MCPFE open-ended Ad-Hoc WG on "Sustainability Criteria" for Forest Biomass Production, including Bioenergy

Background paper I

for the third meeting of the working group,

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MCPFE tools for SFM in relation to new demands for sustainable production of biomass for energy – gap analysis and suggested developments

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Contents

1. Introduction

The MCPFE agreed on a definition of and general guidelines for sustainable forest management (SFM) (Resolution H1) and general guidelines for the conservation of biodiversity of European forests (Resolution H2) in Helsinki in 1993. Pan-European Criteria and Indicators and Pan-European Operational Level Guidelines for SFM (PEOLG) were, respectively, adopted and endorsed in Lisbon in 1998 (Resolution L2). A revised set of indicators was endorsed in Vienna in 2003 (Vienna Declaration). The criteria, indicators and PEOLG for SFM have successfully been integrated in national forestry legislation and guidelines in European countries, and have served as a reference for other regional forest policy processes.

The last years' global challenges, particularly related to climate change, land use, demand for energy, food production and water, have triggered new and increasing interest from society at large on forests and forest management. Increasing demands for renewable raw material, at national, EU, pan-European and global levels, connected to inter alia climate change, biodiversity, and public procurement policies, have accentuated the need for an analysis of the adequacy of the existing MCFPE tools for SFM.

As commitments of high reduction of global fossil fuel consumption are needed to prevent global warming from exceeding plus 2°C, it is likely that global demand for biomass will continue to show a strong increase onwards in case the development pace is not slowed by political means.

At the latest pan-European Ministerial Conference on the Protection of Forests in Europe, in Warsaw 2007, the European ministers responsible for forests highlighted the need to create enabling conditions to increase the mobilisation of wood from sustainably managed forests for all uses. Forest biomass, wood processing residues and recovered wood represent important sources of renewable energy and can reduce greenhouse gas emissions by replacing fossil fuels. The ministers at the Warsaw Conference also underlined that efforts should be made to ensure that all wood production, including short rotation and fast growing energy crops, should be guided by the principles of sustainability. As a follow-up of the commitments in Warsaw, the MCPFE Expert Level Meeting held in Oslo 7 – 8 May 2008 decided to establish an open ended ad-hoc working group on sustainability criteria for forest biomass production, including bioenergy.

2. Purpose and scope of the working group

The purposes of the working group were to assess and demonstrate the applicability of existing MCPFE tools for SFM in relation to new demands for sustainable production of woody biomass and, if deemed necessary, to develop proposals for possible improvements of the MCPFE tools based on this assessment.

To obtain these aims the Working Group has gathered background information about relevant developments and expectations of processes addressing sustainability for biomass production, analysed the applicability of existing MCPFE tools for SFM in relation to new demands for sustainable production of woody biomass, and analysed the need for refinements and/or developments of the MCPFE instruments for SFM.

This report contains an overview of relevant developments and processes addressing sustainability for biomass production and an analysis of the applicability and need for updates of the

existing MCPFE tools for SFM which are particularly relevant for sustainable production of woody biomass for energy. It is assumed that this analysis may also provide important input to the European Commission's elaborations of the need for environmentally motivated minimum requirements on biomass production and extraction for heat and electricity, to be conducted by 31 December 2009 (cf. the directive on renewable energy, RED).

3. Existing MCPFE instruments for sustainable forest management

3.1 Introduction

The instruments, that were developed from 1990 and onwards, include the General Guidelines for Sustainable Management of Forests in Europe, the General Guidelines for the Conservation of the Biodiversity of European Forests, the six pan-European Criteria for sustainable forest management and the Improved Pan-European Indicators for Sustainable Forest Management, the pan-European Operational Level Guidelines, the Pan-European Guidelines for Afforestation and Reforestation with a special focus on the provisions of the UNFCCC as well as the MCPFE approach to National Forest Programmes in Europe.

The Pan-European tools for Sustainable Forest Management form a European reference for global forest dialogue. They can contribute, as a framework representing consensus within the Pan-European Process, to the achievement of further consensus on sustainable management of all types of forests on a global scale. The tools can contribute to improved communication, awareness building and implementation of appropriate action for sustainable forest management.

One of the strengths of the MCPFE instruments for sustainable forest management is that they have been and are being developed in an iterative process with the broadest practical, scientific and political consensus possible. The tools were developed in a transparent way, with broad participation from signatory countries and observer organisations throughout the European region. Considerable resources have been put into the development of the tools, including from the research community, the UNECE and FAO.

The conceptual frame for sustainable forest management may however need adjustments and developments in response to changing circumstances and new demands. The conditions for forests are changing, concepts evolve, technical and scientific knowledge improve and relevant international agreements develop. In order to remain up-to-date, it is paramount for the MCPFE guidelines and tools for sustainable forest management to respond to and cover also the new and upcoming challenges at hand, notably climate change, bio-energy production and public procurement. The following presentation of existing MCPFE tools for sustainable forest management serve as a background for analysing their applicability and adequacy in relation to these new demands.

3.2 The MCPFE general guidelines

The MCPFE general guidelines for sustainable forest management and general guidelines for conservation of biological diversity of European forests were agreed in Helsinki in 1993. In the general guidelines for sustainable forest management, a common concept of sustainable forest management in the Pan-European region was agreed. European ministers responsible for forests agreed that "sustainable management *means the stewardship and use of forests and forest*

lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems" (Helsinki Resolution 1: *General Guidelines for the sustainable management of forests in Europe,* 1993[1]). This concept has been further developed through other commitments, resolutions and declarations of the Ministerial Conferences, dealing with all dimensions of sustainable forest management.

3.3 The MCPFE criteria and indicators and operational level guidelines

The MCPFE was the first regional policy process which developed and politically endorsed criteria and indicators for sustainable forest management. The six criteria describe different aspects of sustainable forest management, and are consistent with the globally accepted seven thematic elements of sustainable forest management (United Nations Forum on Forests 2004). The MCPFE criteria and indicators are also in harmony with criteria and indicator processes for sustainable forest management in other regions of the world. For a comparison of the MCPFE criteria and indicators with globally agreed thematic areas of sustainable forest management and criteria and indicators under the Montreal Process and the International Tropical Timber Organization (ITTO), see Annexes 3 and 4.

The six Pan-European criteria for sustainable forest management are:

1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles;
2. Maintenance of forest ecosystems' health and vitality;
3. Maintenance and encouragement of productive functions of forests (wood and non-wood);
4. Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems;
5. Maintenance, conservation and appropriate enhancement of protective functions in forest management (notably soil and water); and
6. Maintenance of other socio-economic functions and conditions.

The associated quantitative and descriptive indicators were developed to assess and assist further progress in sustainable forest management, at the international and national levels.

The indicators are used in international and national reporting, serving evaluation of progress towards sustainable forest management. It was clear from the beginning that the indicators would be subject to review and further improvement. A set of improved indicators were endorsed by the Ministerial Conference in Vienna (2003) as "*Improved Pan-European Indicators for Sustainable Forest Management*" (Annex 4).

The Pan-European Operational Level Guidelines for Sustainable Forest Management, endorsed at Lisbon Ministerial Conference (1998) were elaborated to further promote sustainable forest management in Europe by translating international commitments down to the level of forest management planning and practices (Annex 5). They form a common framework of recommendations that can be used on a voluntary basis and as a complement to national and/or regional instruments to further promote sustainable forest management at the field level. They are designed in the context of, and in full respect to, national or regional instruments and actions.

[1] http://www.mcpfe.org

Their purpose is to identify complementary actions at the operational level which further contribute to the sustainability of forest management. They consist of two parts: "Guidelines for Forest Management and Planning" and "Guidelines for Forest Management Practices".

3.4 Pan-European Guidelines for Afforestation and Reforestation with a special focus on the provisions of the UNFCCC

The Pan-European Guidelines for Afforestation and Reforestation with a special focus on the provisions of the UNFCCC were developed in cooperation between MCPFE and the Environment for Europe process and its Pan-European Biological and Landscape Diversity Strategy (PEBLDS), and approved November 2008. The guidelines serve as a set of recommendations for consideration in afforestation and reforestation programmes that aim *inter alia* at carbon sequestration and reduction of CO_2 emissions from fossil fuels through woody biomass production for bioenergy.

3.5 MCPFE Approach to National Forest Programmes in Europe

The MCPFE Approach to National Forest Programmes in Europe deals with procedural elements of a policy process, or policy planning, implementation, monitoring and evaluation at national and/or sub-national levels. The following principles are highlighted: participation, holistic and inter-sectoral approach, iterative process with long-term commitment, capacity-building, consistency with national legislations and policies, integration with national sustainable development strategies, consistency with international commitments recognizing synergies between international forest-related initiatives and conventions, institutional and policy reform, ecosystem approach, partnership for implementation, and raising awareness.

4. Potential opportunities and threats related to increasing demands for biomass for energy

Wood has been used for heating and cooking from time immemorial, and domestic fuel is still one of the greatest uses for wood around the world. Due to the access to other energy sources, mainly fossil fuels, humanity has in most regions of the world been able to develop high energy consumption without reaching the limits for what can be extracted or produced from soils. Now that we need to actively reduce the use of fossil fuels to avoid far-reaching climate changes, pressure on land to provide energy at low cost will likely increase significantly. In some forest industry regions, there is now a growing demand for stemwood of low industrial value and of new tree compartments for energy purposes. Various forms of whole-tree harvesting are developing. In some regions and for some forest types, this "third" product beside pulpwood and sawn wood may improve the economic basis for forestry in general, thereby resulting in increased levels of commercial harvesting and potentially also increased ambitions to increase wood production through improved management, fertilisation, afforestation/reforestation, etc. Again in other regions, the economy will improve in cultivating crops (sugar cane, wheat, willow, soy beans, etc) mainly aimed for energy production, often fuels for transport. Such cultivation may in some cases be preceded by deforestation or conversion of other land use that serve certain values.

In this context must be considered the problem of poverty and malnutrition in developing countries and thus the need for increased and improved and sustainable food production and basic economic development in many regions of the world. From this perspective, the increasing demand for bioenergy has potentially a positive impact as it brings new money into rural business and activities and improves possibilities for a general agricultural development. However,

in some regions there will also be a negative effect for the landless through the land-use competition between fuel and food or between land owners and land "users". The processes "Roundtable for Sustainable Biofuels" and "The Forest Dialogue" (see Annex 6) are trying to find guiding principles for dealing with possibilities and potential conflicts from a third world perspective.

In general, the industrial bioenergy sector is currently growing in developing as well as developed countries because of increased competitiveness and as national and regional government policies increasingly encourage the use of domestically available and renewable energy sources that minimize fossil fuel consumption and thereby net carbon emissions (cf Stupak *et al*, in prep.). From this development both positive and negative impacts can be anticipated.

On the positive side of this development is that:

- Reduced GHG emissions will follow in case combustion of fossil fuels is replaced or avoided. Climate mitigation is thereby obtained at a lower cost than if these options would not be available.
- There could be an increased economic benefit for land owners and people working in the chain of production, extraction, transportation, etc, i.e. contribute to rural development, in some countries even poverty reduction and decreased dependency on fuel imports.
- An increased economic benefit from forests that produce unspecific wood qualities at a low cost may promote afforestation and reforestation that lead to increased areas of semi-natural forests in some regions. In such cases, this development could lead to enhanced biodiversity in the landscape.
- There will be a reduced risk for forest fire in more dry regions in case less amounts of fuel are being left on ground.
- In some regions there will be a reduced risk for insect and pest outbreaks and unnecessary losses of wood values when less forest is allowed to grow dense and high before they are hit by storm-felling or a major outbreak of forest damage from insects or pathogens. This may become a factor of growing significance in regions where climate change poses increasing risks for large-scale forest damage.

The three first positive effects are acknowledged in Warsaw Resolution 1 on Forests, Wood and Energy.

However, this development is also accompanied by increasing concerns over whether or not environmental and social values are adequately ensured when the biomass is grown, harvested, and converted to energy.

Conversion of natural and seminatural forests and grasslands into more intensively managed land or (biofuel) plantations may result in:

a. loss of biodiversity because of less breeding and feeding material left at site, competition from exotic species, less light, drastic physical and chemical changes due to harvesting and cultivation, etc [**Forest biodiversity**]
b. imbalanced nutrient budgets in the long-term and/or physically and chemically disturbed pools of mineral soil and organic matter leading to:
    i. reduced long-term site productivity
    ii. reduced quality of run-off water for open-water biodiversity and for drinking purposes [**Soil and water quality**]
c. absent or too small net gain for the climate due to substantial negative effects on biomass and/or soil carbon pools (such as after drainage) or on N_2O emissions, or

because of too high use of fossil input energy for land and crop management, extraction, transport or industrial refinement [**Climate mitigation efficiency**]

d. less production and preservation of other values and goods (cultural, recreational and aesthetical values, berries, fruit, game, wood to collect, etc) - for people who utilise goods and services from natural and seminatural forests and grasslands without tenure rights [**Other services and goods**]

A higher frequency of pest outbreaks could follow from:

e. loss of biodiversity including populations of natural enemies
f. more trade with non-refined biomass that may spread insects and pathogens between regions of the world [**Increased risk of forest damage**]

The production of renewable energy could be increased at the expense of

g. supply of raw material for other forest industries
h. food production to the extent that it increases problems of malnourishment and hunger
i. forest area [**Land-use competition**]

5. Applicability of existing MCPFE tools for sustainable forest management seen in relation to new demands and development

5.1 General remarks

In the following the applicability of existing MCPFE tools for sustainable forest management are examined in relation to the present development related to increased demand for renewable energy. So far, the MCPFE tools provide broad guidelines at pan-European level while the formulation of goals, including threshold values, for the various indicator and limitations for land-owners and operators have been decided at national or regional level, based on national situations and priorities, best available knowledge, etc. An important question is whether this is sufficient also in the current situation, or if some common minimum requirements could or should be set at pan-European level. This is discussed in chapter 6 below. Moreover, the tool package concerns activities in the field only and not the refinement or consumption steps. This could also be discussed (cf chapter 5.4).

The issue of land-use competition is only treated to some extent below.

5.2 Protection of forest biodiversity

Potential effects of increased demand for bioenergy

In chapter 4 was listed the risk that conversion of natural and semi-natural forests and grasslands into more intensively managed land or (biofuel) plantations may bring about loss of biodiversity because of less breeding and feeding material left at site, competition from exotic species, less light, drastic physical and chemical changes due to harvesting and cultivation, etc.

Definition: Forest biological diversity encompasses the multitude of plants, animals and microorganisms that inhabit forest areas and their associated genetic diversity (www.cbd.int/forest).

One has to admit that a great part of the biodiversity that still exist in present forests and other natural and semi-natural lands do so because it was never, or has not been for a very long time,

economic to exploit that land for other purposes, such as for agriculture, infrastructure, mining, intensive plantation forestry, etc. The history of restricting economic activities to any significant extent in favour of biodiversity is not very long. In the coming, now that there is a need to strongly reduce the annual fossil fuel consumption over the coming decades with an amount that corresponds to 7-10 % of the entire net primary production in all terrestrial ecosystems of the world. Therefore, it is likely that pressure successively will increase substantially, even though other renewable energy production systems show a parallel development towards competitive prices.

The applicability of MCPFE tools

The 4th pan-European criterion for sustainable forest management states the necessity of: "Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems". This criterion is relatively precise and strong. Protection of forest biodiversity is thereby a prerequisite for forest management to be defined as sustainable. Countries that want to claim that their forestry is sustainable in accordance with this criterion must see to that forest-dependent species survive in the landscape and are not on the way to being endangered as a result of forestry. Forest owners and companies that want to claim their forest utilisation is sustainable must contribute to meet this criterion in accordance with the regulations and advice set by the country in which they operate. In conclusion, this criterion must be judged to be sufficient also in a future with stronger biomass demand and new methods of utilization.

What about cases where it is not forestry that threatens the forest biodiversity, but other land-use changes? In certain regions, perhaps agricultural forms of biomass production for energy purposes will become profitable and bring about a new wave of deforestation. Considering the need to protect forest biodiversity, where and under what conditions could such land transformation be acceptable and where must forest be preserved? The 1st pan-European criterion for SFM is about "maintenance and appropriate enhancement of forest resources". However, in case the MCPFE criteria address forest management only, they will not directly address these cases. In view of the anticipated development this could be considered a gap, however less so for most European countries. So far, woody biomass compete best with fossil fuels for heat and/or electricity production, whereas transports fuels are more easily produced through agriculture systems. The risk that such land transformation could be of economic interest will be higher if incentives are made significantly stronger for replacing oil-based transport fuels with biomass than replacing coal for heat and electricity production.

A related issue is the question of fair competition between biomass production for energy purposes on agricultural land and on forest land. As food production has been considered more important and "off-nature" than wood production, there are less firm regulations on use of fertilisers, pesticides and such for agricultural production in many countries. For most plowed land today, biodiversity protection is not an issue. This issue is however addressed in the new guidelines for afforestation and reforestation (cf Chapter 3), that states that "Woody biomass production systems including short rotation/fast growing plantations should take into account economic, environmental, social and cultural aspects of sustainable management."

The success of the strategy by which a country is dealing with the 4th criterion depends on the available knowledge. The better the knowledge on what needs various species have in terms of areas of biotopes, substrate, climate, etc and thus which size and types of preserved areas and which restrictions upon forest management and operations are needed, the less "safety margins" are needed to ensure that the 4th criterion is not violated. Therefore pan-European indicators and guidelines have been developed, indicating which factors are most important to consider in protecting forest biodiversity. Indicators are area of forest type, variety of species, area dominated by introduced species, volumes of standing and lying deadwood, areas managed for conservation and utilisation of genetic resources, landscape-level spatial pattern of forest cover,

number of threatened species and areas protected to conserve biodiversity, landscapes and specific natural elements (cf Annex 4). The operational level guidelines (Annex 5) promote key actions such as

- use land-use planning,
- map important forest biotopes including riparian areas and wetland biotopes,
- preserve endemic species and habitats of endangered species,
- use natural regeneration and native species and local provenances are to be preferred if adequate to ensure quality and quantity of the forest resource,
- promote uneven-aged and mixed stands,
- maintain and restore landscape diversity where appropriate,
- cause no lasting damage to ecosystems,
- minimise damage to rare and sensitive species,
- balance grazing pressure,
- leave standing and fallen dead wood hollow trees, old groves and special rare tree species in quantities and distribution,
- protect key biotopes.

The afforestation and reforestation (A/R) guidelines state for example that A/R activities to be promoted are e.g. those that contribute to the improvement and restoration of ecological connectivity and those that use species composition and structural diversity, reflecting the natural diversity at landscape level.

It is difficult to point out any additional factor that is important for forest biodiversity protection and that will need raised awareness as a result of increased demand for biomass for energy purposes, will it introduce increased harvesting in general or new methods like harvesting branches, tops and stumps. When various forms of whole-tree harvesting are conducted, it is important to leave enough dead wood. In regions where the risk for forest fire is high, the extraction of branch wood could reduce this risk and thereby have a secondary positive effect on forest biodiversity. Whole-tree harvesting may also more significantly affect nutrient availability and soil chemistry, which in turn could affect biodiversity. In times when practices are changing and new biomass extraction methods are suggested or introduced, the access to research-based applicable knowledge is crucial for the proper development of regulations and advice concerning where and under what restrictions various utilisation systems could be allowed without threatening biodiversity protection in the landscape. Possibly, this could be stressed in guidelines.

Considering the raised demands for verification from various processes (certification, public procurement, EU energy policy development, etc) that enough consideration be paid to the preservation of biodiversity, it would be difficult to use most of the present indicators together with threshold values, as it varies from country to country and region to region which are the crucial factors to create the required preservation, with the exception of number of endangered species. However, only maintaining or decreasing that number will alone not be sufficient to verify that biodiversity is adequately preserved.

5.3 Protection of soil and water quality

Potential effects of increased demand for bioenergy

In most cases, growth of biomass adds acidity to the soil whereas decomposition consumes acidity and thereby neutralizes the acidification caused by the growth. In soils with low natural buffering capacity (e.g. coarse textured and with no limestone in the mineral composition), an

increased intensity in harvesting that include nutrient-rich tree compartments such as twigs and needles may cause a significant acidification of the site. Harvesting of nutrient rich parts of the trees may also deplete nutrients at a higher rate than they are added to the pool of available nutrients in the soil through processes like weathering, deposition or fixation from the air (nitrogen). Theoretically, these effects could follow from harvesting of stems only. However, whole-tree harvesting could easily increase the average rate of base and nutrient export over the rotation period two or three times. A reduced availability of nitrogen and phosphorous in relation to plant needs cause reduced growth rates directly, whereas too low availability of magnesium and potassium cause needle death as a first step and tree death as a second step.

In agriculture, nutrient depletion causing declining productivity is a direct and economic problem for the farmer and therefore no interference from government is required. In forestry, however, if a certain practice cause reduced or declining productivity, at least in boreal regions this is rather a problem for the next generation. To compensate for such deficits, additions of bases and nutrients may be required, e.g. through ash recycling or with fertilizers. In case such compensatory actions are performed in the wrong way, such action may also cause negative effects on soil chemistry and/or in runoff water.

Another risk could be that the increased traffic of heavy forest vehicles on the site causes soil compaction or spreading of root rot which in turn causes growth reductions.

A practice that contribute to nutrient depletion and increased acidity of run-off water may also affect the species composition of receiving open water ecosystems. Also traditional forestry practices, which may become more common and introduced in new areas, may cause reduced quality of run-off water. Examples are driving near open water that cause outflow of mineral soil and/or organic substances, drainage to improve access or growth, significantly increased rates of decomposition at clear-cut site, use of fertilizers and pesticides, etc. All are actions that may degrade open-water biodiversity and drinking water qualities.

The applicability of MCPFE tools

Four of the pan-European criteria relates more or less directly to these threats:

2. Maintenance of forest ecosystems' health and vitality
3. Maintenance and encouragement of productive functions of forests (wood and non-wood)
4. Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems
5. Maintenance, conservation and appropriate enhancement of protective functions in forest management (notably soil and water)

For the protection of open-water biodiversity in water ecosystems that receive water from forests, both the 4th and 5th criteria are relevant, depending on how much part of the "forest ecosystem" the receiving water ecosystem is considered to be. If the runoff water quality is degraded to the extent that biodiversity is damaged downstream, that is not in accordance with the 5th criterion. (Also terrestrial species could be affected by changes in soil chemistry and nutrient availability see subchapter above). The maintenance of site productivity and of stand health and vitality that could be threatened by excessive harvesting of nutrients and buffering capacity is addressed in the 2nd and 3rd criteria. Thus, at the criteria level, MCPFE tools seem sufficient.

Is there enough guidance in indicators and guidelines concerning the risks related to soil and water to assist countries in their development of regulations and policies? Indicators with relevance are 2.2 Soil condition (Chemical soil properties [pH, CEC, C/N, organic C, base saturation] on forest and other wooded land related to soil acidity and eutrophication, classified by main soil types), 2.4 Forest damage, 3.1 Increment and felling, 4.8 Threatened forest species

(in case they include open-water species within the forest landscape) and 5.1 Protective forests – soil, water and other ecosystem functions. The operational level guidelines stress that:

- special key biotopes such as e.g. water sources, wetlands, etc should be protected
- special care should be given to operations on sensitive soils and erosion-prone areas
- special care should be given in forest areas with water protection function to avoid adverse effect on quality and quantity of water resources
- use of chemicals and other harmful substances or inappropriate silvicultural practices influencing water quality in a harmful way should be avoided
- construction of infrastructure should be carried out with due care

The A/R guidelines add that A/R activities should aim to maintain and protect soil and ground and surface water resources in terms of quantity and quality.

In conclusion, most of the activities that may degrade soils and water quality are mentioned, perhaps with the exception of intensive harvesting or whole-tree harvesting. Key terms that are not mentioned are nutrient and acidity budgets. A common protective measure like leaving buffer strips along streams and rivers is not mentioned. Maybe it could also be seen as a deficit that the open-water biodiversity, of streams, rivers, lakes and wetlands, is not mentioned explicitly. The activities that pose threats to soils and water are covered to a more developed extent in the Montreal process and the ITTO indicator list (cf Annex 4) than in the MCPFE list.

Also here, the importance of developing knowledge about relations between various forest operations and effects on soils and waters at the stand as well as at the catchment area or landscape level could be stressed. Lack of knowledge shall not be a valid excuse for not meeting the criteria. However ambitious a follow-up of the indicators may be, it will take long time before insufficient regulation of many forest operations and activities are detected through negative time trends.

Also for the aspects of soil and water quality that concern biodiversity, there is a raised demand for verification from various actors.

5.4 Climate mitigation efficiency

General

Since climate change is such a great threat towards humanity as well as biodiversity, much emphasis must be put on reducing net emissions of greenhouse gases (GHG) and implementing knowledge about GHG emissions into operational guidelines and, if appropriate, various kinds of regulations. Yet, as long as fossil fuels are used to a large extent for energy production, and this will probably be the case at least for another 20-30 years, climate mitigation will not benefit from attempts to avoid the development and use of biomass energy which results in significantly less GHG emissions than fossil fuels in this time perspective. However, if the use of a certain type of bioenergy constantly, or for a very long time ahead, results in emissions that are, say, more than 30-40 % of the emissions compared to the best fossil fuel, there is little reason to treat this bioenergy as carbon free.

For some systems for bioenergy production and consumption, the approximation of zero GHG emissions is not true in the short time perspective, and sometimes not even in the longer term. The negative impact on GHG emission may appear in two different forms.

The **first** type of potential impact is related to land-use or management system conversion in such cases when carbon pools in biomass or soils are being reduced. In severe cases, the conversion bring about large emissions of carbon dioxide, more than what is saved from replacing

fossil fuels with the biomass, for over a hundred years, e.g. through drainage of peatland and even burning of peat at site. In a mild case, such as harvesting of branches and tops, the new practice reduces the pool of decomposing branch material in the forest. It can also be described as that an inevitable emission will appear at an earlier time-point. After fifteen or so years, this advancement makes little difference for the atmosphere. Another case which may vary from mild to more substantial is intensified cultivation of carbon rich soils. Then carbon may be lost from the soil, at high rate at first and then at a declining rate until a new steady-state in soil carbon pool is reached. Again another example is when forest is replaced with agriculture-like production of biomass for energy purposes. If the forest was dense and carbon-rich and the new production system is low-productive, this may be negative from a climate point of view for too long time to be defendable. However, if the forest had a relatively small carbon pool and low biodiversity values, and the new system is a highly efficient deliverer of biomass and does not induce substantial N_2O emissions, this transformation may in fact be a helpful contribution to climate mitigation.

The problem of climate change poses a challenge for finding sustainable ways of using our natural resources. In 20 years time, global society must reach a long way in its transformation away from fossil fuel dominated energy consumption. However, a too narrow perspective concerning transformation changes of carbon stocks in biomass and soil will not be helpful in this process of societal transfer.

The best knowledge about the net effect of new systems for more intensive site preparation or harvesting, e.g of branches, tops and/or stumps on carbon pools will be gained from replicated long-term field experiments. In most cases, the net effect of such activities has been relatively small and difficult to detect after 20-30 years. At that time, branches, tops and stumps in control plots have decomposed to a high degree, and the site preparation has increased net primary production which evens out the difference[2]. Only when there is a drainage effect on high soil carbon stocks such as in peatland there will be a significant loss of carbon still after 30 years.

The **second** type of potential impact is when high inputs of fossil fuels are being used for the production and/or refinement of a certain biofuel. Such low climate mitigation efficiency of the biofuel production chain is more likely to appear in cases where biofuel production is subsidised or forced to enter the market in other ways. Also, there could be side-effects of intensive fertilisation that lead to constantly high nitrous oxide (N_2O) emissions. In situations where there is a general and high price on GHG emissions, such production systems will be less competitive. In the coming, it will be extremely difficult to combat climate change without internalising the cost for climate change into a general and higher price on GHG emissions, using for example GHG taxes or a more restricted amount of tradable emissions or by other means. Until then, however, there is a need to define limit values for climate mitigation efficiency of the production of bioenergy.

The applicability of MCPFE tools

The 1st of the six basic MCPFE criteria on SFM is: *Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles.*

Indicators relevant for the evaluation of observance of this criterion are: Forest Area, Growing stock, Age structure and/or diameter distribution, and Carbon stock (see Annex 3).

[2] In many cases there will also be secondary effects of whole-tree harvesting. In Nordic countries, it means earlier regeneration and less need for site preparation and in Mediterranean countries it may reduce risk for or severity of forest fires, all of which contribute to preserve carbon stocks.

The 1st criterion is strong in the sense that it does not "allow" deforestation or degradation as a result of forestry or forest operations. This is a basic condition that has to be met, with few exceptions (see below). Otherwise, forest biomass may compare to fossil fuels in terms of "warming effect". Through the reference to "contribution to global carbon cycles", the criterion emphasise the net effect of forestry on climate as far as carbon cycles are affected. However, as forestry also could affect other greenhouse gases than carbon dioxide, the lack of reference to "climate change" or "warming effect" could be judged as a certain shortage. Neither could such reference be found in the indicator list nor in the operational level guidelines.

In the operational level guidelines, there is no guidance on how to meet the need to avoid land use and land-use changes with clear net GHG emissions also in a long-term perspective, such as most large-scale drainage. This case, however, is mentioned in the new A/R guidelines.

In a country where harvesting levels increase as a result of demand for biomass, there could even be an initial transformation-type decrease in average stocking and thereby in the carbon pool. In connection to presentations of changes in carbon pools of forests, it is therefore important also to show the delivery of bioenergy from the same forest area and estimate the theoretical displacement of emissions from fossil fuels through this delivery. In the list of indicators for the Montreal Process, there is "Avoided fossil fuel emissions by using harvested wood" (Annex 4).

In the list of indicators for the Montreal Process is also found: "Forest industry carbon emissions". The motive for presenting these data in this context is not as obvious. These emissions are mainly related to the demand for products made from wood and pulp and is therefore perhaps more relevant in presentations of GHG emissions from various industry sectors than in this connection. The forest industry, like all other industry sectors, must improve energy efficiency and decrease the use of fossil fuels in the production system, though it may be recognised that wood often replace concrete and metals that normally has induced higher GHG emissions when used for the same purpose, and the alternative to paper is often plastics. However, in a possible (near) future where bioenergy is not delivered as a by-product but as one of the main products from the forest industry, knowledge about input fossil fuels in the process will be used to evaluate its "climate mitigation efficiency" profile. It can also be noted that when a price is put on carbon emissions from fossil fuels through carbon taxation or emission trading, replacement of fossil fuels is often first profitable at the forest industries.

So far, the MCPFE tools have mainly addressed activities in the forest. Through the new A/R guidelines, also short-rotation forestry for energy production is clearly addressed. There is now a growing demand for methods to separate bioenergy production systems (from the field to the consumer) with an acceptable "climate mitigation efficiency" from those with too low performance. This is therefore a potential area for extended scope for the MCPFE tools, to contribute to meet the raised demands for verification.

5.5 Other services and goods

Potential effects of increased demand for biomass

Risks: less production and preservation of other values and goods (cultural, recreational and aesthetical values, berries, fruit, game, wood to collect, etc) - for non-forest-owners who utilise various goods and services from natural and seminatural forests and grasslands.

Fishing: In case negative impact on water quality is severe (cf above), the occurrence of valuable fish species could decline.

Tourism/recreation/game: General intensification, new land management systems that challenge the desire for continuity and traditional landscapes and aesthetical values (stump harvesting, soil preparation, several-meter-high instead of one-meter-high crops, a reduction of game populations to counteract severe browsing of many tree species, etc)

The applicability of MCPFE tools

Relevant criteria:
3. Maintenance and encouragement of productive functions of forests (wood and non-wood)
4. Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems
5. Maintenance, conservation and appropriate enhancement of protective functions in forest management (notably soil and water)
6. Maintenance of other socio-economic functions and conditions.

Some relevant indicators: Value and quantity of marketed non-wood goods from forest and other wooded land, Value of marketed services on forest and other wooded land, Area of forest and other wooded land where public has a right of access for recreational purposes and indication of intensity of use, Number of sites within forest and other wooded land designated as having cultural or spiritual values.

In case these criteria and relevant operational level guidelines are respected, an intensification of forestry methods would pose no threat to these values. However, it must be admitted that also these values to a certain extent have been maintained due to a lack of profitability of more intensive forest management in many regions. Thus, along with an intensification of forest management would be needed more conscious and knowledge-based strategies for the maintenance of these other services and goods that our forests provide.

5.6 Increased risk of forest damage

A higher frequency of pest outbreaks could follow from

- loss of biodiversity including populations of natural enemies,
- more trade with non-refined biomass that may spread insects and pathogens to new regions of the world.

Concerning the risk for loss of biodiversity - see 5.2. This should not be a severe effect if MCPFE guidelines are followed and the 4th criterion is met.

There are risks for spreading of potential pest-creating organisms (insects, pathogens, nematodes, etc) already today when non-barked wood is traded between different regions of the world. These risks will increase further with increased trade with biomass for energy: especially as it may become increasingly profitable to market dead wood from outbreaks of insects or pathogens. Also in normal harvesting, the qualities which are too low quality for traditional forest industries may first become available on the international market of biomass for energy purposes. Risks are reduced if the material is debarked and even more if it is chipped or pelletized. Overall, these risks could be counteracted through further development and implementation of phyto-sanitary regulations at the global level and by development of “closed” systems for storage of imported biomass. At present, the MCPFE tools do not address activities outside the forest. However, as it is forests that are at risk, it could be considered a possibility that MCPFE would address also these aspects in future guidelines.

6. Conclusions and suggested amendments and additional tools

General
It is highly likely that increased demand for various forms of bioenergy will follow from developed global climate mitigation policies over the coming years and decades.

The present MCPFE tools already address most of the potential risk connected to intensive management and new methods for biomass extraction. For the scope and purposes that present tools were created, no severe gaps were found. Yet there are a range of "new" problems which additional MCPFE tools could possibly contribute to solve and which could motivate additional tools and possibly increased responsibilities.

Guidelines concerning mitigation and adaptation
First, the development of scientific knowledge about net influence of new and intensified methods on forest environment and values must speed up in many countries. No matter how good intentions and goals, if knowledge is lacking, the best strategies for how to avoid negative impacts cannot be identified. This is a message that could be included in new guidelines.

Also because of the growing understanding of forests roles in the work of mitigating climate change and the growing needs for adaptation to climate change, there is a need for improved MCPFE guidance on these two topics. Some guiding principles could assist in balancing between the sometimes contradicting options for using forests for mitigation. Guidelines could also serve a list of aspects to consider in the work of adapting forest management to a changing climate.

Climate mitigation efficiency is a complicated question which includes a discussion about how to treat the issue of payback time when a land-use change aimed at increasing the delivery of bioenergy cause initial carbon stock losses. In this discussion it is useful to raise the view in time and space when judging options and "not let the best be the enemy of the good". Through its basis in forestry and familiarity with long-term rotation periods and large areas, MCPFE could make a contribution in this discussion. In 20-30 years time, global society must reach a long way in its transformation away from fossil fuel dominated energy consumption. This replacement will not easily be done in two decade's time. Therefore, a too short-term perspective concerning transformation changes of carbon stocks in biomass and soil will not be helpful in this process of societal transfer. It must also be remembered that such carbon stock losses are reversible. Whenever this energy is no longer demanded, carbon stocks can "recover".

Demand for verification of SFM
There is now an obvious demand for sustainable forest management to be a legally binding demand also for imported products, especially for various biofuels (cf Annex 6), but to a growing extent also for traditional forest products (cf the FLEGT process). At present, several organisations processes are developing sets of minimum requirements. In some cases they are quite contradictory to the concept of SFM and the demand of protection of biodiversity and other services and goods at the landscape level, with a national responsibility for the overall strategy of the protection of productivity, biodiversity and other services and goods. It could be a progressive step for MCPFE to contribute to the development of such minimum requirements, and to try to make them more compatible with the MCPFE philosophy and principles (as well as corresponding processes for SFM criteria development such as the Montreal Process and ITTO)..

As a start, such minimum SFM criteria could deal with maintenance of forest resources, preservation of forest biodiversity and climate mitigation efficiency. One question that needs an answer in this context is "who can and shall be responsible for what? Potential users could be institutions, organisations and processes working with developing rules for biomass for energy purposes or biomass-based fuels or electricity (traded or used within the producer country).

Considering the raised demands for verification from various processes (certification, public procurement, EU energy policy development, etc) that enough consideration must be paid to the preservation of biodiversity, as stated in the gap analysis it would be difficult to use most of the present indicators together with threshold values, as it varies from country to country and region to region which are the crucial factors to create the required preservation.

- For the indicator "endangered species (and extinct)", a threshold demand could be there should be no increase in number over time (out of presently known domestic species).

However, only maintaining or decreasing the number of endangered species will alone not be sufficient to verify that biodiversity is adequately preserved, because it would then be possible to have a general deterioration of the ecosystems of many common and semi-common species for a long time without violating such limit.

- Thus, also needed is probably a general (independent?) evaluation of whether enough considerations are taken at district/state/landscape level to maintain viable populations[3] of all forest-depending species in the landscape, for which several of the existing indicators could be formulated threshold values with local, regional or national application.

Negative impact on nutrient and acid-base balances could in some cases affect water ecosystem biodiversity and future site productivity. Also for these aspects have therefore sometimes been formulated verifiable demands on low impact. (A possible minimum requirement could be that forest biomass extraction should not result in large-scale losses of available nutrients or acid buffering capacity at the landscape level over several decades, compared to the natural status[4]. As stated in the gap analysis, general inventory data would not be sufficient to fully meet this criterion, as the impact of forest biomass extraction cannot easily be sorted out from other environmental changes. Data and trends from inventories must be combined with analysis of data from research, in which the effect of biomass harvesting on nutrient and acid/base balances can be isolated. In case nutrient compensation of other elements than N is needed, ash recycling should be given priority before using finite resources. *OBSERVE- not discussed before)*

A minimum requirement for climate mitigation efficiency of land management methods could be;

- Only accepted shall be land management methods for increased biomass production at a certain piece of land which do not result in GHG emissions higher than 30 % of the potential emissions of fossil fuel[5] if used for the same energy purpose in a 50-year perspective, in relation to the average for former land use[6].

[3] At least as viable as today

[4] In regions with high N deposition, a net loss of N could be considered environmentally advantageous. In case nutrient compensation of other elements than N is needed, ash recycling should be given priority before using finite resources.

[5] Coal or transportation fuel based on coal should be used as the fossil reference when substitution gains are calculated.

[6] New compared to old steady-state average carbon stock in biomass and soil plus net increase in emissions of nitrous oxide and methane over rotation period

The MCPFE criteria, indicators and guidelines are already in use in Europe, through government implementation and voluntary certification. Because the criteria, indicators and commitments are developed and agreed upon through participation by various stakeholders within the MCPFE process, an MCPFE contribution has political support as well as acceptance by stakeholders.

Potential additional indicators
Possibly two additional indicators could be added to the existing set of MCPFE list of indicators to picture climate mitigation efficiency of forest biomass production

- Area of land management methods for increased biomass production at a certain piece of land which will most likely result in GHG emissions higher than 30 % of the potential emissions of fossil fuel[7] if used for the same energy purpose in a 50-year perspective, in relation to the average for former land use[8].
- Potential substitution benefit from domestic and imported forest-derived bioenergy (compare with Montreal Process).

Stronger engagement in balance between forests and other land uses
Since the on-going development could include a potential for further deforestation in some regions in which agro-cultivation of biofuels may become profitable, MCPFE could develop its engagement in the balance between forest and other land use, with special focus on the biodiversity protection and restoration aspect. Areas which are not used for any other land use today could well be subjected to governmental policies for reforestation activities, aiming to increase the production of a mixture of forest values (cf MCPFE Afforestation/Reforestation Guidelines).

Engagement in refinement stage?
The refinement stage is normally judged to be beyond the scope of MCPFE, whose mandate is traditionally viewed ends at the boarder of the forest. In some cases high amount of fossil fuels have been used for refinement of the biomass, thereby reducing the climate mitigation efficiency of the biofuel. However, all such cases are a result of biofuels being subsidized instead of given a better competitiveness through raised costs for carbon dioxide emissions from fossil fuel combustion, through carbon taxes or emission right trading. Since the latter must be the more sound and effective way to proceed forward with general climate policies, it is judged that these fossil-fuel dependent refinement systems will soon be phased out anyway.

[7] Coal or transportation fuel based on coal should be used as the fossil reference when substitution gains are calculated.
[8] New compared to old steady-state average carbon stock in biomass and soil plus net increase in emissions of nitrous oxide and methane over rotation period

ANNEX 1: Suggestion of Pan-European Guidelines for Climate Change Adaptation and Mitigation in Forest Management

Draft, May 26

(For illustration, to facilitate discussions of the option of developing MCPFE guidelines on climate change mitigation/adaptation. It is not intended that the Working Group will discuss the concrete content in Uppsala, 11-12 June 2009).

Background and Scope
The IPCC ..... (to be developed)

Conclusions from TAR..

Climate change poses major threats towards production in many regions and biodiversity globally, but in some regions also possibilities for increased prod...

Global action to mitigate climate change will likely lead to a continued growth of the global demand for bioenergy, and possibly also for wood as a construction material, as it is mostly produced at low energy cost. Such increased demands may potentially contribute to economic development in many rural areas around the world. In case incomes are distributed within society, for less wealthy regions this development may also contribute to poverty reduction and thereby lead to reduced sensitivity for climate change. On the other hand, this increased demand for bioenergy has also been shown to lead to increased competition for land and deforestation in certain regions where agricultural production of energy crops becomes profitable, and intensified forestry practices in countries with a fore-running development. These Pan-European Guidelines intend to help finding a sound balance between development, climate change mitigation and other values of the forest for some of these new problems that climate change bring along. The technical guidelines are intended to be used as a check-list for aspects to be considered at adaptation of forest management to a changing climate.

These Pan-European Guidelines supplement the existing MCPFE commitments and tools to implement sustainable forest management, in particular the General Guidelines for Sustainable Forest Management in Europe (MCPFE, Resolution H1) and the Pan European Operational Level Guidelines (PEOLG, MCPFE, Annex 2 of Resolution L2). They can also be seen as a frame for the Pan-European Guidelines for Afforestation and Reforestation with special focus on the provisions of the UNFCCC (Guidelines Aff/Ref). They support synergies in the implementation of decisions of the United Nations Forum on Forests (UNFF), UNFCCC, CBD, United Nations Convention on Combating Desertification (UNCCD) and other relevant forest-related international commitments and aim at contributing to the achievement of relevant internationally agreed goals.

General Guidelines

1. Pan-European Criteria and Indicators for Sustainable Forest Management (SFM) should be used as an overall framework for actions taken to mitigate and adapt to climate change.

2. These guidelines should be considered in national policies and programmes related to forests and forestry (e.g. National Forest Programmes), biodiversity (e.g. National Biodiversity Strategies and Action Plans), climate change, energy, land use planning and management, integrated water resources management and agriculture.

3. Synergies in the national and regional implementation of international commitments under UNFF, UNFCCC, CBD and UNCCD should be promoted when carrying out mitigation activities and taking measures aiming at adaptation.

4. It should be recognized that changing patterns of calamity risks and markets for biomass demand will require a development of adapted forest management and protection strategies.

5. An increase in regional or global demand for bioenergy may lead to new forms of intensified forestry measures. This calls for a continuous research to answer questions about effects on nutrient balances, acid buffering capacity, biodiversity, productivity of wood, other services and values, etc. to form a scientific basis for governmental regulations and good-practice guidelines.

6. An increase in regional or global demand for bioenergy may further lead to increased deforestation or in favor of agricultural energy crop production in certain regions of the world. This calls for conscious governmental strategies and instruments to ensure survival of biodiversity at the landscape level. In other regions, an increased demand for biomass for energy may promote afforestation or reforestation (cf Guidelines Aff/Ref).

7. Effective information-sharing and cross-sectoral cooperation between relevant authorities and stakeholders involved should be provided for strategies and measures related to adaptation.

8. Economic, environmental, social and cultural impacts of suggested adaptation strategies and measures should be broadly assessed, as appropriate, in consultation with the researcher community and with stakeholders.

9. When evaluating various mitigation options, all significant negative and positive effects on greenhouse gas emissions and *albedo*, should be considered. It should be recognized that mitigation actions aiming at increasing carbon stocks in soils and/or biomass require long-term responsibility and maintenance costs to secure permanence. Mitigation strategies should be analyzed in a long-term perspective to ensure their contribution to reducing the climate change is likely to be sufficiently permanent.

10. Mitigation strategies should take into account economic, environmental, social and cultural aspects of sustainable management in a long-term perspective and avoid

such measures for carbon sequestration in managed forests that reduce freedom for coming generations to manage forests according to future conditions.

11. Management measures that reduce carbon stocks in soils and/or biomass significantly in relation to the substitution potential of the gain in biomass production should be avoided. Drainage of pristine peatland will normally show a negative net effect for climate due to the magnitude of peat decomposition.

12. Most likely, global action to mitigate climate change will lead to a continued growth of the global demand for bioenergy and energy-efficient construction materials. Mitigation measures that lead to increased biomass production, *inter alia* in the form of well-planned afforestation/reforestation or improved silviculture methods, therefore have a raised chance of leading to a permanent change in land use.

13. A legal framework for securing regeneration after harvesting will strongly contribute to secure permanence for mitigation measures in the form of afforestation and reforestation, and should therefore be a minimum requirement for the recognition of these activities as efficient mitigation within a country.

Technical guidelines for adaptation

..to be developed..

14. A continuous development of knowledge through research and analyses is needed about probable changes and possible threats resulting from various scenarios for climate change, and about possible adaptation measures.

15. Adapted strategies for biodiversity protection

16. Improved fire control – adapted land-use management, regional cooperation

17. Counteracting increased risk for pests, including risks connected to trade with non-refined biomass

18. Counteracting risks for other calamities (storm-felling, land-slides, flooding, etc)

19. Adapted choice of tree species and provenances

20. Adapted choices of silvicultural regimes

21. Adaption to warmer and wetter winters and non-frozen conditions in boreal forestry – forest and road transports

22. Adapted measures for social values, including cultural heritage

ANNEX 2: *Suggestion of* MCPFE recommendations for generally applicable minimum requirements on sustainable forest management, with special focus on bioenergy and climate mitigation

Draft 20 May

(For illustration, to facilitate discussions of the option of developing MCPFE minimum requirements in Uppsala, 11-12 June 2009)

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

The 1st MCPFE criterion for sustainable forest management requires the "maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles".

A suggestion for a minimum requirement for maintenance of the forest resource is: Unless sufficient regeneration comes naturally, actions to ensure forest regeneration must be taken within x years after a significant harvesting has been conducted that has brought an area from above to below the limits of the FAO definition on forest. The regeneration shall make it highly probable that the new stand will meet the FAO forest definition within 20 years. Exception can be made if the land use is changed, within the x year, but as soon as this new land use is abandoned, the regeneration plight shall again be applicable. A regulation that has these or stronger requirements must be part of the country's legislation and its obedience must be ensured through sufficient measures.

Because of the long-term character of the climate change problem and the high quantities of fossil fuels that need to be replaced or saved, a sufficient "payback time" must be allowed to new bioenergy extraction or production methods that result in an initial carbon stock loss after land conversion. Otherwise options to replace fossil fuels at a reasonable cost and with yet a very positive net effect for climate within a reasonable time will be left out. On the other hand too large losses that will not be "paid back" through substitution within a century or more must be prohibited.

A suggestion for a minimum requirement on climate mitigation efficiency at any land conversion is: New land management or methods for increased biomass production at a certain piece of land should not result in GHG emissions higher than 30 % of the potential emissions of fossil fuel[9] used for the same energy purpose in a 50-year perspective in relation to the average for former land use[10].

Such threshold value would mean that a low-productive non-dense forest, such as is often found on abandoned farmland in large parts of Europe, could be exchanged with short-term rotation forestry when that is considered profitable, whereas an old-grown, non-used and highly carbon dense forest could normally not. Stump harvesting will be enough efficient in most

[9]Coal or transportation fuel based on coal should be used as the fossil reference when substitution gains are calculated.

[10] New compared to old steady-state average carbon stock in biomass and soil plus net increase in emissions of nitrous oxide and methane over rotation period

cases. A loss of a peat layer or organic matter holding 25 ton C (a few cm peat) could then pass in most cases, whereas a loss of a 50 ton C will be above the limit for most cases, depending on net effects on the other GHG gases, the loss or gain in aboveground biomass and the new rate of delivery of biomass.

The refinement stage is traditionally beyond the scope of MCPFE, whose tools are focused on sustainable forest management. In some cases high amount of fossil fuels have been used for refinement of the biomass, thereby reducing the climate mitigation efficiency of the biofuel. However, all such cases are a result of biofuels being subsidized instead of given a better competitiveness through raised costs for carbon dioxide emissions from fossil fuel combustion, through carbon taxes or trading with emission permits. Since the latter must be the more sound and effective way to proceed forward with general climate policies, we suggest that these fossil-fuel dependent refinement systems must soon be phased out or improved towards efficiency anyway.

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

To be able to use the MCPFE 4th criterion for sustainable forest management, i.e. "maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems", as a basis for legally binding agreements is needed a minimum requirement for how to meet this criterion.

A suggestion of such minimum requirement is as follows: enough measures must be taken to ensure that all naturally occurring species survive in viable populations at the landscape level, with only "defendable" exceptions. Since many rare species of natural reasons will be endangered and their populations will never be fully "viable", this criterion must be combined with a criterion that the number of endangered species should not increase over time because of direct human impact[11].

In case such definition (or a similar) would be used as bases for a legally binding text, some kind of independent control function must be developed. Probably also "landscape level" must be somehow defined (suggestion: 1-5 million hectares) as well as a "starting time" (suggestion: 1 Jan 2009). Ecosystems and species in affected run-off water shall be included.

The government should be held ultimately responsible for the overall protection strategy and land-owners and operators will be responsible for following regulations and recommendations given by the government as guidance for how and where various ecosystems and species shall be preserved. Naturally, the preservation of most species can be ensured through an ecosystem approach. Threshold values for various critical biodiversity related MCPFE indicators could then be used locally or at the national level in the verification process.

[11] Out of species that were listed as domestic the starting date. Climate change would have to be considered an indirect impact.

ANNEX 3: Relationship between globally agreed thematic elements of sustainable forest management (UNFF 2004) and criteria as developed by MCPFE, Montreal Process and ITTO

Internationally agreed common thematic elements of sustainable forest management (UNFF Resolution 4/3, 2004)	MCPFE criteria (Lisbon resolution L2, 1998)	Montreal Process (Proposed Revised Indicators, Draft - for review and comment, dated February 10, 2006)	ITTO, International Tropical Timber Organisation (ITTO Policy Development Series No 15, 2005)
1. Extent of forest resources	Maintenance and Appropriate Enhancement of Forest Resources and their Contribution to Global Carbon Cycles (MCPFE C1)	Maintenance of forest contribution to global carbon cycles (MP C5)	Extent and condition of forests (ITTO C2)
2. Biological diversity	Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems (MCPFE C4)	Conservation of biological diversity (MP C1)	Biological diversity (ITTO C5)
3. Forest health and vitality	Maintenance of Forest Ecosystem Health and Vitality (MCPFE C2)	Maintenance of ecosystem health and vitality (MP C3)	Forest ecosystem health (ITTO C3)
4. Productive functions of forest resources	Maintenance and Encouragement of Productive Functions of Forests, Wood and Non-Wood (MCPFE C3)	Maintenance of productive capacity of forest ecosystems (MP C2)	Forest production (ITTO C4)
5. Protective functions of forest resources	Maintenance and Appropriate Enhancement of Protective Functions in Forest Management, notably soil and water (MCPFE C5)	Conservation and maintenance of soil and water resources (MP C4)	Soil and water protection (ITTO C6)
6. Socio-economic functions	Maintenance of other socio-economic functions and conditions (MCPFE C6)	Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies (MP C6)	Economic, social and cultural aspects (ITTO C7)
7. Legal, policy and institutional framework	MCPFE qualitative indicators A. Overall policies, institutions and instruments for sustainable forest management B. Policies, institutions and instruments by policy area	Legal, institutional and economic framework for forest conservation and sustainable management (MP C7)	Enabling conditions for sustainable forest management (ITTO C1)

ANNEX 4. Globally agreed "thematic element of sustainable forest management" and criterion with indicators under the Montreal Process and ITTO, structured according to the six MCPFE criteria and the qualitative indicators

MCPFE Criterion 1: Maintenance and Appropriate Enhancement of Forest Resources and their Contribution to Global Carbon Cycles **UNFF 2004: Thematic element 1. Extent of forest resources** **Montreal Process Criterion 5: Maintenance of forest contribution to global carbon cycles** **ITTO Criterion 2: Extent and condition of forests**			
	MCPFE Indicators	Montreal Process Indicators	ITTO indicators
	1.1 Area of forest and other wooded land, classified by forest type and by availability for wood supply, and share of forest and other wooded land in total land area 1.2 Growing stock on forest and other wooded land, classified by forest type and by availability for wood supply 1.3 Age structure and/or diameter distribution of forest and other wooded land, classified by forest type and by availability for wood supply 1.4 Carbon stock of woody biomass and of soils on forest and other wooded land	5.a Total forest ecosystem carbon pools and flux 5.b Total forest product carbon pools and flux 5.c Forest industry carbon emissions 5.d Avoided fossil fuel emissions by using harvested wood	2.1 Extent (area) and percentage of total land area under comprehensive land-use plans 2.2 Extent (area) of forests committed to production and protection (on protection, cf. MCPFE C 4.9, 5.1 and 5.2) 2.3 Extent (area) and percentage of total land area under each forest type 2.4 Percentage of PFE boundaries physically demarcated 2.5 Changes in forest area 2.6 Forest condition
MCPFE Criterion 2: Maintenance of Forest Ecosystem Health and Vitality **UNFF 2004: Thematic element 3. Forest health and vitality** **Montreal Process Criterion 3 : Maintenance of ecosystem health and vitality** **ITTO Criterion 3: Forest ecosystem health**			
	2.1 Deposition of air pollutants on forest and other wooded land, classified by N, S and base cations 2.2 Chemical soil properties (pH, CEC, C/N, organic C, base saturation) on forest and other wooded land related to soil acidity and eutrophication, classified by main soil types 2.3 Defoliation of one or more main tree species on forest and other wooded land in each of the defoliation classes "moder-	3.a Area of forest affected by biotic processes beyond reference conditions 3.b Area of forest affected by abiotic agents beyond reference conditions	3.1 Extent and nature of forest encroachment, degradation and disturbance caused by humans and the control procedures applied 3.2 Extent and nature of forest degradation and disturbance due to natural causes and the control procedures applied

	ate", "severe" and "dead" 2.4 Forest and other wooded land with damage, classified by primary damaging agent (abiotic, biotic and human induced) and by forest type			
MCPFE Criterion 3: Maintenance and Encouragement of Productive Functions of Forests, Wood and Non-Wood. UNFF 2004: Thematic element 4. Productive functions of forest resources Montreal Process Criterion 2: Maintenance of productive capacity of forest ecosystems ITTO Criterion 4: Forest production				
	3.1 Balance between net annual increment and annual fellings of wood on forest available for wood supply 3.2 Value and quantity of marketed roundwood 3.3 Value and quantity of marketed non-wood goods from forest and other wooded land 3.4 Value of marketed services on forest and other wooded land 3.5 Proportion of forest and other wooded land under a management plan or equivalent		2.a Area of forest land and net area of forest land available for wood production 2.b Total growing stock and annual increment of both merchantable and non-merchantable tree species in forests available for wood production 2.c The area and growing stock of plantations of native and exotic species 2.d Annual removal of wood volume compared to volume determined to be sustainable 2.e Annual removal of non-wood forest products compared to the level determined to be sustainable	Resource assessment 4.1 Extent and percentage of forest for which inventory and survey procedures have been used to define the quantity of the main forest products 4.2 Actual and sustainable harvest of wood and non-wood forest products 4.3 Composition of harvest 4.4 Total amount of carbon stored in forest stands (cf. MCPFE-I-1.4) Planning and control procedures 4.5 Existence and implementation of: (a) forest harvesting/operational plans (within forest management plans); and (b) other harvesting permits (small-, medium- and large-scale permits without forest management plans) 4.6 Extent of compartments/coupes harvested according to: (a) harvesting/operational plans; and (b) any other harvesting/cutting permit 4.7 Existence of a log-tracking system or similar control mechanism 4.8 Long-term projections, strategies and plans for forets production 4.9 Availability of historical records on the extent, nature and management of forests Silvicultural and harvesting guidelines 4.10 Availability and implementation of silvicultural guidelines for timber and non-wood forest products 4.11 Availability and implementation of harvestingl guide-

				lines for timber and non-wood forest products 4.12 Area over which silvicultural and harvesting guidelines are effectively implemented
MCPFE Criterion 4: Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems **UNFF 2004: Thematic element 2. Biological diversity** **Montreal Process Criterion 1: Conservation of biological diversity** **ITTO Criterion 5: Biological diversity**				
	4.1 Area of forest and other wooded land, classified by number of tree species occurring and by forest type 4.2 Area of regeneration within even-aged stands and uneven-aged stands, classified by regeneration type 4.3 Area of forest and other wooded land, classified by "undisturbed by man", by "semi-natural" or by "plantations", each by forest type 4.4 Area of forest and other wooded land dominated by introduced tree species 4.5 Volume of standing deadwood and of lying deadwood on forest and other wooded land classified by forest type 4.6 Area managed for conservation and utilisation of forest tree genetic resources (in situ and ex situ gene conservation) and area managed for seed production 4.7 Landscape-level spatial pattern of forest cover 4.8 Number of threatened forest species, classified according to IUCN Red List categories in relation to total number of forest species 4.9 Area of forest and other wooded land protected to conserve biodiversity, landscapes and specific natural elements, according to MCPFE Assessment Guidelines		*1.1 Ecosystem diversity* 1.1.a Area of forest by forest type by age class or successional stage, and forest ownership or tenure 1.1.b Area of forest by forest type in protected areas defined by age class or successional stage 1.1.c Fragmentation of forests *1.2 Species diversity* 1.2.a The number of known forest associated species for which ecological information is available. 1.2.b The number and status of forest associated species at risk as determined by legislation or scientific assessment. 1.2.c Status of in situ and ex situ efforts focused on conservation of species diversity *1.3 Genetic diversity* 1.3.a Number of forest associated species at risk from isolation and the loss of genetic variation 1.3.b Population levels of selected representative forest associated species to describe genetic diversity 1.3.c Status of in situ and ex situ efforts focused on conservation of genetic diversity	*Ecosystem diversity* 5.1 Protected areas containing forests 5.2 Protected areas connected by biological corridors or 'stepping stones' *Species diversity* 5.3 Existence and implementation of procedures to identify and protect endangered, rare and threatened species of forest-dependant flora and fauna 5.4 Number of endangered, rare and threatened forest-dependant species *Genetic diversity* 5.5 Measures for in situ and/or ex situ conservation of genetic variation within commercial, endangered, rare and threatened species of forest flora and fauna *Procedures for biodiversity conservation in production forests* 5.6 Existence and implementation of procedures for the protection and monitoring of biodiversity in production forests by: (a) retaining undisturbed areas; (b) protecting rare, threatened and endangered species; (c) protecting features of speial biological interest (eg nesting sites, seed trees, niches, keystone species, etc); and (d) assessing recent changes in (a), (b) and (c) above through inventories, monitoring/assessment programs and comparison with control areas 5.7 Extent and percentage if production forest that has been set aside for biodiversity conservation

MCPFE Criterion 5: Maintenance and Appropriate Enhancement of Protective Functions in Forest Management, notably soil and water **UNFF 2004: Thematic element 5. Protective functions of forest resources** **Montreal Process Criterion 4: Conservation and maintenance of soil and water resources** **ITTO Criterion 6: Soil and water protection**		
5.1 Area of forest and other wooded land designated to prevent soil erosion, to preserve water resources, or to maintain other forest ecosystem functions, part of MCPFE Class "Protective Functions" 5.2 Area of forest and other wooded land designated to protect infrastructure and managed natural resources against natural hazards, part of MCPFE Class "Protective Functions"	*4.1 Protective function* 4.1.a Area of forest whose designation or land management focus is the protection of soil or water resources *4.2 Soil* 4.2.a Area of forest subject to forest management activity that is deemed at risk of [irreversible] significant soil disturbance 4.2.b Degree of compliance with locally applicable, enforceable legislation, regulations and policies on soil disturbance and degradation 4.2.c Area of forest with [persistent [significant] degradation [processes]] [significant][irreversible] [adverse] [soil disturbance and/or degradation] *4.3 Water* 4.3.a Area of forest subject to [harvest related] [forest] management activities that could result in significant impact on water quantity, or biological or physical qualities 4.3.b Degree of compliance with locally applicable, enforceable legislation, regulations and policies on harvesting and road construction, stream crossing and riparian zone management that address water quality, quantity and timing 4.3.c Area of water bodies, or stream length, in forest areas with significant change in physical or biological properties from reference conditions	*Extent of protection* 6.1 Extent and protection of total forest area managed exclusively for the protection of soil and water 6.2 Procedures to ensure the protection of downstream catchment values *Protective functions in production forests* 6.3 Procedures to protect soil productivity and water retention capacity within production forests 6.4 Procedures for forest engineering, including: (a) drainage requirements; (b) conservation of buffer strips along streams and rivers; (c) protection of soils from compaction by harvesting machinery (d) protection of soils from erosion during harvesting operations 6.5 Extent and percentage of areas in production PFE that have been defined as environmentally sensitive (eg very steep or erodible) and protected

MCPFE Criterion 6: Maintenance of other socio-economic functions and conditions **UNFF 2004: Thematic element 6. Socio-economic functions** **Montreal Process Criterion 6: Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies** **ITTO Criterion 7: Economic, social and cultural aspects**		
6.1 Number of forest holdings, classified by ownership categories and size classes 6.2 Contribution of forestry and manufacturing of wood and paper products to gross domestic product 6.3 Net revenue of forest enterprises 6.4 Total expenditures for long-term sustainable services from forests 6.5 Number of persons employed and labour input in the forest sector, classified by gender and age group, education and job characteristics 6.6 Frequency of occupational accidents and occupational diseases in forestry 6.7 Consumption per head of wood and products derived from wood 6.8 Imports and exports of wood and products derived from wood 6.9 Share of wood energy in total energy consumption, classified by origin of wood 6.10 Area of forest and other wooded land where public has a right of access for recreational purposes and indication of intensity of use 6.11 Number of sites within forest and other wooded land designated as having cultural or spiritual values	6.1 *Production and consumption* 6.1.a Value and volume of wood and wood products 6.1.b Value and quantities of production of non-wood forest products 6.1.c Value of forest based services 6.1.d Production and consumption and import/export of wood products 6.1.e Production and consumption and import/export of non wood products 6.1.f Degree of recycling of forest products and utilization of byproducts [wastes] *6.2 Recreation and tourism* 6.2.a Area of forests available for a variety of public recreation and tourism demands 6.2.b Number of visits attributed to recreation and tourism *6.3 Investment in the forest sector* 6.3.a Value of investment in forest management, wood and non-wood product industries, forest-based services, recreation and tourism 6.3.b Value of investment in research and development, and education *6.4 Cultural, social and spiritual needs and values* 6.4.a Area of forests managed to protect the range of cultural, social and spiritual needs and values 6.4.c Non consumptive use of forest values *6.5 Employment and community needs* 6.5.a Direct and indirect employment rates in the forest sector 6.5.b Workforce health and welfare (wellbeing) 6.5.c Resilience of forest dependent communities, including indigenous communities 6.5.d Area of forests used for subsistence purposes *6.6 Social equity - distribution of benefits* 6.6.a Area of forest by by legal right of use	*Socioeconomic aspects* 7.1 Value and percentage contribution of the forestry sector to gross domestic product (GDP) 7.2 Value of domestically produced wood, non-wood forest products and environmental services in: (a) domestic markets; (b) export markets; and (c) informal markets including subsistence and illegal activities (estimate) 7.3 Forest products' ndustry structure and efficiency 7.4 Existence and implementation of mechanisms for the equitable sharing of costs and benefits of forest management 7.5 Existence and implementation of conflict-resolution mechanisms for resolving disputes between forest stakeholders 7.6 Number of people depending on forests for their livelihoods 7.7 Training, capacity-building and manpower development programs for forest workers 7.8 Existence and implementation of procedures to ensure the health and safety of forest workers 7.9 Area of forests upon which people are dependant for subsistence uses and traditional and customary lifestyles 7.10 Number and extent of forest sites available primarily for: (a) research and education; and (b) recreation *Cultural aspects* 7.11 Number of important archaeological, cultural and spiritual sites identified and protected *Community and indigenous peoples' rights and participation* 7.12 Extent to which tenure and user rights of communities and indigenous peoples over publicly owned

			6.6.b Distribution of economic benefits from the wood [and non-wood forest] products industry	forests are recognized and practised 7.13 Extent to which indigenous knowledge is used in forest management planning and implementation 7.14 Extent of involvement of indigenous peoples, local communities and other forest dwellers in forest management capacity-building, consultation processes, decision making and implementation
MCPFE qualitative indicators **UNFF 2004: Thematic element 7. Legal, policy and institutional framework** **Montreal Process Criterion 7: Legal, institutional and economic framework for forest conservation and sustainable management** **ITTO Criterion 1: Enabling conditions for sustainable forest management**				
	A. Overall policies, institutions and instruments for sustainable forest management A.1 National forest programmes or similar A.2 Institutional frameworks A.3 Legal/regulatory frameworks and international commitments A.4 Financial instruments/economic policy A.5 Informational means *B. Policies, institutions and instruments by policy area* B.1 Land use and forest area and OWL (crit. 1) B.2 Carbon balance (crit.1) B.3 Health and vitality (crit. 2) B.4 Production and use of wood (crit. 3) B.5 Production and use of non-wood goods and services, provision of especially recreation (crit. 3) B. 6 Biodiversity (crit. 4) B. 7 Protective forests and OWL (crit. 5) B.8 Economic viability (crit. 6) B.9 Employment, incl. safety and health (crit. 6)		*7.1.a* Legislation and policies supporting the sustainable management of forests *7.1.b* Cross sectoral policy and programme coordination *7.2.a* Taxation and other economic strategies that affect the sustainable management of orests *7.3.a* Clarity and security of land and resource tenure and property rights *7.3.b* Enforcement of laws related to forests *7.4.a* Programmes, services and other resources supporting the sustainable management of forests *7.4.b* Development and application of research and technologies for the sustainable management of forests *7.5.a* Partnerships to support the sustainable management of forests *7.5.b* Public participation and conflict resolution in forest-related decision making *7.5.c* Monitoring, assessment and reporting on progress towards sustainable management of forests	*Policy, legal and governance framework* 1.1Existence and implementation of policies, laws and regulations to govern forest management 1.2 Forest tenure and ownership Economic framework 1.3 Amount of funding in forest management, administration, reaserch and human resource development 1.4 Existence and implementation of economic instruments and other incentives to encourage sustainable forest management *Institutional framework* 1.5 Structure and staffing of institutions responsible for sustainable forest management 1.6 Number of professional and technical personell at all levels to perform and support forest management 1.7 Existence of communication strategies and feedback mechanisms to increase awareness of sustainable forest management 1.8 Existence of, and ability to apply, appropriate technology to practise sustainable forest management and the efficient utilization and marketing of forest products

	B. 10 Public awareness and participation (crit. 6) B.11 Research, training and education (crit. 6) B.12 Cultural and spiritual values (crit. 6)			*Planning framework* 1.9 Capacity and mechanisms for planning sustainable forest management and for periodic monitoring, evaluation and feedback on progress 1.10 Public participation in forest management planning, decision-making, datacollection, monitoring and assessment 1.11 Existence of forest management plans (cf. MCPFE I 3.5)

References:
MCPFE criteria adopted in 1998 (Resolution L2) and the improved indicators endorsed in 2003 (annexed to Vienna Declaration).
UNFF 2004 refer to the seven thematic elements of sustainable forest management, drawn from the criteria identified by criteria and indicator processes, and offering "a reference framework for sustainable forest management", cf. United Nations Forum on Forests Resolution 4/3, 2004.
Montreal Process criteria and indicators are found in Proposed Revised Indicators, Draft - for review and comment, dated February 10, 2006.
ITTO criteria and indicators refer to Revised ITTO criteria and indicators for the sustainable management of tropical forests including reporting format (ITTO Policy Development Series No 15, 2005).

ANNEX 5. Pan-European Operational Level Guidelines

ANNEX 2 OF THE RESOLUTION L2
Pan-European Operational Level Guidelines for Sustainable Forest Management

The Operational Level Guidelines form a common framework of recommendations that can be used on a voluntary basis and as a complement to national and/or regional instruments to further promote sustainable forest management at the field level, on forest areas in Europe.

Adopted at the Fifth Expert Level Preparatory Meeting of the Lisbon Conference on the Protection of Forests in Europe, 27-29 April 1998, Geneva Switzerland.

1. INTRODUCTION

Forests in Europe grow in a wide and diverse range of ecological conditions, from boreal to Mediterranean and from alpine to lowlands. These forests have been influenced by human settlement and action over the centuries, and in some countries planted forests constitute a major part of the resource. Forest management in Europe is characterized by a large proportion of private, fragmented, small-scale farm-related ownership structures in the majority of countries, as well as a large proportion of public forests and forests owned by private forest enterprises in others.

Forest management takes place within clearly established ownership rights and with a long history of national/regional laws and regulations based on long-term planning. Thus, the concept of sustainability has a long tradition in forestry in Europe. However, the meaning of 'sustainable forest management' has developed over time according to the changing needs of

society. Originally, sustainability in forest management was mainly considered as the sustained yield of timber to cope with historic wood shortages. However, the importance of other multiple functions of forests have gradually been incorporated in forest management. During the 1980's the concern about the deterioration of forests throughout Europe led to an increasing awareness of the economic, ecological, social and cultural values of forests by the broader public. Nowadays many important aspects of sustainable forest management are covered by national and/or regional laws and regulations and are already being regularly monitored.

The wish for a concerted effort at a political level to protect and further improve the sustainable management of European forests led to the First Ministerial Conference on the Protection of Forests in Europe held in Strasbourg in 1990. At the Second Ministerial Conference, held in Helsinki in 1993, the ministers responsible for forestry in Europe embraced the internationally accepted UNCED[12] Forest Principles, taking a further step in the history of the concept of sustainable forest management by adopting, *inter alia*, Resolution H1 "General Guidelines for Sustainable Management of European Forests" and Resolution H2 "General Guidelines for the Conservation of the Biodiversity of European Forests". These General Guidelines represent the political commitment of the signatory states of the Helsinki Resolutions by providing a general policy direction and a long-term goal to meet the demands on European forests for multiple goods and services in a manner that is consistent with their sustainable management, and conservation and enhancement of their biological diversity.

A new, common definition of 'sustainable forest management' was laid down in Resolution H1:

> *'the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems'*

For the follow-up and the implementation of the General Guidelines, the pan-European national level criteria and indicators[13] were adopted at the expert level within the Follow-Up Process of the Helsinki Ministerial Conference in 1994. They are a policy instrument for evaluating and reporting progress towards sustainable forest management, as described in Resolution H1, in individual European countries and in Europe as a whole.

The six pan-European criteria for sustainable forest management are:

1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles;
2. Maintenance of forest ecosystem health and vitality;
3. Maintenance and encouragement of productive functions of forests (wood and nonwood);
4. Maintenance, conservation and appropriate enhancement of biological diversity in forest

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[12] United Nations Conference on Environment and Development, Rio de Janeiro, 1992.

[13] **Criteria** characterise or define the essential elements or set of conditions or processes by which sustainable forest management may be assessed. The direction of change within each criterion is shown by periodically measured **indicators**.

ecosystems;
5. Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water); and
6. Maintenance of other socio-economic functions and conditions.

The Pan-European Operational Level Guidelines have been elaborated to further promote sustainable forest management in Europe by translating the international commitments down to the level of forest management planning and practices. They represent a common framework of recommendations for reference at the field level that can be used on a voluntary basis. These Guidelines are directly based on Resolutions H1 and H2, and they follow the structure of the six pan-European criteria that were identified as the core elements of sustainable forest management. For clarity they are divided into 'Guidelines for Forest Management Planning' and 'Guidelines for Forest Management Practices', focusing on basic ecological, economical and social requirements for sustainable forest management within each criterion.

The Pan-European Operational Level Guidelines are designed to be applied in the context of, and in full respect to, national and/or regional instruments and actions. They cannot be used in isolation to determine sustainability in forest management. Their purpose is to identify complementary actions at the operational level which will further contribute to sustainability of forest management. This should reflect national, economic, ecological, social and cultural conditions, research and traditional knowledge, and must respect forest and environmental legislation, decisions on protected areas, other general principles, as well as codes for forest practice such as standards used for forest management in any given country.

The effective implementation of these Guidelines implies recognizing the major role and the legal rights of forest owners. Furthermore, the implementation of sustainable forest management in the field requires continuous extension, training and education of forest managers, owners and workers, for which the Pan-European Operational Level Guidelines can provide an important reference.

2. POTENTIAL USES OF THE PAN-EUROPEAN OPERATIONAL LEVEL GUIDELINES

In general, the Pan-European Operational Level Guidelines are designed for sub-national applications at a practical level. Whenever used, their content should be adapted to the specific local, economic, ecological, social and cultural conditions, as well as to the respective forest management and administrational systems already in place; in this process participation of all interested parties should be encouraged. Therefore, all guidelines may not necessarily be relevant for all levels, all types of forest, or ownership categories.
In order to facilitate the implementation of these voluntary Guidelines, there might be a need for the promotion and equitable support by government, society and other beneficiaries to create and maintain a sound balance of interests including a sound economic basis for forestry.

The potential applications and users of the Pan-European Operational Level Guidelines are:

• **Forest managers and forest owners**

The Guidelines can assist forest managers and forest owners in planning and implementing improved sustainable management practices and operations in the field. They can be used for increasing communication and awareness in relation to the evolving concept of sustainable forest management and the desired actions at the operational level amongst forest owners, managers, employees, contractors or others.

• **Sub-national organisations**

The sub-national (regional or local) organisations can use the guidelines as a reference tool in informing and advising forest owners and forest managers, in planning the practices and/or in supervising their implementation. These types of organisations include, for example, sub-national administrational forestry organisations and forest owners or management associations.

• **National/governmental decision makers**

The Guidelines can be used as an internationally agreed framework for the guidance of forest management bringing the commitments made in the international policy *fora* (UNCED Forest Principles and Helsinki Resolutions) down to the field level. They can serve as a reference for setting codes for forest practice and forest management planning.

• **International forest dialogue**

The Guidelines form a European reference to the global forest dialogue. They can contribute, as an instrument representing consensus within the Pan-European Process, to the achievement of further consensus on sustainable management of all types of forests on a global scale.

• **Communication tools and certification systems**

These guidelines can serve as a tool to improve communication and awareness building related to sustainable forest management. In addition, although certification and other quality assurance systems or programmes as such would remain independent from the Pan-European Process and are voluntary to the interested parties, the Guidelines could provide an indicative reference for the establishment of standards for those systems.

3. PAN-EUROPEAN OPERATIONAL LEVEL GUIDELINES FOR SUSTAINABLE FOREST MANAGEMENT

CRITERION 1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles

1.1 Guidelines for Forest Management Planning

a. Forest management planning should aim to maintain or increase forest and other wooded area, and enhance the quality of the economic, ecological, cultural and social values of forest resources, including soil and water. This should be done by making full use of related services such as land-use planning and nature conservation.

b. Inventory and mapping of forest resources should be established and maintained, adequate to the local and national conditions, and in correspondence with the topics described in these Guidelines.

c. Management plans or their equivalents, appropriate to the size and use of the forest area, should be elaborated and periodically updated. They should be based on legislation as well as existing land use plans, and adequately cover the forest resources.

d. Monitoring of the forest resources and evaluation of their management should be periodically performed, and their results should be fed back into the planning process.

1.2 Guidelines for Forest Management Practices

a. Forest management practices should safeguard the quantity and quality of the forest resources in the medium and long term by balancing harvesting and growth rates, and by preferring techniques that minimise direct or indirect damage to forest, soil or water resources.

b. Appropriate silvicultural measures should be taken to maintain the growing stock of resources at - or bring to - a level that is economically, ecologically and socially desirable.

c. Conversion of abandoned agricultural and treeless land into forest land should be taken into consideration, whenever it can add economic, ecological, social and/or cultural value.

CRITERION 2. Maintenance of forest ecosystem health and vitality

2.1 Guidelines for Forest Management Planning
a. Forest management planning should aim to maintain and increase the health and vitality of forest ecosystems and to rehabilitate degraded forest ecosystems, whenever this is possible by silvicultural means. b. Health and vitality of forests should be periodically monitored, especially key biotic and abiotic factors that potentially affect health and vitality of forest ecosystems, such as pests, diseases, overgrazing and overstocking, fire, and damage caused by climatic factors, air pollutants or by forest management operations. c. Forest management plans or their equivalents should specify ways and means to minimise the risk of degradation of and damages to forest ecosystems. Forest management planning should make use of those policy instruments set up to support these activities.

2.2 Guidelines for Forest Management Practices
a. Forest management practices should make best use of natural structures and processes and use preventive biological measures wherever and as far as economically feasible to maintain and enhance the health and vitality of forests. Adequate genetic, species and structural diversity should be encouraged and/or maintained to enhance stability, vitality and resistance capacity of the forests to adverse environmental factors and strengthen natural regulation mechanisms. b. Appropriate forest management practices such as reforestation and afforestation with tree species and provenances that are suited to the site conditions or the use of tending, harvesting and transport techniques that minimise tree and/or soil damages should be applied. The spillage of oil through forest management operations or the indiscriminate disposal of waste on forest land should be strictly avoided. c. The use of pesticides and herbicides should be minimised, taking into account appropriate silvicultural alternatives and other biological measures. d. In case fertilisers are used they should be applied in a controlled manner and with due consideration to the environment.

CRITERION 3. Maintenance and encouragement of productive functions of forests (wood and non-wood)

3.1 Guidelines for Forest Management Planning
a. Forest management planning should aim to maintain the capability of forests to produce a range of wood and non-wood forest products and services on a sustainable basis. b. Forest management planning should aim to achieve sound economic performance taking into account possibilities for new markets and economic activities in connection with all relevant goods and services of forests. c. Forest management plans or their equivalents should take into account the different uses or functions of the managed forest area. Forest management planning should make use of those policy instruments set up to support the production of merchantable and non-merchantable forest goods and services.
3.2 Guidelines for Forest Management Practices
a. Forest management practices should be ensured in quality with a view to maintain and improve the forest resources and to encourage a diversified output of goods and services over the long term. b. Regeneration, tending and harvesting operations should be carried out in time, and in a way that do not reduce the productive capacity of the site, for example by avoiding damage to retained stands and trees as well as to the forest soil, and by using appropriate systems. c. Harvesting levels of both wood and non-wood forest products should not exceed a rate that can be sustained in the long term, and optimum use should be made of the harvested forest products, with due regard to nutrient offtake. d. Adequate infrastructure, such as roads, skid tracks or bridges should be planned, established and maintained to ensure efficient delivery of goods and services while at the same time minimising negative impacts on the environment.

CRITERION 4. Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems

	4.1 Guidelines for Forest Management Planning
a.	Forest management planning should aim to maintain, conserve and enhance biodiversity on ecosystem, species and genetic level and, where appropriate, diversity at landscape level.
b.	Forest management planning and terrestrial inventory and mapping of forest resources should include ecologically important forest biotopes, taking into account protected, rare, sensitive or representative forest ecosystems such as riparian areas and wetland biotopes, areas containing endemic species and habitats of threatened species, as defined in recognised reference lists, as well as endangered or protected genetic *in situ* resources.
	4.2 Guidelines for Forest Management Practices
a.	Natural regeneration should be preferred, provided that the conditions are adequate to ensure the quantity and quality of the forests resources and that the existing provenance is of sufficient quality for the site.
b.	For reforestation and afforestation, origins of native species and local provenances that are well adapted to site conditions should be preferred, where appropriate. Only those introduced species, provenances or varieties should be used whose impacts on the ecosystem and on the genetic integrity of native species and local provenances have been evaluated, and if negative impacts can be avoided or minimised.
c.	Forest management practices should, where appropriate, promote a diversity of both horizontal and vertical structures such as uneven-aged stands and the diversity of species such as mixed stands. Where appropriate, the practices should also aim to maintain and restore landscape diversity.
d.	Traditional management systems that have created valuable ecosystems, such as coppice, on appropriate sites should be supported, when economically feasible.
e.	Tending and harvesting operations should be conducted in a way that do not cause lasting damage to ecosystems. Wherever possible, practical measures should be taken to improve or maintain biological diversity.
f.	Infrastructure should be planned and constructed in a way that minimises damage to ecosystems, especially to rare, sensitive or representative ecosystems and genetic reserves, and that takes threatened or other key species - in particular their migration patterns - into consideration.
g.	With due regard to management objectives, measures should be taken to balance the pressure of animal populations and grazing on forest regeneration and growth as well as on biodiversity.
h.	Standing and fallen dead wood, hollow trees, old groves and special rare tree species should be left in quantities and distribution necessary to safeguard biological diversity, taking into account the potential effect on health and stability of forests and on surrounding ecosystems.
i.	Special key biotopes in the forest such as water sources, wetlands, rocky outcrops and ravines should be protected or, where appropriate, restored when damaged by forest practices.

CRITERION 5. Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water)

	5.1 Guidelines for Forest Management Planning
a.	Forest management planning should aim to maintain and enhance protective functions of forests for society, such as protection of infrastructure, protection from soil erosion, protection of water resources and from adverse impacts of water such as floods or avalanches.
b.	Areas that fulfil specific and recognised protective functions for society should be registered and mapped, and forest management plans or their equivalents should take full account of these areas.
	5.2 Guidelines for Forest Management Practices
a.	Special care should be given to silvicultural operations on sensitive soils and erosion-prone areas as well as on areas where operations might lead to excessive erosion of soil into watercourses. Inappropriate techniques such as deep soil tillage and use of unsuitable machinery should be avoided on such areas. Special measures to minimise the pressure of animal population on forests should be taken.
b.	Special care should be given to forest management practices on forest areas with water protection function to avoid adverse effects on the quality and quantity of water resources. Inappropriate use of chemicals or other harmful substances or inappropriate silvicultural practices influencing water quality in a harmful way should be avoided.
c.	Construction of roads, bridges and other infrastructure should be carried out in a manner that minimises bare soil exposure, avoids the introduction of soil into watercourses and that preserve the natural level and function of water courses and river beds. Proper road drainage facilities should be installed and maintained.

CRITERION 6. Maintenance of other socio-economic functions and conditions

6.1 Guidelines for Forest Management Planning
a. Forest management planning should aim to respect the multiple functions of forests to society, have due regard to the role of forestry in rural development, and especially consider new opportunities for employment in connection with the socio-economic functions of forests. b. Property rights and land tenure arrangements should be clearly defined, documented and established for the relevant forest area. Likewise, legal, customary and traditional rights related to the forest land should be clarified, recognised and respected. c. Adequate public access to forests for the purpose of recreation should be provided taking into account the respect for ownership rights and the rights of others, the effects on forest resources and ecosystems, as well as the compatibility with other functions of the forest. d. Sites with recognised specific historical, cultural or spiritual significance should be protected or managed in a way that takes due regard of the significance of the site. e. Forest managers, contractors, employees and forest owners should be provided with sufficient information and encouraged to keep up to date through continuous training in relation to sustainable forest management.
6.2 Guidelines for Forest Management Practices
a. Forest management practices should make the best use of local forest related experience and knowledge, such as of local communities, forest owners, NGOs and local people. b. Working conditions should be safe, and guidance and training in safe working practice should be provided. c. Forest management operations should take into account all socio-economic functions, especially the recreational function and aesthetic values of forests by maintaining for example varied forest structures, and by encouraging attractive trees, groves and other features such as colours, flowers and fruits. This should be done, however, in a way and to an extent that does not lead to serious negative effects on forest resources, and forest land.

ANNEX 6. Developments and processes addressing sustainable production of bioenergy

1. Introduction

Because of the fast development of bioenergy extraction and production chains, concerns have been raised about how this will affect biodiversity and how effective they actually are in terms of climate change mitigation. The climate change mitigation efficiency can be lowered either because high amounts of fossil fuels are used for their production and/or refinement or because a preceding land-use conversion result in large carbon and/or other greenhouse gas emissions. Apart from a development of national legislation and good-practice guidelines to prevent such negative effects, these concerns has also resulted in several examples of international cooperation on developing criteria and indicators for sustainable bioenergy production and systems for assuring that certain minimum requirements are being met in the energy production.

Below is presented short descriptions of some of these international processes addressing sustainability of production of biomass, with references to further information.

2. Processes for legally binding commitments

European Commission – The renewable energy directive (RED) and biofuel quality directive

The European Community (EC) has established an overall binding target of a 20% share of renewable energy sources in energy consumption and a 10% binding minimum target for biofuels in transport to be achieved by each Member State, as well as binding national targets by 2020 in line with the overall EU target of 20%.

Faced with the concern about the sustainability of biofuels, the European Commission has developed minimum requirements in relation to certain potential environmental impacts for biofuels used for transports, which were adopted in a directive in December 2008. An on-going analysis of whether similar requirements should be developed also for biomass used for electricity and heating purposes will report to the EU parliament in December 2009. As wood is at present the most important source of renewable energy, this is bound to influence the rules of the game for the forest sector in Europe and in countries from where biomass for energy production is being imported.

Within the EU, there are other processes that possibly, in one way or the other, will refer to the criteria developed for the RED (e.g. EC process for public procurement, EU Eco-labelling, EU FLEGT, CEN – EU standard).

In the RED, a general criterion states that the greenhouse gas emission saving from the use of the fuel should be at least 35 %, which means that fossil fuels used for the production/refinement should not emit more than 65 % of the emissions that are avoided when the biofuel is consumed (*must be checked*). Concerning land-use change, biofuels (to be accounted for when meeting targets) shall not come from wetlands transferred from a natural to a drained status or from land that was deforested after January 2008. Carbon losses in soils caused by changes in the cultivation system should be divided over 20 years and accounted for in the minimum limit of 35 % savings in a 20-year-long time perspective (*check*).

National initiatives and legislation concerning sustainable and renewable fuels

The UK obligation for blending: (http://www.opsi.gov.uk/si/si2007/pdf/uksi_20073072_en.pdf)

include in paragraph 13 that the Administrator may require a transport fuel supplier to provide information as to the effects on carbon emissions, agriculture, other economic activities, sustainable development, or the environment generally which are or may be associated with the production, supply or use of the renewable transport fuel which has been supplied.

3. Public procurement policies

Public procurement policies aim at ensuring that all products stem from sustainable and/or legal sources. Procurement policies on wood and other forest products are being developed at national (e.g. UK, Netherlands, Sweden) and European level.

4. Cooperation on sustainability of biomass between countries, organisations, etc

Roundtable on Sustainable Biofuels: an initiative of the EPFL Energy Center, Lausanne, Switzerland

The Roundtable on Sustainable Biofuels is an international initiative bringing together farmers, companies, non-governmental organizations, experts, governments, and inter-governmental agencies concerned with ensuring the sustainability of biofuels production and processing. It has a multi-stakeholder steering board consisting of mainly company representatives, but also representatives from the UN Environment Programme, some NGO:s, (e.g. WWF) and Swiss and Dutch ministries. A draft standard has been produced that is largely based on work already conducted by the Forest Stewardship Council, the Dutch Cramer Commission, the Low Carbon Vehicle Partnership in the UK, the Roundtable on Sustainable Palm Oil, the ILO's Decent Work agenda, the Sustainable Agriculture Network, the Better Sugarcane Initiative, and other sustainable agriculture initiatives (Version zero of August 2008) that includes a principle level and a guiding criteria level:
http://cgse.epfl.ch/page65660-en.html

Nordic Council of Ministers – Sustainable biomass from forestry and agriculture

During spring 2008, representatives from the ministry or national agency level, NGO:s, land owner organisations and research in Sweden, Finland, Denmark and Norway participated in a time-limited project to discuss and develop common guidelines for sustainable biomass production at a Nordic level. The project was lead by agencies for forestry and agriculture under the Swedish Ministry of Agriculture. Criteria for biodiversity protection, climate mitigation efficiency were also suggested. A report was produced that will be printed by the Nordic Council of Ministers secretariat. (www.norden.org)

IRGC - Risk governance guidelines for bioenergy policies

The International Risk Governance Council (IRGC) is an independent foundation based in Switzerland whose purpose is to identify and propose recommendations for the governance of emerging global risks. In a year-long project, the opportunities and risks of bioenergy have been examined, deficits in the governance of those risks have been identified, and recommendations for improvements to the risk governance of bioenergy have been developed (www.irgc.org).

The Forest Dialogue

The Forest Dialogue (TFD) was initiated by the World Business Council on Sustainable Development (WBCSD), World Resources Institute (WRI) and International Union for Conservation of Nature (IUCN) in 1999. The TDF steering committee consists of representatives for forestry companies and NGOs and international organisations (e.g. ITTO, Global Forest Partners, International Alliance of Indigenous and Tribal Peoples of the Tropical Forests, The World Bank, Building and Woodworkers' International, CEPF, The Nature Conservancy, WWF, Friends of the Earth- Amazonia) and research institutes (e.g. World Resources Institute, Australian National University.

Its aim is to promote sustainable forest management by providing a platform for dialogue and confidence building between different forest stakeholders such as environmental and social groups, businesses, forest owners, labour unions, indigenous people and international organisations. TFD's initiative to address forestry and climate change was launched during COP 13 in Bali 2007. It aims to produce a statement that addresses the way forests may be included in a post-Kyoto deal concerning Reducing Emissions from Deforestation and Degradation (REDD). One major concern of TFD is that forests risk being treated as mere "sticks of carbon" rather than a multi-functional and multi-value asset on which hundreds of millions of people depend. Unless addressed with a sustainable forest management (SFM) approach, particularly taking into account the critical importance of governance and users' rights, REDD is likely to fail according to TFD. The suggested declaration (Sept 2008 version) included six principles:

1. Ensure that forest-related action for climate change mitigation and adaptation complement and give impetus to sustainable development;
2. Tackle the main drivers of deforestation, which mostly lie outside the forest sector;
3. Recognize and remove barriers to transparent, inclusive, and accountable forest governance;
4. Respect and support local processes that clarify and strengthen tenure, property, and carbon rights;
5. Support balanced approaches to mitigation and adaptation strategies in both forest-rich and forest-poor countries;
6. Provide substantial additional funding to build the capacity of countries, communities, and forest managers and owners to participate in forest-related climate change mitigation and adaptation initiatives.

and can be downloaded at: http://research.yale.edu/gisf/tfd/index.html

5. Standardisation

In 2006, the Dutch government has asked a national group of experts to define principles and criteria for the sustainable production of biomass; the so-called Cramer criteria after the chair of that group. The Cramer principles and criteria are divided in six themes:

1. greenhouse gas emissions balance,
2. competition with food, local energy supply, medicine and construction materials,
3. biodiversity (no adverse effects on protected areas or valuable ecosystems),
4. environment (management of waste, erosion, water and emissions),
5. prosperity,
6. social well-being (social, human and property rights).

The task of the project group was to formulate principles and criteria for the production and the processing of biomass for energy, transport fuels and chemistry. The aim was that these could be made applicable to food, feed and fuel. In parallel or shortly thereafter UK and German governments have initiated similar activities in the attempt to introduce more sustainable bio-

mass on their internal market. From the 15th of April 2008, UK suppliers of biofuels in the transport sector need to report the product's sustainability.

CEN, the standard development organisation of EU, is conducting a process for development of standards for sustainably produced biomass for energy application "(CEN/TC 383)biofuels". CEN had a plan to produce a proposal for a standard that include minimum requirements for biomass production until September 2009, however this time plan is now delayed. According to the initial plan, the technical committee of CEN will elaborate on a European meta-standard for sustainable produced biomass for transport fuels and energy production applications. This meta-standard allows users to check for the sustainability themes as laid down by the Dutch (Cramer), the British (RTFO), the German (BSO) and the European (RED) authorities. This means the set shall include definitions, basic requirements, principles, criteria and possibly indicators for sustainability assessment (including a fossil fuel and GHG balance), and ways to assess them in relation to biomass produced, supplied or used.

6. Certification

The total area of forests certified globally has increased steadily from less than 25 million hectares in 1998 to 275 million hectares in 2006, the latter constituting 7.6% of the world's forests (Stupak et al, in prep). The Programme for the Endorsement of Forest Certification (PEFC www.pefc.org.), an umbrella organization that endorses a large number of previously independent national initiatives (e.g., Canadian Standards Association (CSA) and Sustainable Forestry Initiative (SFI)), accounts for 69% of global certified forests and the Forest Stewardship Council (FSC www.fsc.org) accounts for another 28%.

The Nordic Ecolabel: Nordic requirements for ecolabelled transport fuels was published in June 2008 (www.svanen.nu)

7. Research and development projects

There is also a range of past and present investigations and research projects in which these issues are being examined. Examples of this include:

"How much bioenergy can Europe produce without harming the environment" (http://reports.eea.europa.eu/eea_report_2006_7/en)

EUROFORENET: European forest energy network (www.euroforenet.eu) is an ELO action supported by the European Commission, Directorate General of the Environment. Its goal is to stimulate and encourage the co-operation between both private and public stakeholders, in order to improve efficiency at a local level in forest-wood-energy supply chains in various Member States of the EU. The main objectives are to propose a set of recommendations, tools and guidelines for both private and public decision makers, in order to promote energy-oriented sustainable forest management, as well as to support the benefits of wood energy in general. EUROFORENET used two tools to achieve these objectives: a communication campaign and a platform of experts who developed a practical guide. It also incorporates scientific tools, such as the one developed by FAO - Forestry Department, Wood Energy "WISDOM" (Woodfuel Integrated Supply / Demand Overview Mapping). EUROFORENET is also an awarded partner of the Sustainable Energy Campaign by the European Commission DG Energy and Transport.

Guidelines can be downloaded:
http://www.euroforenet.eu/wp-content/uploads/File/EUROFORENET%20guidelines.pdf

MAKE-IT-BE is a new ELO project (starting after the Summer of 2008) forming a follow-up of the EUROFORENET initiative and co-financed by the Intelligent Energy Europe pro-

gramme supported by the European Commission, DG for Energy and Transport. Involving partners from Italy, Slovenia, Austria, Belgium and the UK, this high-level project will develop "decision making and implementation tools for the delivery of local and regional Bio-energy chains". This 36-month action aims at providing feasible solutions for countryside managers on the ground with a view to help member states implementing their EU renewable energy targets.

EFORWOOD: The aim of the project is to provide methods and tools that will integrate Sustainability Impact Assessment of the whole European Forestry-Wood Chain (FWC), by quantifying performance of FWC, using indicators for all three pillars of sustainability; environmental, economic and societal. www.eforwood.com.

WOOD-EN-MAN (www.flec.kvl.dk/wood-en-man)

In the EU Life project RecAsh (www.recash.info), the final international seminar with participants from more than ten European countries resulted in a set of recommendations: http://www.recash.info/uploads/documents/Recommendations%20RecAsh%20Workshop%20061011.pdf