forest owner trusts in the quality of the operation and

that “his wood” is measured and paid correctly. Personnel of the State forest service or independent certified measuring institutions might act as independent intermediates to establish this mutual trust. Certified harvester protocols or certified measuring devices at mill gate are also accepted in many cases. Even more important than paying a good price is to assure, that the money flow back to the forest owner is smooth and quick. And last not least the harvested forest should be left behind without major disturbances of soil and roads and damages to the remaining trees.

3.2.5. Technical Tools

The mobilization of additional wood resources is often restricted by incomplete access to the respective forest areas. Difficult terrain conditions and / or fragmented forest ownership makes the establishment of an adequate road network technically difficult and expensive. Furthermore the fragmentation in many small private holdings makes road planning difficult, because the layout of the road may not meet individual interests and therefore can be blocked for many reasons. Especially in mountainous regions, there are also conflicts with environmental groups who oppose road building in general for nature conservation and protection reasons. Alternative harvesting techniques like cable systems are expensive and difficult to use. Complex, expensive and long lasting programs are necessary to overcome these obstacles. Extensive discussion, moderation processes and subsidies from public financial resources may be necessary to plan and construct successfully a forest road network.

Harvesting techniques, which are developed and used in big scale forest operations quite often do not fit with the situation of a fragmented and individually managed network of privately owned wood parcels. The need of the owners to be able to identify “their own wood” makes harvesting more complicate and expensive. Furthermore, many private forest owners prefer to do at least parts of the harvesting work themselves, because they have experience, time, the necessary tools and therefore prefer to earn the money themselves instead of paying expensive contractors. Adapted small-scale technology, which is cheaper and less complicate to use may be a solution to mobilize successfully additional wood resources in these cases. More downstream along the forest-wood-chain, logs, which are offered in small quantities, are difficult to market. This problem becomes more serious if the ongoing concentration process in the wood industry continues. Traditional local saw mills and other small businesses disappear, and big units with high market power are reluctant to get their great quantities of wood supply in small portions. Furthermore the demand of these big firms with regards to quality and dimension is very often quite specific and forest owners and personal without expert knowledge and training are often not able to fulfil these demands exactly, which is another obstacle if it comes to market the wood at competitive prices. This leads in many cases to the solution, that entrepreneurs buy the whole forest “on the stump” and do all the subsequent work of harvesting, grading and sorting as well as a transport on their own, which leaves only a margin stumpage fee to the forest owner. In this case many owners decide not to use their forest at all, because they feel treated unfairly.

3.2.6. Overcome fragmentation

One solution to overcome this problem is the formation of strong forest owner associations, which give all kinds of services and information to the it members and enable them to act as a bigger group with greater market power. These types of active forest association exist only in some parts of Europe, especially in Sweden, Norway, Denmark and parts of Germany as well as in France, where as in other regions and countries there is a lack of active cooperation between forest owners. Especially in the eastern European Countries of transition, all type of cooperation is still refused because of bad experiences in the socialist period. Information, education and financial support are the only means to overcome these structural deficits. Policy makers as well as State forest service may play a role to overcome these obstacles but they have been (or still are today) too much involved in the ancient structures.

3.2.7. The role of the forest industry

In a situation like today, when the wood industry expands their capacity and consequently needs in the future a far bigger mount of wood than today, it is in their own interest to intensify their efforts to mobilize additional

forest resources. Paying higher prices has only a limited success, as it has been mentioned before, and it has a negative influence of the competitiveness of the industry. It seems to be more promising that the wood industry cooperates actively with the forest side to overcome in a joint effort the obstacles, which hamper a mobilization so far. These efforts can result in supporting the development of a consistent forest information system or includes contributions to develop a regional and GIS-based forest resource assessment. Wood industry also could support road building by financial contributions or long term loans to forest owners. Together with State forest agencies, wood industry could form private public partnerships to implement joint mechanisms, which support a better mobilization, as it happens today in parts of Germany. Wood industry could also train forest owners and experts to enable forest owners and contractors to do the grading and sorting according to the industrial needs. Last not least wood industry could also try to get long term leasing contracts from those public and private forest owners who are not able rewilling any more to manage the in forests themselves actively. All those activities from the wood industry side should be introduced and accompanied by trust building measures, which indicate, that the wood industry is not just trying to "pull the forest owners over the table", but aims at a real long term partnership and to create a win-win situation. In many cases it might be better for the industry to act in this context as an association or group of companies instead of a single firm.

3.2.8. Financing mobilization

The description of the actual situation and of the measures and instruments, which are necessary to make mobilization effective, shows clearly, that mobilization is not cheap. To develop and implement the necessary instruments like forest information systems, web portals and small scale technology is an investment, which is needs to be implemented before the first cubic meter is mobilized. The financial resources for these activities may come from both sides public funding and from the wood industry, which is interested to get more raw material. Beside this investment in mobilization, there are operational costs for the day-to-day work of mobilization. Because also the wood industry is more and more influenced by globalisation, the international competition limits the possibility to pay high costs for the raw material. As a consequence the operational activities and processes to mobilize wood must be cost-effective and remain cheap. Forest owners must recognize, that expensive mobilization means lower prices for the forest. Experiences from Germany and other countries show, that the starting cost to establish an effective mobilization system may be as high as 5 - 7 €/m³ in the first years, and the operational cost for the day to day mobilization work after this period of first investment will still be in the range of 2 - 4 €/m³. It is a political decision, if these costs should be at least partly subsidised from public financial resources. The arguments to do so would be both social and environmental: To strengthen and revitalize rural areas, and to replace fossil energy and industrial material by wood as an eco-friendly and renewable resource with an excellent carbon balance.

4. Policies to promote wood mobilization[6]

4.1. Subsidies versus market driven processes

Because wood markets are basically free markets in most countries, market driven processes are in principle the first-choice solution to stimulate mobilization. Higher demand, expressed in higher prices for roundwood, will encourage harvesting and increase wood supply. Wood prices that do not cover the direct cost of harvesting (and at least partially the indirect cost of forest management) do not create enough incentives for increased wood mobilization. Consequently, forests which are difficult and expensive to harvest will only be utilized if the price exceeds the margin costs: early thinning, small dimensions, steep or inaccessible terrain, and remote areas are typical cases. If wood prices go up, more of these margin situations will be harvested.

These fundamental economic principles only apply, however, if forest owners demonstrate rational behaviour. Experience and research have shown that the price elasticity of the wood supply in many cases is negligible or even negative, which means that an increase in price does not stimulate additional cuttings in the same proportion, or can even result in reduced cuttings: Some private owners, but especially government-owned companies, tend to aim more at a steady cash flow than a maximum profit. Consequently, they will sell less volume if prices are higher because their budget requirements have been met. They “save the wood for bad times in the future”. Another reason for an under-proportional increase of cutting in spite of rising prices is the limited technical capacity of forest enterprises: There are not enough workers, harvesters, contractors and planning staff to bring a significantly greater amount of wood to market. Wood markets are changing more and more on an international and even global scale, but technical capacities are small in absolute figures and are not very flexible, because they need special technical equipment and specially trained workers. Building capacity in one area or dislocating capacity from one area to another takes time and is risky and costly, and creates restrictions on the ability to react quickly to increased market demands, even at higher prices.

Furthermore, infrastructure and technical considerations often limit the possibility of cutting more wood. If underused forests have no good access to the public or forest road network, increased cutting is only possible after a time-consuming and expensive planning and construction of new forest road systems. The ability of small and very small forest owners to participate in a growing market is also limited by structural disadvantages. To build up organizational structures such as forest owner co-operatives or similar institutions takes time and costs money, so that increasing prices will not automatically result in increased cuttings.

4.1.1. Do subsidies make sense?

Public funding (subsidies) are one answer to overcoming these technical and structural deficits. These depend on the political framework, first of all whether subsidies are accepted as a means of economic policy. In this context, the basic question has to be asked: If a country or a community of countries has an underused forest resource, is it the obligation of the State to mobilize this underused resource? The answer might be yes if the positive effect on growth and income, especially in rural areas, is taken into account, as well as the positive effects of replacing fossil fuels and mining products by wood, which is a renewable material and makes a positive contribution to the CO_2 balance. The answer might be no if the priority of independent decisions about private property is a major principle of policy.

If subsidies are considered, however, they should be effective and efficient and granted only temporarily. In the long term, wood supply and the wood industry are economic activities, which must be able to survive without permanent subsidies from taxpayer money.

[6] Chapter prepared by Gero Becker, University of Freiburg, Germany

4.1.2. Indirect subsidies

Because wood mobilization means to a great extent convincing people and society to cut their forests, information and even propaganda targeted to both forest owners and society is a typical activity that indirectly supports wood mobilization.

Research and development on attitudes, organization and adapted technologies connected with the forest wood chain is another important and effective way to make mobilization happen.

Up-to-date and precise forest inventories and subsidies to management plans are necessary preconditions to mobilize more wood, which should be organized (and perhaps also financed) at the national level to guarantee quality, compatibility and reliability of results.

Consultations by State forest agencies or other public bodies, especially with small and medium sized forest owners and companies and offered for free or at substantially reduced fees, is another typical indirect subsidy to support mobilization. This model has been quite common in many European countries for decades. Nevertheless, it has not been entirely successful, otherwise there would not be these remarkable reserves in the forests today. In spite of the fact that the State forest employees who consult with private forest owners are in generally well educated, they often lack of the private owner perspective and have little incentive to mobilize more wood. Furthermore, there has been a trend of downsizing public forest organizations and forest personnel, which has also led to less intensive consulting with private forest owners.

Tax reductions for forest owners who utilize their forests intensively is another option. This has only a limited effect on mobilization, however, because small and medium-sized forest owners very often do not pay taxes at all, so there is no direct incentive for them.

Programs for reorganizing fragmented forest ownership (land consolidation), funded by public money, are in place in several European countries (e.g.. Germany and France). Often, these programs are accompanied by incentives for land sales by individual owners or forest owners' cooperatives. In theory, this model leads to a less fragmented situation, which should result in a better mobilization of wood. Yet because all the parcels have to be surveyed and their value (in land and timber) has to be evaluated in financial terms, these programs are very costly and take a long time, so they do not seem to be very effective and efficient.

Financial support for forest road planning and construction is a typical public action to improve technical access and thereby facilitate wood mobilization. In Germany, for example, subsidies account for as much as 70 to 80 per cent of the total construction cost of roads. Experience has shown new roads usually stimulate wood mobilization.

Subsidies can also be conditional (e.g. a certain amount of more wood must be cut in the 10-year period following road construction).

4.1.3. Direct subsidies

In lieu of State foresters providing free or cheap consulting to the private forest owners, vouchers can be given to forest owners who ask for consulting services, making the owners free to choose which consultant (private or public) they may employ. Compared to the institutional system, this can prove to be cheaper, more flexible and more competitive. To make the work of the private consultants more effective, the State forest service must grant them access to its database on private forest owners and their forests. However, a crucial question is: Under which conditions can this happen without affecting data protection laws? Another approach is to provide financial support for forest owners to invest in technology that enables them to mobilize wood. This can be information technology (GIS, GPS), forest management planning and /or technical equipment such as chainsaws, tractors, winches, etc. Because most of private forests are too small to use this technology efficiently, these subsidies are usually limited to forest owner associations. Only recognized forest owner associations that fulfil minimum requirement (size, number of members, etc.) have access to these subsidies.

4.1.4. Support of institution-building (e.g. building up forest owner cooperatives)

This subsidy pays a part of the management costs that private forest owner co-operatives have to spend to harvest and market the wood for their members. For example, in Germany, forest owner co-operatives can receive these subsidies for a maximum period of 10 years. These start by covering 60 to 80 per cent of the cost of management and are gradually reduced down to 20 per cent towards the end of the 10-year period.. This kind of subsidy is beneficial for stimulating activity, but does not guarantee mobilization.

Direct subsidies to forest owner co-operatives to mobilize wood recently have been implemented. For a limited time span (e.g. 10 years), a premium of €-1-2 per cubic metre is paid for every mobilized cubic metre of wood. The subsidy can be limited to a maximum amount per forest owner co-operative (e.g. €80,000 per year). The subsidy per cubic metre can be varied to easy and difficult conditions (e.g. terrain). A minimum total amount of wood mobilized per year (e.g. 5.000 m^3) and/or a minimum size of the forest associations (e.g. 5.000 ha) can be combined with this premium.

We have no experience with the effectiveness of this new model. For new forest owner co-operatives, it can be difficult to mobilize quickly enough to start harvesting the wood required to get enough money out of the premium model. Thus, in some regions the models of financial support to management and premiums for every mobilized cubic meter are combined.

Another type of direct subsidy is transport subsidies for wood that is cut in remote areas far from wood industry centres. This type of subsidy encourages the utilization of remote, underused forests.

4.1.5. Who gets the subsidy?

All the subsidies mentioned above are primarily targeted to the forest owners. This seems logical, as they are the ones who finally decide about cutting their forests. However, transport subsidies can also target the wood industry consumers or transport contractors.

There are also subsidies that go to energy providers in the industry, and even to end-consumers, to promote the use of wood. Usually these subsidies are linked to the objective of reducing CO_2 emissions. These subsidies tend to increase the demand for energy wood. Because prices for different wood assortments are closely linked, this higher demand will trigger higher prices not only for energy wood but also for other wood assortments. This could have a negative influence on the competitiveness of the classic wood industry, e.g. particle board, pulp and paper and sawnwood for packaging. A macroeconomic evaluation of these effects (e.g. less CO_2 emissions versus less competitive wood industry) has not yet been done. Recently, the European wood industry has been advocating for reconsidering subsidies that promote wood as a renewable resource for energy.

4.1.6. Financing of the subsidies

Per definition subsidies are usually paid by the State, from taxpayer money. Because wood utilization is also beneficial for the wood industry, the latter could be regarded as partly (or even totally) responsible for this kind of financial support. There are models of public-private partnership (PPP) where the wood industry or wood industry associations in certain areas support mobilization activities on the forest side to get more wood or to secure future supply. These models are quite new, and it is not yet clear how well they work in practice.

Other possible financing models use a fee (per m^3) or a percentage (per value), which are calculated according to every cubic metre sold by the forest and/or bought by the industry. These go into a fund from which mobilization activities are supported. This funding system could be organized on a totally private basis, or it could be established by national law (comparable to road tolls for truck transport on motorways).

Another example of a PPP has recently been implemented in Germany:

The leading wood-consuming industry (Deutscher Holzwirtschaftsrat) and the leading forest owners association (Arbeitsgemeinschaft Deutscher Waldbesitzerverbände) jointly founded a private company that will provide the wood industry and related companies (e.g. contractors, transport companies) with a digital

road network and navigation system (NavLog). Forest owners agreed to provide maps of their respective forests in digital format and to collect field data about road quality. Access to this dataset is limited to wood-related enterprises, including wood energy companies, which pay an annual fee for using the system. The dataset is updated periodically. Both parties hope that this system will make wood transport easier and cheaper, saving time and money and reducing emissions. The system will also contribute to mobilizing wood from underutilized areas and private forest holdings.

5. Cross-sectoral implications of increased wood utilisation[7]

5.1. Interactions between increased wood mobilization and different sectors

As previously shown, increased wood mobilization is expected to have a positive - mainly economic - impact on the forest sector in general. However, the mobilization of additional wood resources to satisfy the demand for both raw material and energy is likely to have collateral implications on various sectoral policies and activities. This chapter aims at highlighting the possible impacts of increased wood utilization on biodiversity, energy, climate and agriculture. The listing below is not exhaustive, and aims at providing scenarios as regards to possible cross-sectoral implications of increased wood utilisation.

5.1.1. Biodiversity

Forest ecosystems offer diverse habitats for a large percentage of the terrestrial plants, animals and micro-organisms. Forest biological diversity thus provides a wide array of timber and non-timber forest goods and services, offers livelihoods and employment opportunities for people, and plays an important economic, social and cultural role for human societies worldwide. In this context, strategies to mobilize additional wood resources such as. mobilization of underused forest areas, intensification of forest management or short rotation plantations are most likely to impact on forest ecosystems, landscapes and biological diversity:

- Increased economic interest for wood and wood products raises interest to mobilize additional forest resources in underused or unused forests. This trend may not only increase interest to mobilize wood resources in forests that were so far economically unprofitable (e.g. for topographical, ecological or technical reasons) but might reduce the interest of forest owner to set aside forest reserves or may raise the risk of illegal logging in protected forest areas and natural forest reserves.
- Experience has shown that intensive forest management (e.g. use of high productivity species, genetically improved forest plants or fast growing exotic species) is likely to have major negative impacts on forest ecosystems, landscapes and biological diversity. Intensified sylviculture (e.g. wider spacing, heavy and repeated thinning operations, shorter rotations or increased mechanization of forest operations) requires a dense forest road network that may have an impact in environmentally sensitive ecosystems, and increases the impact of intensive logging (soil compaction, disturbance, dead wood, etc.)
- Increased use of wood for raw material and energy implies an increased removal of biomass from forest stands. This biomass export may affect soil fertility by removing important natural nutrients from forest stands and reducing soil and subsoil fertility – especially in poor or already altered sites. A more intensive utilization of wood and wood products is thus likely to reduce the total amount of standing dead trees and lying deadwood that contributes significantly to forest biological diversity.
- Short rotation plantations require a great amount of water, the use of herbicides and fertilizers, have a greater export of biomass and are more uniform - less diverse - than "natural" forest ecosystems. In this respect, increased areas of plantation forests may also render landscape patterns more monotonous – especially on agricultural land.

On the other hand, improved wood mobilization may also impact positively on forest ecosystems, landscapes and biodiversity:

[7] Chapter prepared by Evelyn Coleman & Yves Kazemi

- In many forests, the growing standing stock has reduced light conditions in forest stands, leading to a reduction of plant and micro-organism diversity. Increased wood utilization may led to more open space and better light condition that can improve dynamic and diversity of forests.
- As regards to short rotation plantations, the impact of tree plantations is far less intensive and environmentally sensitive as compared to conventional agricultural production of annual crops.

The elements above show that despite existing principles of close to nature forestry and sustainable forest management, implications of improved wood mobilization on forest ecosystems, landscapes and biological diversity are not to be neglected and require strengthened cross-sectoral approaches and mechanisms.

5.1.2. Climate

Unused standing stock represents a potential to reach climate policy objectives, in particular the reduction of CO2-induced climate change (cf. UNFCCC and Vienna Resolution V5). An increased use of wood therefore has positive effects on the climate:

- The use of timber as a substitute for other materials has a positive impact on the CO_2 balance in three ways: Firstly timber can replace energy intensive building materials such as concrete or steel, secondly it acts as a CO_2 sink even when used in building, and thirdly construction timber can be used as source of energy when the time for its disposal has come.
- The use of energy wood as a substitution for fossil fuels has a direct positive impact on the CO_2 balance.
- Afforestation and reforestation activities under the Kyoto Protocol (Land-use, land-use change and forestry LULUCF), particularly the establishment of plantations with fast-growing species, not only have a positive effect on the CO_2 balance, they also increase the wood potential for timber and energy wood.

However, there are some contradictions between climate policy and forest policy objectives, in particular as related to CO_2 sinks and the sustainable management of forests:

- The setting aside of forests as CO_2 sinks is done with the objective of conserving – or even increasing – standing stock, rather than decreasing it, as is the objective in regions where standing stock is unsustainably high.
- Under the Kyoto Protocol, wood utilization from the forest is in any case counted as a source of CO_2, independently of the further use of this wood. Forests are considered closed systems, which is not in line with the notion of sustainable forest management, which also includes wood utilization. (Though if wood is used to substitute fossil fuels, the overall effect on the CO_2 balance will still be positive.)

Thus climate policy is sending out ambiguous signals and is creating contradictory situations: On the one hand the climate debate is opening new perspectives to forestry, by giving positive incentives to an increased use of wood. (The recognition of wood as a CO_2 neutral substitute material is certainly one of the main reasons for the increased demand.) On the other hand however, the Kyoto Protocol reduces forests to their CO_2 function, leading to a tendency to further increase standing stocks, rather than to use the full potential of forests.

5.1.3. Energy

The most relevant energy policy objectives are: climate protection (CO_2 reduction, see above), ensuring sufficient energy supply by reducing dependency on fossil fuels, remaining competitive on an international energy market, preventing air pollution, security of energy supply and reduced dependency on energy imports, and encouraging energy efficiency[8]. One of the measures taken is the encouragement of the use of renewable sources of energy, including wood.

[8] See e.g. EU energy policy objectives

Current energy policies, coupled with the current high prices for fossil fuels, are one of the main triggers for the increased demand for wood as a renewable and locally available source of energy. The EU for instance wants to double the amount of biomass used for energy purposes by 2010. Demand is however now getting so high that energy objectives might not be met: If a region cannot cover its needs in wood energy and has to resort to imports, it has done nothing more than change its dependency situation. Furthermore, transporting energy wood over large distances is hardly energy efficient.

A further objective of energy policy is the introduction of more energy efficient – and thereby less energy consuming – apparatus. In implementation of this objective, new wood heating systems are being developed, making it possible to replace inefficient installations, some of which are even dangerous (emission of carbon monoxide or toxic smoke). This would mean that less wood need to be mobilised for energy if the wood which is mobilised is used in efficient and safe installations. Growing markets for energy efficient wood heating systems would be possible with a slower increase in energy wood demand.

Another issue to be addressed is the effectiveness of different energy wood uses: energy wood can not only be used to produce heat, but also as a replacement for fossil fuels (as ethanol, methane), or as an energy source for electricity production. The effectiveness of such uses is however low (the degree of effectiveness in the production of diesel out of wood is below 50%). In light of the increasing demand for energy wood, it needs to be discussed which uses of energy wood are most effective and efficient.

Though energy policy strongly influences the demand for energy wood, it has to be noted that inversely, woody biomass is only a small part of energy policies (currently, biomass including agricultural energy crops meets 4% of the EU's energy needs, ditto for Switzerland). The political impact of difficulties in meeting demand for wood energy supply would therefore be great, in that it would reduce the trust in wood as a source of renewable energy.

5.1.4. Agriculture

The establishment of short rotation plantations on agricultural land is an option that is being seriously considered in many parts of Europe. This can mean a reduction of the pressure on forest areas as such plantations can contribute substantially to cover the growing needs for biomass and fibre. Though it is not the case yet, such plantations could within the near future become an interesting option for farmers.

Considering that such areas fall rather under agricultural than forestry legislation, the question arises as to how and to which extent such short-rotation plantations have to meet the standards of sustainable forest management. If such plantations are to be treated as equal to other forest areas, then the same instruments need to be applied in these plantations as in forest areas. From a purely ecological point of view, it can be argued that such forests are much more problematical than sustainably managed forests. In relation to other agricultural uses however, the ecological impacts of plantations compare favourably to other agricultural crops. There are currently no clear answers to this question in either forestry or agricultural policies, it is therefore a typically cross-sectoral topic that needs to be addressed. Besides the economic possibilities and the ecological impacts, the concept of SFM requires considering also the social aspects of short-rotation plantations (contribution to farmer's livelihoods, impact on the landscape, and acceptance by the public).

5.2. Implications of increased wood mobilization for SFM

Forest management must be sustainable: there exist many references and definitions on this subject, notably the definition of sustainable forest management in Helsinki Resolution H1, which has been endorsed by all European countries and introduced into forest legislation in many countries. This is supported by a structure of criteria and indicators, laws and regulations, as well as a number of certification systems, which are now well established in most European countries.

Increased wood mobilization will certainly have an impact on sustainable forest management, be it positive or negative. This chapter therefore aims at highlighting the possible implications of increased wood utilization for sustainable forest management, using the structure of the six MCPFE criteria and improved quantitative indicators. (see Table 4 below). The listing below is not exhaustive, and only provides possible scenarios. Its objective is to provide food for thought and a basis further discussion.

C1 Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles

A greater mobilization of wood may have a number of positive effects on the forest resource, in that it can act as an incentive to increase the forest area (e.g. on agricultural land). Furthermore it may have a positive impact on growing stocks, where these are unsustainably high, and on age structure and diameter distribution in underused forests.

There are possible risks however: In forests with insufficient protection status (preservation of forest area) forests may be overused and thus degraded, with growing stocks sinking below sustainable level and an unbalanced age and diameter distribution.

Increased mobilization makes carbon stocks decrease. This may cause a problem in forests accounting under the Kyoto Protocol (see previous chapter). The overall influence on the CO_2 balance is however positive, due to substitution effects.

C3 Maintenance of forest ecosystem health and vitality

Increased wood mobilization may have an indirect positive influence on forest health and vitality, in particular if wood is used as a substitute for sources of energy with higher emissions. This however is only true on condition that installations are efficient and clean (see energy policy above).

There is however a risk of nutrient imbalance in forest soils due to the increased extraction of trees including branches.

C4 Maintenance and encouragement of productive functions of forest

An increased demand certainly boosts the wood production function of forests, thanks to better wood prices and higher wood sales. In underused forests, greater mobilization can improve the ration between increment and felling.

In forests with insufficient protection status (e.g. no management plans, greater mobilization may lead to overuse, and increases the risk of illegal logging.

With the economic interest in wood rising, the provision of non-wood goods and services may suffer, in that it may become less attractive to invest in them than in wood production.

C5 Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems

More intensively used forests may pose a problem for biological diversity. Tree species composition may be less varied, as choices concentrate on fast-growing species, leading to a reduction of genetic diversity; there might be less deadwood in forests and sensitive threatened forest species may suffer from the negative impacts of intensive logging. The larger economic value of forests for wood production also increases the pressure on undisturbed and semi-natural forests and landscape patterns may change (particularly if

plantations outside the forest area become interesting. Forest owners will probably also be less motivated to set aside forest reserves, as this limits the production potential of their forest.

An increased use of forests for wood production may however also have positive effects, e.g. by increasing the area of (natural) regeneration in over-aged forests, or by creating more diverse and dynamic forests and landscape patterns. Some threatened species need light forests, so may profit from more intensive wood use. Introduced tree species with high production potential may help minder the pressure on other forests.

C5 Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water) => add protective function of mountain forests (avalanches, rock fall) and erosion

Forests help to protect soil from erosion, and play an important role in the water cycle and in water quality. Intensive logging may however impair these functions.

Many forests with a protective function against natural hazards are over-aged. Increased mobilization can improve their structure by having more regeneration. However greater mobilization can also mean increased pressure on these forests, thereby possibly reducing their ability to fulfil their protective function if the status of these forests is unclear or insufficiently ensured.

C6 Maintenance of socio-economic functions and conditions

Wood consumption and energy from wood are expected to rise, possibly substantially. This will logically also boost trade in wood and – on condition that the increase in demand also means a rise in prices – net revenue for forest owners and thereby the contribution of the forestry sector to the gross domestic product of European countries should increase.

The higher income may give rise to greater investments of forest owners in long-term forest services, but may also mean a reduced interest in the provision of services, in view of short and medium term profits from wood production. Public expenditure for services is indirectly affected by this.

A greater focus on the wood production function may lead forest owners to be less interested in keeping or even opening their forests to the public for recreation. Recreation forests may be under greater pressure for wood use, which may impair this function.

The forest sector workforce may need to increase in order to meet demand, but may also be reduced due to investments in rationalized and highly mechanised forest management systems. The risk of occupational accidents and diseases may increase if demand is high (time pressure), but could also be reduced if more highly mechanized systems are used.

A medium to long-term effect of wood mobilization may be changes in the ownership pattern, with the creation of more rational management units, in particular in small privately owned forests.

Table 4 Possible "positive & negative" impacts of increased wood mobilization on sustainable forest management using the structure of the six MCPFE criteria and improved quantitative indicators.

MCPFE Criteria & Indicators	Possible positive impacts	Possible negative impacts
C 1 Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles		
Forest area	Possible incentive to increase forest area (e.g. plantations on agricultural land).	Assuming a high protection of forest land in Europe, low risk of deforestation, but possible risk of degradation if use is intensified above sustainable level. Higher demand and higher wood prices may also increase risk of illegal logging.
Growing stock	Increase in volume extracted (i.e. reduction of growing stock) possible without going above sustainable level in forests with high growing stock. Possible positive effect on biodiversity (lighter forests).	Unsustainable decrease of growing stock possible in forests with insufficient protection framework (e.g. management plans laying down allowed felling)
Age structure, diameter distribution	Possible positive effect on age and diameter structures in underused and over-aged forests.	Tendency to shorter rotation periods and less large diameters / old trees
Carbon stock	The overall influence on the CO_2 balance positive, due to substitution effects.	With intensified use reduction of carbon stock. This may cause a problem in forests accounting under the Kyoto Protocol.
C 2 Maintenance of forest ecosystem health and vitality		
Deposition of air pollutants	Possible indirect impact through substitution effects (fewer emissions).	
Soil condition		Possible nutrient imbalance through increased removal of biomass from the forest
Defoliation	Possible indirect impact through substitution effects (fewer emissions).	
Forest damage	Possible indirect impact through substitution effects (reduction of stress due to climate change).	Possible shift to fast-growing species with increased risk of pathogens.
C 3 Maintenance and encouragement of productive functions of forests (wood and non-wood)		
Increment and fellings	Better relationship between increment and felling in underused forests.	Risk of overuse in forests with insufficient protection status
Round wood	Increase and potential higher value due to rise in prices.	Higher risk of illegal logging.
Non-wood goods		Possible negative incentive on provision of non-wood goods (less attractive).
Services		Possible negative incentive on provision of non-wood services (less attractive).
C 4 Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems		
Tree species composition		Possibly less interest in diversification of species (concentration on fast-growing or introduced tree species)

MCPFE Criteria & Indicators	Possible positive impacts	Possible negative impacts
Regeneration	More regeneration areas in over-aged forests.	Less natural regeneration in forests with intensified use (impact on species composition, soil condition)
Naturalness		Higher pressure on undisturbed/semi-natural forests.
Introduced tree species	Increase of production potential through introduced species (in particular fast-growing).	Risks linked to increased use of introduced species (pathogens, biodiversity).
Deadwood		Potentially less deadwood.
Genetic resources		Possible reduction of diversity due to concentration on certain species and genetic types (plantations); environmental impact of new tree varieties with high production potential and GM tree crops
Landscape pattern	Increased diversity through more intensive management patterns.	Change of landscape pattern if plantations on agricultural land become interesting (see forest area)
Threatened forest species	More light in underutilized forests leading to positive effect on plant diversity. Increased utilization can lead to more dynamic forests (more open spaces, pioneer vegetation).	Negative impacts of intensive logging (soil compaction, disturbance, more limited choice of tree species, less dead wood)
Protected forests		Less interest of forest owners to set aside forest reserves
C 5 Maintenance and appropriate enhancement of protective functions in forest management		
Protective forests – soil, water and other ecosystem functions		Possible negative impacts of intensive logging
Protective forests – infrastructure and managed natural resources	Positive effect in over-aged stands (utilization = regeneration).	Risk of overuse and thus reduction of protective capacity in case of insufficient protection status (setting aside of, special rules for protective forests)
C 6 Maintenance of other socio-economic functions and conditions		
Forest holdings	Possible long-term effect of more rational units in small private forests	
Contribution to GDP	Increase of contribution of forestry.	
Net revenue	Increase, on condition of efficient structures / rising prices.	
Expenditure for services	Better income from wood sales may prompt forest owners to invest more in services, and make them less dependant on public funding	Short and medium term profits from wood sales may lessen the attractiveness of expenditure for long-term forest services
Forest sector workforce	Higher need of forestry workforce to cover demand.	Reduction of workforce through rationalized forest management.
Occupational safety and health	Incentive to more highly mechanized extraction systems, reducing risk of accidents and occupational diseases.	More pressure leads to increased risk of accidents.
Wood consumption	Increase.	
Trade in wood	Increase.	
Energy from wood resources	Increase.	

MCPFE Criteria & Indicators	Possible positive impacts	Possible negative impacts
Accessibility for recreation		Greater focus on production function may affect forest owners' interest in making/keeping their forest accessible to the public; greater pressure on recreation forests.
Cultural and spiritual values		Possibly increased pressure on such areas for wood utilization may impair function of these forests.

5.3. Questions for further discussion

During the workshop, participants may wish to further discuss following issues:

a) Interactions between increased wood mobilization and different sectors:

- Despite existing principles of close to nature forestry and sustainable forest management, increased wood mobilization has implications for forest ecosystems, landscapes and biological diversity. How can cross-sectoral approaches and mechanisms be strengthened in order to avoid or at least control these effects?
- Climate policies are sending out ambiguous signals to forestry (increased use of CO_2-neutral wood vs. carbon sequestration in forests). How can this problem be addressed? And by whom?
- Current energy policies are one of the main triggers for the increased demand for wood as a renewable and locally available source of energy, while forest owners have an economic interest in raising their income from energy wood. This seems like a win-win situation, if it were not for the potential implications for sustainable forest management, especially if demand for energy wood is covered by "energy plantations". How can energy and forestry authorities cooperate, and which instruments are best able to bring together these interests? Should energy policies incorporate the principles of sustainable forest management? Is there a need for ground rules or codes of practice for "energy plantations"?

  Not all uses of wood for energy are equally effective and efficient. Which uses (heating, electricity, replacement of fuels) are interesting and worth promoting? Which can be the role of the forest sector?
- An expansion of wood production outside the forest area is possible. This gives rise to a number of issues to be addressed, such as:

  Should intensive wood crops on former agricultural land follow the principles of sustainable forest management or those of agriculture crops? There are significant differences, for instance on biodiversity, access, recreation, use of fertilisers etc.

  Is there a need for ground rules or codes of practice for "energy plantations"? Recently an MCPFE workshop in Vilnius drew up a code of conduct for forest management for climate change (*reference*), which broadly confirms traditional forest practice (discouraging for instance the use of introduced species, and stressing the importance of biodiversity and social and economic criteria). Should this code, or a variation of it, be applied also to areas designed for the intensive supply of wood for energy, as well as to areas for carbon sequestration?

b) Implications of increased wood mobilization for SFM

- An increased demand for wood changes the balance between the different criteria defining sustainable forest management. Which aspects are most affected and what is the overall effect for SFM?
- By what means can positive impacts be enhanced and/or negative impacts be reduced?