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FOREST BIODIVERSITY AS A CHALLENGE AND OPPORTUNITY FOR CLIMATE CHANGE ADAPTATION AND MITIGATION

PRESIDENCY BACKGROUND PAPER

Informal Meeting of EU Environment Ministers
11–13 April 2008, Ljubljana/Brdo

Prepared by:
Ministry of the Environment and Spatial Planning

Environmental Directorate:
Radovan Tavzes, MSc, Environmental Advisor to the Minister
Department for EU Affairs:
Tea Glažar, MA, Head of the European Affairs Department
Dunajska 48
1000 Ljubljana
Slovenia
www.mop.gov.si

Contact:
Tea Glažar
Tel: +386 1 4787 333
e-mail: tea.glazar@gov.si

1. INTRODUCTION

The Informal Meeting of Environment Ministers under the Slovenian EU Presidency will take place from 11 to 13 April 2008 in Brdo, Slovenia. The meeting will focus on biodiversity, biomass and biofuel to underline the need to make progress in deploying criteria for the sustainable use of forest biomass in Europe and to promote forest biodiversity as an important issue in environmental sustainability. Discussion will be dedicated to "forest biodiversity as a challenge and opportunity for climate change adaptation and mitigation".

On the first day of the Informal Meeting, we have organised a concert and dinner for the environment ministers. The session itself will start on Saturday in a traditional setting. After a short introduction from the Presidency, guests from Slovenia, Finland and Italy will take the floor as keynote speakers. Responses from the European Commission and ministers from the Member States, as well as special quests, including from the European Environment Agency and European Environmental Bureau, will be very welcomed.

We kindly ask that the ministers focus their interventions on the 3B issues (biodiversity-biomass-biofuel) on the basis of the following questions:

1. Greater synergies between climate change and biodiversity policies are very important for securing co-benefits. What is an appropriate EU follow-up to these issues, particularly in the context of adaptation to climate change?

2. Would increased utilisation of wood for energy move us away from multi-purpose forest management? What would be the implications?

3. Is the production of second-generation biofuels from forest biomass possible without endangering biodiversity?

2. WHAT'S ON THE AGENDA?

Three mutually connected elements on the meeting agenda will give the ministers the opportunity to discuss criteria for the sustainable energy use of forest biomass:

2.1. Impacts of climate change on forest biodiversity and sustainable development

2.2. Bioenergy potential of forests

2.3 Eligible use of the bioenergy potential of forest biomass for second-generation biofuels

2.1 Impacts of climate change on forest biodiversity and sustainable development

Forests play an important role in regulating the Earth's climate. They are an essential link in the global carbon cycle because they take up CO_2 for their growth. In most European countries, a significant share of forest land is currently at a lower intensity than in previous centuries.

Forests contain some of the greatest diversity in terms of species, genetic material and ecological processes of all ecosystems. Forest habitats play a central role in the functioning of the biosphere, as they are the origin of many cultivated plants and animals. They have an important role to play in providing environmental services, in particular when they are not fragmented. They absorb and retain water, store carbon, protect the soil from wind and water erosion, and are needed for socio-economic services. The conservation and enhancement of biodiversity in forests represents a major contribution to global ecological balance and sustainable production of raw materials, as well as other goods and services. The continuation of this contribution is under threat for several reasons, among them and becoming ever more important – climate change.

The need to achieve greater synergies between climate change and biodiversity policies exerts pressure to find a way to secure co-benefits, in particular by strengthening mutually supportive activities and measures with regard to climate change mitigation, including emissions from forest degradation, as well as in respect of the sustainable energy use of forest biomass and associated concerns regarding conservation of forest biodiversity and ecosystems.

With regard to climate change adaptation, further land use measures should allow for establishing networks of protected areas and other natural forest areas to enable adaptation of species and populations, which is indispensable for the achievement of the biodiversity target. In addition, climate change as such is likely to put pressure on certain existing land uses and may provide opportunities for new land uses, and the same applies to forest types. Activities such as tourism are likely to be significantly affected

by ramification or land use. Adaptation of forests to the changing climate in terms of both their ecological and productive functions should be viewed in the very long term.

Forest fires, floods and storms continue to affect Europe, causing serious losses of human life and property, as well as environmental damage. Climate change could result in even greater damage caused by natural disasters and, in particular as regards forest fires, a shift to countries thus far not significantly affected by them.

The net primary productivity of forests provides renewable materials and energy, and their presence influences local and regional weather and climatic conditions. The disappearance of forests causes substantial greenhouse gas emissions from biomass decay and mineralisation of organic matter in the soil. About a third of the increase in GHG concentration since the start of the industrial era can be attributed to land use change, mainly to deforestation.

Biomass energy currently makes up 75% of the renewable energy used in the EU, and in order to achieve the 20% objective that the Commission proposed last January, this contribution will at least have to double by 2020. There are indications that in certain regions the increased use of wood for energy has already shifted management towards intensification of production, which may negatively impact biodiversity.

On the other hand, the use of bioenergy from forest biomass may imply improved energy security, economic gain, rural development, greater energy efficiency and, *under certain condition*s, reduced GHG emissions compared to standard fuels.

2.1.1 Climate change challenges

For forests, several impacts of climate change are relevant and need consideration:

- changes in productivity related to changes in evapotranspiration, fertility of soils and mix of tree species
- increase in water stress, in particular water scarcity due to prolonged drought periods
- increase in storm and fire risk, in terms of both frequency and scale of damage
- increase in nutrient imbalance in soils
- northward migration of species, including pests and pathogens causing species loss (insects and fungi)
- non-native tree species, invasive and harmful species, such as game animals and insects
- new calls for intensification of forest management, mainly for bioenergy development

It is expected that climate change will cause forest ecosystems to change in various ways, such as in animal and plant species distribution, changes in tree physiology and stability. This will manifest itself in stand-level effects, as well as in major disruptions or disasters caused by more dramatic weather events. Therefore, forest protection and management will have to assure that these effects can be foreseen, managed and limited to the greatest extent possible, particularly due to the very long production and ecological cycle of forests.

The impact of other environmental factors, such as natural water scarcity, air pollution, intensive management, etc., can be exacerbated by climate change, leading to particular threats which are more readily perceived by the public as being problematic.

Effects of climate change on forests are clearly transboundary in nature. Protecting forests against them and adaptation of forest management should therefore be further explored.

2.1.2 Facing climate change: Biodiversity challenges

For conserving and enhancing forest biodiversity, the main variables to consider are the following:

- *Tree composition*: maintaining indigenous species and provenances may not always be possible, but species and genetic diversity should be assured in order to increase the stability, vitality and resistance of forests to climatic biological stress.

- *Forest structure:* forest management that promotes both horizontal and vertical variation in stand structures increases stability in case of extreme weather.

- *Forest fragmentation*: undisturbed border zones between forests and other land cover can be very important for biodiversity; corridors between forest complexes allow the movement of species to maintain viable populations.

- *Regeneration:* natural regeneration allows the most effective conservation of the genetic resource base and its adaptation to changing climatic conditions through self-selection.

- *Rotation length, proportion of deadwood and ageing stands:* ensure conservation of associated species but may be threatened by intensification of production.

- *Forest reserves*: are needed to strictly protect rare habitat types and habitats threatened at the regional level.

The NATURA 2000 network of Special Protection Areas (Birds Directive) and Special Areas of Conservation (Habitats Directive) is an important

contribution to improved forest protection. At its March 2008 session, the European Council encouraged the Member States and the Commission to strengthen efforts aimed at halting biodiversity loss by 2010 and beyond. It noted that the 9th Conference of the Parties to the CBD in May 2008 in Bonn and full implementation of the NATURA 2000 network are essential steps towards achieving this objective.

2.2 Bioenergy potential from forests - Wise use of forests as a renewable natural resource: torn between protection and intensified use

2.2.1 Increasing output of forest products – the new challenge

In the period 1950–2005 there was a general trend towards a lower utilisation rate of EU forest resources, in parallel with the shifting of primary production and raw material provision to emerging economies.

Today, timber, pulp and panels have become forest commodities that circulate all over the globe, and the value of ecosystem services such as protection of soil, watersheds and climate regulation is often not considered in economic terms. Forest owners frequently complain that these services are not sufficiently recognised.

The Commission's renewable energy proposal, particularly the binding 20% target for the overall share of renewable energy and a 10% target for transport biofuels by 2020, is likely to create a greater market for forest biomass to meet increased demand for feedstock. The rate of utilisation of forests is therefore likely to rise.

The EU is aiming to increase the share of renewable energies in total energy consumption. An important contribution might be expected from the forest sector. Here, different categories of biomass can contribute to renewable energy supply:

- industrial wood residues and recycled wood
- forest residues (stem tops, branches, foliage, stumps and roots)
- complementary fellings (difference between sustainable harvest and recent harvest)
- woody biomass from new forests on (abandoned) agricultural land
- biomass from short-rotation forestry

Since the first category has already been in use for some time, the unused potentials reside mainly in the last four categories.

2.2.2 Bioenergy potential from forests

To define the links between bioenergy potential and the sustainability of forests, sustainable bioenergy potential should be defined as the quantity of forest biomass that is technically available for energy generation in such a way that no additional pressures on forest biodiversity, soil, water and other forest resources, including the greenhouse-gas sink potential of forests, are exerted compared to forest development without increased bioenergy production.

Despite its high population density, roughly 30% of Europe's land area is covered by forests, and these remain a key ecosystem for biodiversity.

Most European forests are economically productive to some extent. Nevertheless, on average about 25% of the forest area is subject to management constraints to secure ecosystem services such as nature conservation, protection from soil erosion, water supply and recreation.

In contrast to many other parts of the world, forestry in Europe extracts forest biomass at a rate slower than or equal to the increment in growing stock, so that average felling rates are currently around two thirds of the increment. The current level of fellings has advantages for biodiversity, as forests of all sorts in Europe are growing older. Bigger and older trees host a number of species confined to late forest successions and produce deadwood of specific qualities for a number of organisms.

The need for the conservation of dead organic matter calls for modelling of stocks of forest-related organic matter to avoid increased extraction of forest residues and other forms of intensification of use of forest resources, which can compromise forest biodiversity value. Using such a model, possible impacts of forest policy decisions could be assessed by estimating the balance level of felling in relation to forest growth increment.

Modelling of stocks of available forest biomass can be a useful tool to assess:

- compliance of forest management policy with environmental sustainability criteria for biofuels, as requested by the European Council at its March 2008 session,[1] and
- the optimisation of maintenance, conservation and utilisation of forest ecosystems regarding the sustainability of ecological and socio-economic functions.

All biofuel systems rely on a productive land base, which is a limited and vulnerable resource. It is imperative to use our land as efficiently as possible, without sacrificing its long-term productivity or compromising

[1] The Presidency Conclusions of 14 March 2008: "22. In meeting the ambitious target for the use of biofuels it is essential to develop and fulfil effective sustainability criteria to ensure the commercial availability of second-generation biofuels, which in the future could also be considered for the use of other forms of biomass for energy in line with the conclusions of the 2007 Spring European Council."

environmental objectives, including biodiversity. Overall benefits should be enhanced by developing and favouring the most efficient bioenergy pathway.

To maintain the variety of forest functions and uses, multipurpose forest management was developed and successfully applied in many EU countries. Therefore, the new "old" task of the forest serving as bioenergy potential needs careful adjustment with other uses and functions, reconsideration of forest policy and future management, as well as intersectoral reconciliation.

2.2.3 Reasons for increase of growing stocks in European forests

The trends of harvest levels in European forests have been variable over time. Throughout the Great Depression between the world wars of the 20th century, forests in Europe were overexploited. During WW II, exploitation stopped but then started afterwards with new vigor for the needs of the restoration of Europe. Fellings were still above the increment during the 1950s, when investments were needed for forest roads. Later, the growing stock gradually started to increase, and fellings never exceeded the increment again. This development is well documented for Slovenia (Figure 1) and was similar in many other EU Member States. The accumulation of growing stock was deliberately set in forest management plans in many countries. It targeted optimal growing stock and improvement of increment, as well as the overall quality of forests with emphasis on large-diameter trees, which are important for value increment and for the ecological stability of forests. The relatively low prices of oil only partially influenced this development.

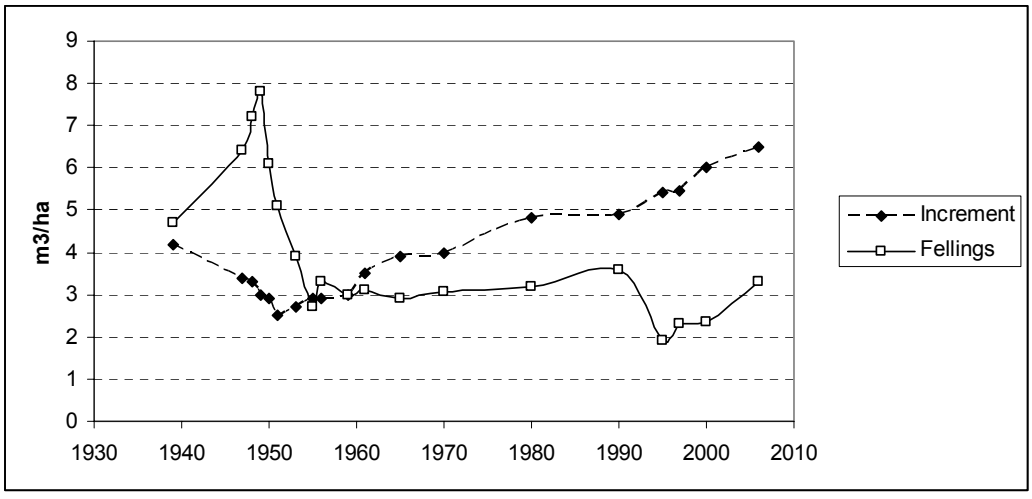

Figure 1: Yearly harvest and current annual increment in Slovenian forests for the period 1939–2005 (source: Slovenia Forest Service)

Many European countries still make efforts to attain the optimal growing stock. For example, in Slovenia the growing stock in 2005 amounted to about 266 m^3/ha, while the optimal level is estimated at 330 m^3/ha. Within

the scenario of harvesting two thirds of the increment by 2020 and three quarters by 2030, the optimal growing stock would be achieved between 2031 and 2040. This is also in accordance with the internationally acknowledged carbon sequestration scenario for Slovenia.

From the 1990s on, there was a stronger decline in timber harvests, for different reasons in the old and new Member States. In the old Member States, the decline was triggered mostly by the low prices of wood and factors related to the structure of the timber industry. Low prices were due to the abundance of wood from storms in Europe, heavier fellings outside Europe and low transport costs. Still, these trends have only partially influenced the decrease of harvests in the new Member States, where organisational changes and forestry privatisation were important obstacles for fulfilling the allowable harvest.

Optimal growing stock assures, along with a balanced structure of forest development phases, the maximum productivity of forests and long-term sustainability of all forest functions. Many European forests have not yet reached the optimal growing stock. In 1990, the mean growing stock amounted to 142 m^3/ha.

2.2.4 How to adjust bioenergy with other forest uses and functions

In Europe many different forest management models exist which contribute to the diversity of forests and landscapes. They are based on two paradigms: segregation and multifunctionality. The first implies the spatial division of forests into protective, productive or recreational categories. This model is widely accepted in the "New World" and in some parts of Europe with a coarse-grained settlement pattern. Due to lower environmental standards in productive forests, large protected areas are needed to conserve biodiversity and assure the ecological stability of landscapes. The use of full mechanisation and chemicals allows high economic returns in the short run. However, experience from wind disturbances in Europe shows that forests under this approach are especially vulnerable. Therefore, it is expected that they will be severely affected by climate change. Also, the protective, recreational and aesthetic functions of forests may suffer under this approach.

In Central Europe, the best practices of close-to-nature management can be seen from family forest to large state-owned forests. Although forests managed in this way are easy to certify, this approach should not be mixed with various certification schemes, since it is not striving for minimum standards but rather the maximum achievable. Due to small environmental impact, this approach can support maximal sustainable harvests for long periods of time with no harm to site productivity or biodiversity. Moreover, with this approach nature conservation takes place over the entire forest area and is more effective when compared to the segregation approach with the same amount of protected areas. One of the practical examples is Slovenian state forests, managed in this way for centuries but still home to

many species which are rare and endangered elsewhere. Almost all Slovenian state forests are included in the Natura 2000 network. According to experiences in Slovenia, this type of management can also be applied in protection and recreational forests (e.g. urban forests), since these forests also need perpetual management to assure stability.

Due to the many negative side effects, it seems very likely that segregation of forest functions cannot bridge intensified resource utilisation with conservation objectives. Furthermore, even short-term economic effectiveness is being questioned, with high external costs in the long run.

2.3 Eligible use of the bioenergy potential of forest biomass for second-generation biofuels

There is a presumption that besides residues from wood production additional sources of forest biomass are included in the evaluation of forestry bioenergy potential. These additional sources are mainly so-called "complementary fellings", which means the difference between the maximum sustainable harvest level and the actual harvest needed to satisfy roundwood demand. So the gap between the level of fellings and the increment in growing stock provides an opportunity to use forest biomass that currently remains unexploited as a source of renewable energy.

To take advantage of the opportunity afforded by complementary fellings, it is critical to develop and deploy economically competitive technologies that can convert abundant cellulose biomass resources into liquids.

It is expected that the combination of cellulose biomass resources and next-generation biofuel conversion technologies will be able to fully compete with conventional gasoline and diesel fuel in the coming decades.

Development efforts to date have demonstrated that it is possible to produce a variety of liquid fuels from cellulose forest biomass for use in existing vehicles:

- The hydrolysis pathway relies on advanced enzymes that can catalyze cellulose and lignocelluloses into sugars and then ethanol.
- The gasification pathway (also called the biomass-to-liquid (BTL) pathway) uses high temperatures, controlled levels of oxygen and chemical catalysis to convert biomass into liquid fuels.

3. ISSUES for discussion

Climate change will have significant implications for EU forests, in particular:

- biodiversity loss,
- forest protective functions (water, soil, etc.) – loss or change in
- ecosystem services,
- forests as a source of bioenergy and biofuels, and
- forest fires and other natural disasters – enhanced extreme
- events.

Adaptation of forests to the changing climate in terms of both their ecological and productive functions should be viewed in the very long term.

When discussing bioenergy potential from forests, the following considerations should be taken into account:

- Forests are an important renewable natural resource for Europe and can provide many functions and services if managed properly.
- Accumulation of growing stock in forests is partially planned to reach the optimal growing stock.
- Mobilising forest resources in private forests depends on beneficial market conditions and subventions, as well as on the interest and knowledge of owners. In the new Member States, organisational support is necessary.
- The use of bioenergy is limited by site potential and competes with other forest products, especially valuable logs. This also applies to complementary fellings.
- Afforestation/new plantations may heavily affect biodiversity.
- Experience from the past (litter collection, moving, grazing) shows that the use of forest residues is problematic for ecosystem functioning.
- Differences in forests and forestry within and among European countries should be acknowledged, as they contribute to the overall diversity of landscapes. In the search for the best management model, multi-purpose, sustainable forest management should be considered.
- Close-to-nature forest management combines the highest sustainable use of natural resources with low environmental impact and therefore should be given special attention.