

ECCP - Working Group on Forest Sinks

FINAL REPORT

**Conclusions and recommendations
regarding forest related sinks & climate change mitigation**

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Summary¹

Background and working group activities

From the beginning, the European Climate Change Programme intended to establish a working-group on forest-related carbon sequestration (sinks) once the rules and procedures for the accounting of carbon credits and debits from different forest types and their management became clear.

At COP7 in November 2001, the definitions, rules and modalities for sinks were agreed, including the activities under Art. 3.3 of the Kyoto Protocol (afforestation, reforestation and deforestation) as well as (optionally) those under Art. 3.4, such as forest management. Sink credits gained by activities under Art. 3.3 are unlimited, while debits can be off-set up to a certain amount by forest management activities under Art. 3.4. At the same time, credits for Parties under Art. 3.4 are subject to individual quotas for forest management (including Joint Implementation), totalling a maximum of 5.17 Mt C (approx. 19Mt CO₂eq) per year.

With these rules and procedures being agreed, the ECCP Working Group on Forest-Related Sinks was set up to propose and assess forestry measures that can enhance forest-related carbon sequestration in the EU-15. At the same time, GFA consultants of Hamburg carried out a study about detailed technical aspects of forest-related sinks. The Group met four times between May 2002 and January 2003. To ensure a science-based approach, links with other activities and adequate assessment of the proposals, both open discussion and transparency were key principles of the working group's activities. In the last meeting, the group suggested that it would be worthwhile keeping this working group going as a forum for stakeholder consultation in relation to the Commission's future co-ordination efforts in this field.

The working group members identified a number of promising "*candidate technical measures*" (forestry practices) and assessed their carbon sequestration potential, together with other environmental and socio-economic effects. In addition, the group also considered a series of policy guidelines and recommendations, and identified a number of EU policy instruments that can be used to promote the candidate technical measures. An in-depth assessment of the role and potential of EU forests in terms of material and energy substitution was not part of the mandate of the group. However, in view of the implications of the enhancement of sinks for these down-stream activities, the working group did consider their relationship.

The full report, as well as the various contributions of stakeholders, are available on the ECCP website².

Limitations and uncertainties

The working group indicated that its results are subject to a number of limitations and uncertainties, such as:

¹ List of acronyms and abbreviations p. 7

² <http://www.europa.eu.int/comm/environment/climat/forestrelatedsinks.htm>

- Geographical differentiation across the EU is important for practical implementation; the proposed CTMs are considered valuable instruments, but should not be seen as generally applicable solutions, nor is the set of proposed candidate technical measures to be regarded as exhaustive.
- The IPCC Good Practice Guidance on LULUCF is still under development and could therefore not be fully taken into account.
- Longer term issues, such as permanence of sinks and saturation of carbon pools.
- Implications of monitoring and reporting requirements.
- Cost-effectiveness could not be analysed in a systematic way.
- More knowledge is required concerning certain specific carbon pools, such as forest soil carbon.

In order to reduce uncertainties and improve quantitative results, it is regarded as of utmost importance to continue research in these fields and to study economic implications more in detail, for instance through application of economic modelling tools and testing of proposed measures.

Afforestation, reforestation and deforestation

Between 1990 and 2000, **afforestation and reforestation** activities have extended the total EU forest area of 113Mha by **340,000ha/yr.** or 3% , resulting from nearly equal surfaces of planted forests (in many cases through support from the “2080/92” afforestation scheme and the rural development regulation 1257/99) and natural forest expansion. The Group estimates that, if this process continues at the same rate during the present decade, it may result in a sequestration potential of approximately **3.84Mt C/yr. (14Mt CO₂ eq/yr)** during the first commitment period. In case of a sustained afforestation trend and taking into account an extended EU of 25 Member States, a technical sequestration potential of 34Mt C/yr (125Mt CO₂ eq) may be reached in the long term.

The following ARD activities were considered:

Afforestation programmes. The AFFOREST Project, Spain, Poland, Ireland and the UK gave detailed information about the expected GHG benefits from forest extension by plantations on former agricultural or derelict land. The group advised that Community support for this activity under Regulation 1257/99 should be continued and optimised in the framework of the future CAP.

Natural expansion of forests on formerly cultivated or grazed land is an important ongoing process in the EU that results from agricultural and socio-economic trends and policies. The importance of the environmental benefits of this process and the necessity to manage it need to be recognised. The new set aside rules of the CAP Reform are expected to have a significant impact on this process. Active management of natural forest expansion could be envisaged through the rural development regulation.

Short rotation tree plantations on former agricultural land. Although there is a short-term potential for carbon sequestration, the GHG benefit of this activity was found to be most important for increasing the production of biomass for energy substitution, in line with EU energy policy. The necessity for careful consideration of the environmental impacts was recognized. In this respect, there is a clear need to define best practice and develop guidelines. The CAP reform proposals introduce a specific support scheme for energy crops that could be reviewed later on for further improvements.

Deforestation is not a large scale problem in the EU. Small areas are affected, usually linked to urban and infrastructure development. On the other hand, because almost the entire carbon stock is lost in a very short time frame, the carbon losses per unit area are large. Several countries (Austria, Belgium, Finland, Sweden, Denmark and France) are expected to report small debits due to deforestation. As most of these countries are not experiencing large scale afforestation, it would be possible to compensate for the debits through forest management activities.

Forest management

Forest management measures have an important potential for application as they can cover a much larger area than ARD activities, implying that small GHG benefits per unit area may yield large impacts. For the first commitment period the potential **is capped at 5.17 Mt C (19Mt CO₂eq)**. Very rough IPCC estimates of the quantitative impact of forest management measures indicate a potential for an average gain of 20% in yearly carbon uptake by adapting management, but there is a need for more accurate EU figures. The socio-economic impacts of adapting forest management are expected to be more important than in the case of ARD measures and might therefore require more directed policy support.

The following forest management activities were proposed:

Establishment of forest reserve areas. Research by CarboEurope has indicated that absence of management interventions enhances carbon sequestration, even in old growth forests, but this measure can only be applied on a limited scale due to its restriction to areas that are specially designated according to nature and bio-diversity protection requirements.

Restoration of forest wetlands. As drainage tends to increase mineralisation of soil organic matter, restoration of forest wetlands may produce important GHG benefits, while at the same time enhancing bio-diversity. For these measures, one should also consider the impact on emissions of other greenhouse gases such as CH₄ and N₂O. The socio-economic implications of such measures can be important and may require compensation of economic operators.

Continuous cover forest management can potentially increase carbon sequestration in growing stock by a factor 1.2 to 1.6 in the long term. It is well established policy in the public forest estate but its application is limited to certain forest types and local situations.

Prevention of forest fires is seen as a specific measure for the Mediterranean region. Through specific *silvicultural management*, it is possible to lower the risk of fires, while increasing the use of biomass for energy substitution, raising the marketable timber output and enhancing bio-diversity. Another option considered by the group encompasses improved fire prevention through investments in infrastructure, fire prevention and control equipment and improved supervision and access.

Improved management of fast growing plantations in S. Europe can contribute to carbon sequestration if the necessary trade-offs between forest functions and fire risk analysis are taken into account.

For the first commitment period 2008-2012, the combined potentially accountable carbon credits for the EU from ARD measures (3.84Mt C/yr or 14Mt CO₂ eq/yr) and Forest management (capped at 5.17 Mt C/yr or 19Mt CO₂eq/yr) would thus be approximately 9Mt C/yr or 33Mt CO₂eq/yr, which is roughly 10 % of the corresponding EU emission reduction target of ca. 337 Mt CO₂ eq /yr.

Policy guidance

The working group has given some more general policy recommendations :

- To improve accuracy of the quantitative estimates of the GHG benefits and to reduce the uncertainties, more research will be needed.
- More investigation will also be needed on the economic aspects of climate related measures in forestry, whereby economic modelling may play an important role.
- The Good Practice Guidance on LULUCF activities that is expected to be published by IPCC later this year will have to be taken into account in future policy developments.
- EU forest sinks can contribute to the realisation of emission reduction targets, but they are only to be regarded as a temporary supplement for effective reductions of GHG emissions in the long term.
- Measures to enhance carbon sequestration need to be based on principles of sustainable forest management & the multifunctional role of forests.
- National forest policies will be the first policy tool for deciding on concrete application of the measures .
- Effective measures should aim for win-win situations that benefit rural development, the environment and economic activity .
- Existing Community instruments for incentives in the forestry sector should be screened for possible adaptations related to climate change mitigation objectives.

The working group also considered, in general terms, the relationship between carbon sequestration in forests, and the use of forest resources for material substitution and for energy substitution. Although the subject requires in-depth investigations, the following observations can be made :

- Preserving and enhancing the amount of carbon in the forests through sustainable forest management is a pre-condition for enhancing material and energy substitution.
- Wood products are a physical pool of carbon (currently not accounted for under the Kyoto Protocol) and can act as a substitute for more energy-intensive materials.
- A carbon-conscious hierarchy for the use of wood and the residues and by-products of its processing should be respected, while ensuring a level playing field for all economic operators and allowing the market to operate without distortions.

Given the non definitive nature of the list of proposed measures, the group recommended that exchange of ideas and concepts continues to take place at EU level and that the Commission play a co-ordinating role in this process.

All documents related to the activities of the WG have been made public on <http://www.europa.eu.int/comm/environment/climat/forestrelatedsinks.htm> .

List of abbreviations and acronyms

ARD	Afforestation , Reforestation and Deforestation
BD	Birds Directive
C	Carbon
CAP	Common Agricultural Policy of the European Union
CBD	Convention on Biological Diversity (UNCED, Rio de Janeiro 1992)
CDM	Clean Development Mechanism
CEEC	Central and Eastern European Countries
CEPF	Confédération européenne des Propriétaires forestiers
COP	Conference of the Parties
COPA	Comité des Organisations Professionnelles Agricoles de L'Union Européenne
CP	Commitment Period
DG	Directorate-General of the European Commission
E	Energy
EAGGF	European Agricultural Guidance and Guarantee Fund
EU	European Union
EEA	European Environment Agency
EEC	European Economic Community
EIA	Environmental Impact Assessment
EFI	European Forest Institute
ERDF	European Regional Development Fund
ESF	European Social Fund
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GHG	Green House Gas (as defined under FCCC rules)
GPG	Good Practice Guidance
(M) ha	(Million) hectares
HD	Habitats Directive
IFF	Intergovernmental Forum on Forests
IPF	Intergovernmental Panel on Forests
IPCC	Intergovernmental Panel on Climate Change
IUCN	World Conservation Union
JI	Joint Implementation (in the sense of Art. 6 of the Kyoto Protocol)
KP	Kyoto Protocol
LULUCF	Land Use , Land-Use Change and Forestry
MCPFE	Ministerial Conference on the Protection of Forests in Europe
MS	Member States (of the EU)
NFP	National forest programme
NGO	Non-governmental organisation
OM	Organic matter
OWL	Other wooded land
PSCI	proposed Site of Community Importance (for Natura 2000)
RDR	Rural Development Regulation
RES	Renewable Energy Sources
SAC	Special Area of Conservation (for Natura 2000)
(S)FM	(Sustainable) Forest Management
SPA	Special Protected Area (for Natura 2000)
UNCED	United Nations Conference on Environment and Development
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environmental Programme
WMO	World Meteorological Organisation
WWF	World Wide Fund for Nature
yr	Year

1. Introduction

1.1. Mandate of the group

Background

From its beginning, the European Climate Change Programme intended to establish a working-group on forest-related carbon sequestration (sinks) once the rules and procedures for the accounting of carbon credits and debits from different forest types and their management became clear. With certain rules and definitions related to article 3.3 of the KP being agreed at FCCC COP7, in November 2001, this working group has started identifying and assessing forestry measures that may enhance C-sequestration by forest related sinks in Europe, taking into account the EU Forestry Strategy³. While there is now certainty on the sinks credits that EU Member States (and accession countries) can obtain from forest management there are only approximate figures for potential credits from afforestation and reforestation. Initial estimates by FAO on the basis of current data have suggested a potential credit for these two activities of around 3.3 MtC/yr. for the actual EU. However, these figures were probably underestimated since not all Member States provided figures on the possibilities of accounting for these activities.

Objective

The objective of the ECCP working group on forest-related sinks is to assess the potential contribution of EU Member States' forests to achieve the GHG emission reduction target of -8% with reference to the 1990 baseline levels. Equally, appropriate policy instruments for realising this potential in the time-frame 2008-2012 or "First commitment period" should be identified.

Scope

Stakeholders were invited to address the following issues with a view to making recommendations for appropriate policy action :

- (a) evaluating existing data on the potential sink credits for activities under Art. 3.3;
- (b) assessing technical measures that could increase existing afforestation and reforestation programmes (Art. 3.3 KP) with regard to costs, environmental and other ancillary effects. Ranges of **uncertainties** should be assessed and particular attention must be paid to impacts on **biodiversity**. An assessment should also be made on future developments with regard to deforestation;
- (c) assessing technical measures under Art. 3.4 that could enhance sinks in managed forests with regard to costs, environmental and other ancillary effects and uncertainties;
- (d) analysing existing and potential policy instruments to implement measures under (b) and (c).

³ See footnotes no. 10 & 11

Expected Outcome

On the basis of the identified technical measures, their ancillary effects and their costs, the Working Group is expected to put forward recommendations to the Commission on appropriate EU policy initiatives.

Organisation of Work and Working Schedule

The Working Group was expected to meet four times during 2002. At each meeting specific tasks were attributed to participants in order to prepare for the next meetings. Papers were made available to participants by electronic mail. Between meetings participants communicated by e-mail and telephone.

Close co-operation was ensured between the WG on sinks and the working group on agricultural soils.

A list of participants is provided in annex I to this report.

1.2. Activities of the Group

WG meeting no. 1 : 3 May 2002

- General overview of ECCP activities and FCCC developments by DG ENV
- Presentation of the mandate, discussion of working procedures and timing.
- Presentation of a template for submission of CTMs
- Presentation of the first results of the study "Harnessing Europe's forests for climate change mitigation" by GFA consultants.
- Academic presentations on forest growth, forest inventories and carbon storage, land use strategies.
- First comments by Commission DG's, MS officials and stakeholder representatives.

WG meeting no. 2 : 16 July 2002

- Presentation of CTMs by participants
- Update on the work of GFA.
- Technical presentations by DG Agriculture (sinks in agricultural soils), Pro Silva (continuous cover forestry), DG Environment (economic modelling of sinks).
- Synthesis of received CTMs by DG Environment and discussion on further steps.

WG meeting no. 3 : 18 October 2002

- Presentation of additional CTMs by participants.
- Presentation by DG Agriculture on Community support for afforestation.
- Presentation by DG Environment of a draft outline of conclusions of the WG, followed by round table discussion and conclusions for drafting of a final report.

WG meeting no.4 : 17 January 2003

- Presentation of a draft final report by DG Environment
- Discussion of the participants' contributions to the draft final report and practical agreements for a last round of inputs from the group.

1.3. Nature and limitations of this report

This document has been drafted by the services of the Environment Directorate General of the European Commission, following discussions with stakeholders from the forestry sector and from civil society, authorities of the actual and future Member States of the EU, other Commission services and academic circles. The text reflects only the recommendations of the working group and is not intended to offer any conclusions of a binding nature nor does it represent the position of the European Commission.

The present version of this report is not meant to be a definitive one. Indeed, this document may be revised in the future, according to experience that will arise from increased scientific knowledge and from any future agreements or decisions related to the FCCC or its advisory bodies such as the IPCC. The Commission may also consider to produce a simplified version of this text for wider distribution at a later stage.

The ECCP Working Group on Forest Related Sinks wishes to stress that its findings and recommendations concerning the potential use of forest sinks for climate change mitigation purposes are subject to the following general observations :

- The proposed measures and conclusions are largely based on the use of empirical conversions, gross estimates and extrapolations, with no indications of error margins or limits of confidence.
- There is a considerable lack of knowledge on and a high uncertainty concerning processes in the carbon cycle that have not yet been fully investigated or understood. This obliges to make a reserve for corrections in case that more scientific results become available, especially on underground non-biomass carbon in forest ecosystems and on long term stability of sinks.
- Geographical differentiation will be very important for practical application of any of the measures that are being proposed. Large differences in effects and offsets between biogeographical regions and social environments are to be expected. Therefore , none of the recommendations of this WG are meant to be generalized.

It should therefore be clear that the “Candidate Technical Measure’s” presented in this document are not to be considered universal recipes valid for all MS and that they can only be applied if correctly framed in the different bio-geographical and socio-economical situations in the EU.

The scope of this document is limited to the actual 15 EU Member States and does not take into account specific situations in countries currently negotiating EU accession.

1.4 Basic figures about the Carbon cycle⁴ and conversion units

Total Carbon (C) in cycle : 42.000 Gt
C added to atmosphere after 1750 : 271 Gt
(This includes estimated 136 Gt from historical land use change.)
Total current C emissions (global) : 6 Gt /yr. (22.020 Mt CO₂ eq./yr.)

Total C stock in EU forests : 4.100 Mt
Normal C-sequestr. in EU forests : 63 Mt/yr.

1990 baseline EU emissions of GHG : 4.208 Mt CO₂ eq.
8 % reduction commitment by 2008 : 337 Mt/yr. CO₂ eq.
Assigned EU GHG emissions(1stCP): 3.871 Mt/yr. CO₂ eq
EU Cap on forest management credit : 19 Mt/yr. CO₂ eq.

There is NO cap on afforestation credits.

C-equivalent : 1 tonne carbon / 3.67 tonne carbon dioxide (t CO₂)
CO₂ equivalent : 1 tonne carbon dioxide / 0.273 tonne carbon (t C)

1 tonne (t)	1 000 kilogram (kg)	10 ⁶ gram (g)	1 Megagram (Mg)
1 Megatonne (Mt)	1 000 000 t	10 ¹² g	1 Teragram (Tg)
1 Gigatonne (Gt)	1 000 000 000 t	10 ¹⁵ g	1 Petagram (Pg)

1 hectare (ha)	10 000 square metre (m ²)
1 square kilometre (km ²)	100 hectare (ha)
1 tonne per hectare (t ha ⁻¹)	100 gram per square metre (g m ⁻²)

1.5 Glossary of terms⁵

Activity

A practice or ensemble of practices that take place on a delineated area over a given period of time.

Baseline

A reference scenario against which a change in greenhouse gas emissions or removals is measured.

Biosphere

That component of the Earth system that contains life in its various forms, which includes its living organisms and derived organic matter (e.g., litter, detritus, soil).

Carbon Pool

A reservoir. A system which has the capacity to accumulate or release carbon. Examples of carbon pools are forest biomass, wood products, soils, and atmosphere.

Carbon Stock

⁴ Sources : “State of the World 2001”, IPCC reports, Commission report COM(2002) 702 final

⁵ IPCC definitions

The absolute quantity of carbon held within a pool at a specified time.

Forest Estate

A forested landscape consisting of multiple stands of trees.

Forest Stand

A community of trees, including aboveground and belowground biomass and soils, sufficiently uniform in species composition, age, arrangement, and condition to be managed as a unit.

Land Cover

The observed physical and biological cover of the Earth's land as vegetation or man-made features.

Land Use

The total of arrangements, activities, and inputs undertaken in a certain land cover type (a set of human actions). The social and economic purposes for which land is managed (e.g., grazing, timber extraction, conservation).

Permanence

The longevity of a carbon pool and the stability of its stocks, given the management and disturbance environment in which it occurs.

Practice

An action or set of actions that affect the land, the stocks of pools associated with it or otherwise affect the exchange of greenhouse gases with the atmosphere.

Regeneration

The renewal of a stand of trees through either natural means (seeded on-site or adjacent stands or deposited by wind, birds, or animals) or artificial means (by planting seedlings or direct seeding).

Sequestration

The process of increasing the carbon content of a carbon pool other than the atmosphere.

Sink

Any process or mechanism which removes a greenhouse gas, an aerosol, or a precursor of a greenhouse gas from the atmosphere.

Source

Opposite of sink. A carbon pool (reservoir) can be a source of carbon to the atmosphere if less carbon is flowing into it than is flowing out of it.

Uptake

The addition of carbon to a pool. A similar term is "sequestration."

Wood Products

Products derived from the harvested wood from a forest, including fuelwood and logs and the products derived from them such as sawn timber, plywood, wood pulp, paper, etc.

2. General analysis of the role of EU forests in relation to climate change

2.1. Forest related carbon sinks under the Kyoto Protocol's rules

2.1.1 The Kyoto Protocol and the Marrakesh Agreements

The Kyoto Protocol as finalised under the Marrakesh Agreements (COP7) has set the following rules for allowing FCCC Parties to take into account Land Use , Land Use Change and Forestry (“LULUCF”, as defined in the IPCC special report , 2000⁶) as a contribution to meeting the agreed reductions of anthropogenic carbon dioxide equivalent emissions during the first commitment period 2008-2012 :

- The extent for taking into account GHG emissions by sources and removals by sinks from afforestation, reforestation and deforestation activities (“ARD”) on the basis of Article 3.3 KP and the agreed definitions will be unlimited. Parties are subject to an **obligation** to report on and account for all ARD activities.
- GHG removals by sinks resulting from forest management , on the basis of Article 3.4, will be limited to a pre-defined cap for each party (Annex Z, Bonn Agreement), in total representing 5.17⁷ Mt C. (19Mt CO₂eq.) for the EU. This cap also includes credits received through forest management activities in Joint Implementation projects. The cap itself calculated from FAO and MS data on growing stock changes in forests, with a 85% across the board discount to retain only human induced activities. Reporting on art. 3.4 KP being optional, a Party may **choose** to account for additional directly human-induced activities for the first commitment period, provided that these activities have taken place since 1990. These activities are : revegetation, forest management, cropland management and grazing land management.
- Creation of the possibility for a Party to compensate deforestation debits by forest management removals, up to a maximum of 9Mt C (33 Mt CO₂eq) per year.

2.1.2 IPCC⁸ Good Practice Guidance for LULUCF activities

The IPCC effectively collates and analyses the global knowledge on climate change and has produced most technical reference documents on which greenhouse gas

⁶ Land Use , Land Use Change and Forestry, IPCC Special Report, 2000, Cambridge University Press.

⁷ Minor changes on this estimate could occur due to the fact that a Party may reconsider its numerical values no later than 2 years prior to the beginning of the first commitment period (FCCC/CP/2001/13/Add.1)

⁸ The Intergovernmental Panel on Climate Change (IPCC) was set up jointly by the World Meteorological Office (WMO) and the United Nations Environment Programme (UNEP) to provide an authoritative international statement of scientific opinion on climate change. IPCC provides periodic assessments of the causes, impacts and possible response strategies to climate change, and develops methodologies, including methodologies for inventories of emissions by sources and removals by sinks. IPCC website : <http://www.ipcc.ch>

inventories, emission estimates, rules of implementation and the resulting agreements of the different FCCC COPs have been based. The IPCC does not carry out research nor does it monitor climate related data or other relevant parameters. It bases its assessment mainly on peer reviewed and published scientific/technical literature. After the Revised 1996 IPCC Guidelines for National GHG inventories, IPCC produced a Special Report on LULUCF in 2000 and a first volume of Good Practice Guidance⁹ (“GPG 2000”) that was adopted at COP6bis in Bonn.

As the GPG 2000 did not elaborate on land use change and forestry activities; COP7 invited IPCC to complete its work in these fields.

The IPCC mandate for GPG on LULUCF activities is threefold :

Task 1 :

IPCC will develop Good Practice Guidance (GPG) to ensure that country inventories on LULUCF are neither over- nor underestimated as far as can be judged, and uncertainties are reduced as far as practicable and facilitate the best use of available resources, taking different national circumstances into account. The GPG on LULUCF should ensure that countries use the same criteria as listed in the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. The following areas will be covered:

- Source-specific good practice guidance on the 1996 IPCC Guidelines for the requirements of the UNFCCC
- For eligible LULUCF activities and projects under Articles 6 and 12 of the Kyoto Protocol, the IPCC will elaborate methods and develop good practice guidance, to estimate, measure, monitor and report changes in carbon stocks and anthropogenic greenhouse gas emissions by sources and removals by sinks
- Underlying Issues of Good Practice : an approach to ensure a consistent representation of land areas for use across the source and sink categories and number of additional cross-cutting issues – including identification of key sources and sink categories, uncertainty analysis, recalculation and verification.

Task 2 :

IPCC will develop a report comprising definitions for direct human-induced degradation of forests and devegetation of other vegetation types, and methodological options to inventory and report on emissions resulting from these activities.

The purpose of this report is to respond to concerns that non-selection of eligible activities under Article 3.4 of the Kyoto Protocol could give rise to an unbalanced accounting if certain types of degradation or devegetation activities are not included. The report would develop definitions for direct human-induced degradation of forests and devegetation of other vegetation types, develop methods to inventory emissions from these activities and analyse the implications of different options to include the accounting of these activities under the provisions of Article 3.4 of the Kyoto Protocol, including the relation to forest management and revegetation. The development of the methodologies would be done in close cooperation with the preparation of the report on good practice guidance and uncertainty management for the LULUCF sector. Any available information from the IPCC work on factoring out human-induced changes in carbon stocks and greenhouse gas emissions by sources and removals by sinks from those due to indirect human-induced and natural effects, and effects due to past practices in forests would also be utilised in the work. The final result of the work would be a methodology report.

Task 3 :

To develop practicable methodologies to factor out direct human induced changes in carbon stocks from indirect and natural effects (such as those from carbon fertilisation and nitrogen deposition) and from effects due to past practices in forests (pre-reference year).

A first “Draft IPCC Good Practice Guidance for LULUCF” , corresponding to tasks 1 and 2 is currently being circulated in the scientific community for comments to be

⁹ IPCC Good Practice Guidance and Uncertainty Management in National GHG Inventories, 2000

sent to IPCC by the end of January 2003. As this drafting process is going to run well into 2003, the working group could not fully take into account the consequences of this technical work. However, the working group believes this IPCC work is of primary importance for the future and should be taken into account fully when further developing policies on LULUCF.

For the future commitments periods, it is well possible that the rules will be even further developed and reviewed on the basis of the experience and scientific progress (e.g. changes to the forest management cap, inclusion of accounting for forest products, exclusion of certain sinks, inclusion of sinks from other biomes). This is of particular importance in view of the long term nature of decisions/policies applicable to the forest sector.

2.2 Carbon sequestration in European forests

Since the publication by FAO and UNECE of the Temperate and Boreal Forest Resources Assessment in 2000 (“TBFRA 2000”)¹⁰, a full set of comparable data on forest cover and forest cover change is now available for Europe, CIS, N. America, Australia, Japan and N. Zealand. All figures that follow are based on TBFRA 2000. They are only applicable to forests and not to “other wooded land” (OWL)¹¹.

The following basic data are to be considered when quantifying C-sequestration in European forests

EU forests cover approximately 113 Mha, while EU OWL accounts for another 23 Mha (TBFRA 2000). EU forests and OWL are estimated to store 5 Gt C (18.3 Gt CO₂ eq.) in their total woody biomass (not counting non-biomass soil C). The above stump carbon content is estimated at 4.2 Gt C (15.4 Gt CO₂ eq.) of which 0.1 Gt are found in OWL and 4.1 Gt in forests. It has to be noted that the total amount of carbon stored in EU forests has considerably fluctuated as a result of historical LULUCF practices.

EU forests are expanding : in 1990-2000 the area under forest cover in Europe has increased by 3.40 M ha, i.e. an annual increase in area of 340.000 ha (TBFRA 2000, average based on country sources for different multi-year periods around 1995).

Basically, forests can act as effective carbon sinks. It is estimated that EU-15 forests and OWL take up 63 Mt C (231 Mt CO₂eq.) annually in their biomass¹² (TBFRA 2000). This process is routinely termed "removal", meaning the total C-uptake from the atmosphere by forests (not to be confused with the same term used in forest inventories, where it stands for total volumes that have been cut). However, it should be noted that only a small fraction of this amount could be accounted for under the rules of the Kyoto Protocol because most of this carbon uptake is not “additional” with reference to the 1990 baseline figures. Moreover, the increase in sequestration that has been noticed is partly due to CO₂ fertilisation, indirect nitrogen deposition (which are not regarded as direct human induced effects) and also to effects originating from pre-1990 measures.

The permanence of forests as carbon sinks is subject to discussion. There appears to be some scientific argument to suppose that large parts of EU forest may turn into effective GHG sources instead of sinks, as a result of raising temperatures.

¹⁰. TBFRA 2000 was created to have better figures than those from the 10-yearly FAO Global Forest Resources Assessment which is known to contain unverified inputs from countries outside the TBFRA geographical coverage. In principle, all countries participating in TBFRA accept that their data be checked against other sources.

¹¹ OWL : permanent status characterized by presence of > 10 % crown cover < 5 m height at maturity (scrub, maquis, matorral etc..) or 5-10 % crown cover > 5 m height at maturity (wooded pasture – agroforestry systems)

FOREST : crown cover > 10 % and mature height > 5 m, including clearings, cuttings, streams and water bodies

¹² This figure includes above ground and terrestrial biomass of standing trees, dead or alive. It does not take account of harvesting nor of carbon content of organic matter in forest soils.

2.3 . The integration of climate change mitigation measures and forestry

On the basis of the expected effects from most of the candidate technical measures (CTMs – see section 3) identified by the working group, it can be concluded that certain forestry practices and forest measures in the EU can provide an additional contribution to achieving the Member States' and EU emission reduction targets for the first commitment period of the Kyoto Protocol.

The 1998 Communication from the Commission¹³ on a Forestry Strategy for the European Union emphasised the multifunctional role of European forests, including, amongst others, the following key concerns :

- promotion of the development of the forestry sector as a contribution to **rural development**
- protection of the natural environment and our forest heritage (e.g. **soil protection, erosion control, water regulation, improvement of air quality, carbon sequestration, prevention of climate change, protection of natural habitats, and bio-diversity**) and the restoration of damaged forests
- the maintenance of the **social and recreational functions** of forests
- the **improvement of ecological, economic and social sustainable forest management** within the framework of the internal market, and in line with Union's international obligations, including WTO-compatible trade rules
- [the fulfilment of the targets of the fifth environmental Action programme and] the protection of **forests against deforestation, forest fires and atmospheric pollution.**
- ensuring the role of **forests as carbon sinks and reservoirs** through SFM, to contribute to the Kyoto Protocol's objectives .

The ensuing Council Resolution¹⁴ confirmed the importance of the above mentioned elements of community actions concerning forests and forestry, noting that the responsibility for forestry policy and implementation of international commitments lies with the Member States. Regarding climate change, this is expressed as follows in paragraph 13 of the Resolution : *“the role of forests as carbon sinks and reservoirs within the European Union can be best ensured through sustainable forest management and that the contribution to the European Union and Member States' climate change strategies, in accordance with the Kyoto Protocol, and can best be achieved through the protection and enhancement of existing carbon stocks, the establishment of new carbon stocks and encouragement of the use of biomass and wood-based products”*.

The 1999 “Communication from the Commission on the State of the Competitiveness of the EU Forest-based and related Industries”¹⁵ states that :

- “Sustainable forest management is a key priority, necessary to maintain all the ecological, social and economic functions of forest resources, amongst which is a necessity of ensuring a constant supply of raw materials at competitive prices.”

¹³ Ref.: COM(1998)649 final , not published in the OJ

¹⁴ Ref.: Council Resolution of 15.12.1998 , O.J. no. C 56/1 of 26.09.1999

¹⁵ Ref. : COM(1999)457 final

- “Increased use of wood products can both stimulate forests growth and carbon sequestration, and increase the carbon storage effect, while decreasing the emissions through material substitution” .

The ensuing Resolution of the European Parliament¹⁶ stressed that the forest-based industry can and should become a model sector in the field of sustainable development because its activities are based on renewable natural resources, that it contributes effectively to the binding of carbon in forests and wood products and that, with effective management of the product cycle, it also operates in an environmentally sustainable way.

In addition, the **6th Community Environmental Action Programme (6EAP)** contains a number of important objectives to be pursued in the coming 10 years which are or can be related to forests and forestry:

- Relating to climate change :

Realisation by 2005 of demonstrable progress in achieving the commitments under the Kyoto Protocol.

- Relating to renewable energy :

Encouraging renewable fuels for power generation, including the use of incentives, so as to meet the indicative EU objective of 12% of primary energy production in 2010.

- Relating to giving broader scope to agri-environmental measures under the CAP :

Encouraging more environmentally responsible farming, including, where appropriate, extensive production methods, integrated farming practices, organic farming and agro-biodiversity, in future reviews of the Common Agricultural Policy, taking account of the need for a balanced approach to the multifunctional role of rural communities

- Relating to bio-diversity :

Ensuring the implementation and promoting the monitoring and assessment of the Community's biodiversity strategy and the relevant action plans, including through a programme for gathering data and information, developing the appropriate indicators, and promoting the use of best available techniques and of best environmental practices

- Relating to forest certification :

Stimulating the increase of the market share for sustainably produced wood i.a. through encouraging certification for sustainable forest management and encouraging labelling of related products

¹⁶ Ref. : C5 – 0306/2000 - 2000/ OJ C262/252 of 18.09.2001

- Relating to the wood products carbon sink :

Enhancing carbon storage through the use of wood-based products in housing and industry.

Conclusion

Measures to enhance carbon sequestration will have to be seen as an integral part of the overall objectives of sustainable forest management¹⁷ and multifunctionality. Future implementation of such measures will need to be based on increased integration of forestry activities, rural development, nature protection and other policies.

Climate change benefits are therefore to be seen as one of several objectives that will have to be pursued simultaneously. In this way, the creation of **win-win situations**, where climate change mitigation would be supplemented by economic (material delivery) , social (rural development) and other environmental (biodiversity) benefits should be aimed for. The identification of the potential for the different categories of benefits can increase general public support as well as cost-effectiveness, compared to a single issue analysis. Taking advantage of incentives for activities leading to climate change benefits can therefore provide an additional stimulus for economic operators to take decisions that are environmentally, socially and economically sound, but measures that maximise carbon sequestration at the expense of other agreed objectives should be avoided. This means that synergies will have to be found between the equally important objectives regarding climate and biodiversity protection and rural development. In the light of the long term nature of any decisions related to forests and the issue of permanence of carbon sinks, a **clear commitment to sustainable forest management and a long-term strategy** are needed.

Although the Treaty establishing the European Community makes no provision for a comprehensive common forest policy, Community measures on nature conservation, climate change and rural development are expected to have an effect on national forest policies. This is because measures relevant to climate change can be accommodated and promoted in other contexts, provided that they are eligible under existing rules and contribute to the fulfilment of the overall objectives of other policies. Considering the above, the principle of subsidiarity has to be applied and Member States are responsible for the development of their own forest policy. The National Forest Programmes, as proposed by the IPF in 1997, are an adequate instrument to translate the above principles taking into account the specific circumstances in each national territory (considering forests, soil, erosion control, water regulation, carbon sequestration, protection of natural habitats, biodiversity,...). The role of the EU could be to develop an operational framework for financial support of climate mitigation measures, to set eligibility criteria for such support and to co-ordinate further initiatives and exchanges by MS .

¹⁷ As defined in Resolution H1 of the Helsinki MCPFE Conference: *“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”*

3. Candidate Technical Measures

The candidate measures received from the members of the group can be divided as among the following clusters suggested by Mr. Kapp from GFA in the introductory presentation that he gave during the first session of the WG :

- Afforestation (ARD – KP art. 3.3) : 6 proposals
- Prevention of deforestation (ARD – KP art. 3.3) : no proposals
- Management measures for C - conservation (FM – KP art. 3.4) : 3 proposals
- Management measures for enhancement of C-sinks (FM – KP art. 3.4) , 6 proposals

In total, 19 different reactions were received, of which 14 had effectively used the template, one consisted of template plus policy remarks, two are in the form of presentation sheet and two others consist of general remarks on the CTMs. Please see overview table in annex II.

In general, socio-economic aspects and implementation frameworks were covered to a lesser extent than purely technical matters, while the necessity for adequate geographical differentiation of the measures was repeatedly stressed.

3.1. Afforestation

CTM No. 1 : The AFFOREST project (Mr. Vesterdal & Ms. Freibauer / www.fsl.dk/afforest/) presented a technical overview on the possibilities in Europe for afforestation of former agricultural lands. The GHG benefits are clearly indicated and explicit references are made to biodiversity impacts and to results of former afforestation programmes such as the 92/2080 Regulation. Estimated area cover is 5-6 M ha in EU 15 + 3.8 M ha in CEEC The potential for the use of forest inventory systems for monitoring and the remaining problems to estimate total biomass and C-contents are also indicated. C-sequestration is estimated at 0.6 t C/ha/yr. during the first 10-20 years after plantation , leading to a stable average carbon stock level of 240 tC/ha

- The group observed that more information will have to be gathered about the socio-economic impacts of large-scale undertakings of this kind , which would certainly affect the living conditions of many rural people and which would also have important spin-offs on employment and use of biomass products for a diverse range of purposes.

CTM No. 2 : The Polish Government submitted a concise description of its plan to increase the actual afforestation rate in Poland, on both private and public agricultural land which may be abandoned by cultivation as a result of agricultural intensification. Description of this measure lists a total potential area of 4 M ha and average uptake of 1.4 t C/ha/yr during the 1st 20 years, at an establishment cost of € 1100/ha. Environmental effects and socio-economic impacts are only briefly touched. Means

and resources for practical execution are described in a few lines, indicating that Poland has lots of experience which large scale afforestation which used to run up to 100000 ha/yr. in the past.

- The group concluded that, given the large potential area for application, the rather low expected costs and the presumption of existence of similar situations in other CEECs, implementation of this proposal could make an important contribution to C-sequestration. It was also noted that maximum sequestration level may only be reached after ca. 20 years because it depends on the actual development and the growth rate of the plantations.

CTM No. 3 : The Spanish Govmt. submitted a description of its plans for a large scale afforestation and reforestation programme on a growing area of soils with “no clear use as a source of products”. These plantation measures are framed in the Spanish national Forest Plan (available on www.mma.es in Spanish) and will be partly co-financed through RDP funding of the EU.

Application of this measure is expected for an area cover of 3.8 M ha and the extrapolated total C-uptake is 0.49 tC/ha/yr over the first 30 years. The description of the action explicitly protective forest and natural forest extension.

Although not explicitly mentioned, the measure seems to answer the need to give a destination to areas abandoned by cultivation and/or grazing (possibly classified as OWL) as a result of intensification of agriculture and livestock raising. Its socio-economic impact may therefore be quite important.

- The group found that on some points, this measure would merit more detailed studies, notably concerning :

- * selection of species according to site characteristics
- * expected biodiversity impacts, both in relation to protected areas as concerning future use and management
- * the institutional framework for implementation
- * economic feasibility and relations between the private and the public sector

CTM No. 4 : The Federal Research Center for Forestry and Forest Products, Hamburg. (Mr. Dieter) presented an outline of the possibilities to enhance terrestrial C-sinks by establishing plantations of fast growing trees on agricultural land. This measure runs largely along the same lines as other afforestation proposals, with the exception that the rotation periods are very short. It consists mainly of an account of German investigations and experiences about E-substitution by the use of biofuels. Potential application area is not given but costs, environmental and leakage effects as well as political and legal frameworks are analysed.

- The group agreed to withhold this proposal under the ARD measures in a separate section (see 4.1.3) because this type of measure has not yet been treated by any one of the E working groups of the ECCP.

CTM No. 5 : The Government of the UK (Dr. Gregory) presented a contribution combining elements of CTM no. 1 and no. 4 and noting the potential of derelict industrial land to be included in afforestation programmes in addition to agricultural land. Like CTM no. 4 this contribution stresses the possibilities for biomass production by using fast growing species on land that did not previously carry any forest cover. Socio-economic impacts and ancillary effects are treated in detail but indications about GHG benefits and areas concerned are quite general.

It was observed that the estimated costs were quite high when compared to other European countries .

Special opportunities for afforestation : Land Renewal in the UK

Land that was damaged through past industrial activities is often found in areas of high population and is associated with economic stagnation and environmental degradation. The amount of such “derelict land” in the UK is estimated at 200-250,000 ha. A significant proportion of it could be restored by establishing inexpensive plantations quickly over extensive areas. In this way, coal tips and open cast mines have been restored to forest areas .Although mainly intended for improving the landscape and creating new habitats for wildlife, such projects could just as well be geared towards carbon sequestration objectives. The benefits of converting wasteland include a potential for fast biomass production, if planting techniques, species and management techniques are adequately chosen. To do this , the UK Forestry Commission maintains a substantial programme of research to improve existing practice and to find new ways of overcoming the very harsh environmental conditions that are found on some derelict sites.

CTM No. 6 The Government of Italy (Mr. Lumicisi) submitted a short contribution on using of the process of natural forest extension on previously cultivated or grazed land as a carbon sequestration measure. This issue was extensively discussed in the WG meetings, leading to the conclusion that the process of recolonization by forest vegetation, which is responsible for 50 % of forest extension in the EU between 1990-2000 and mainly occurs in the Mediterranean region, could be managed in a way that combines climate, economical and biodiversity benefits.

- After discussion, most participants to the group agreed about the human induced character of forest extension by natural regeneration after land abandonment but WWF expressed strongest disagreement with this position. It was also observed that the IPCC LULUCF guidelines (2000) and the currently circulating IPCC draft GPG on LULUCF only address methodology to account for carbon stocks and fluxes and cannot be used as a reference for defining activities to be included under application of art. 3.3 KP.

3.2. Prevention of deforestation

After discussion, it was decided to mention CTM no. 9 (“Prevention of forest fires”) in section 3.3 in stead of retaining it as a measure to avoid deforestation.

3.3. Management measures for C – conservation in forests

CTM No. 7: The CARBOEUROPE Project (Ms. Freibauer) submitted a description of the sink effects of non-managed and non-disturbed forests reserve areas . This contribution describes the potential for increasing C-sequestration in above-ground biomass, coarse woody debris and soil by totally abandoning any forest management intervention. Although the potential of this measure for enhancing sink functions and for biodiversity conservation is obviously clear, there remain lots of open questions because the contribution does not give many quantitative details. Possibilities for monitoring by the use of existing forest inventory systems and the need to couple them with information on other C-pools in the forest ecosystem are also indicated.

- The group noted that the feasibility and the relevance of this measure will very much depend on its socio-economic impacts, implying that banning any economic use over large forest areas may be hard to marry with the activities of a large number of economic operators that depend on the use of this resource. Therefore, this type of measure will very probably remain limited to specific situations such as reduced areas of priority habitats. It was also noted that application may be limited because of risk factors (fire / biotic agents) and that non-management may have implications in relation to KP accounting procedures .

CTM No. 8 : The CARBOEUROPE Project (Ms. Freibauer) submitted a description of the potentially positive sink effects of the restoration of forest wetlands. The argument is based on the premise that large scale drainage of wetlands (such as peatlands, mires and river bottomlands) in order to enhance tree growth on them or to establish plantations, has produced a release of GHG from mineralisation of the organic soil layers that far exceeds potential C-sequestration by the forests established on them. (This thesis was also defended by Mr. M. Olsson in his presentation to the 1st session of the WG). The basic action to be undertaken is the rewetting of these areas by disabling drainage systems and it is estimated that this would result in a GHG benefit of +60 % over the actual situation (detailed estimations given). Consideration was also be given to that fact that more humid conditions may provoke an increase in emissions of other GHG , such as CH₄ and N₂O.

- Like for the preceding measure the group concluded that execution of this proposal would result in substantial reduction of economic use to be applied over large areas of naturally wet soils. Important compensations to landowners might be needed and strong political resistance can be expected from the commercial forestry sector. Therefore, the same remarks about limitation to small scale or specialized use apply. It was also observed that rewetting of forest lands can result in outright deforestation of these areas, which would mean that the activity would have to be accounted for under art. 3.3 KP in stead of art. 3.4 .

CTM No. 9 : A contribution about prevention of forest fires in the Mediterranean Basin was presented by the Portuguese Federation of Pulp and Paper Industries (Mr. Canaveira). This proposal argues that with a combination of measures consisting of reduction of fuel load on the forest floor, construction of specific infrastructures such as access roads and adequate surveillance a significant GHG emission reduction can

be achieved by avoiding large catastrophic fires. The presentation was based on results from a case study on CELPA holdings covering 244070 ha for which a basic total prevention cost of approx. € 20 /ha/yr was calculated. No quantified GHG benefits were indicated. Effectiveness of the measure is gauged by comparing the expected burnt areas with the effectively burnt area.

3.4. Management measures for enhancement of C-sinks in forests

CTM No. 10 : The Spanish Government submitted a description of a series of principles from its National Forest Plan for “improvement of the forest area “ by application of C-conscious forest management in existing natural and semi-natural forest areas and also in older plantations which have not been managed until present. No general description of the management system to be installed is given although the expected environmental effects indicate that an evolution towards more continuous forest cover is targeted . GHG benefit is estimated at + 20 % over the present situation. Estimated baseline figures are an additional C-uptake of 0.16 t C/ha/yr. over a potential area of 1.3 M ha. Investments to be made will have to come largely from EU (co-)funding under CAP or REGIO budgets.

- The group found that, like the Spanish plantation proposal, this measure answers the same concerns to give a function to areas abandoned by cultivation/grazing.

CTM No. 11 : “ Continuous Cover Forest Management “

GFA – Terra Systems , who executed a study about EU forest sinks potential for DG ENV E1, presented conversion to Mountain Selection Forest as candidate technical measure. This is based on changing the management in one specific forest type (middle elevation Spruce-Fir-Beech forest in central Europe) in order to obtain GHG benefits that are estimated at +60 % over the initial situation, from 450 tC/ha to over 800 tC/ha (on very productive sites). Proposed change in management consists of replacing the currently pre-dominant age-class forestry by traditional selection cutting in small plots or on a stem by stem basis combined with natural regeneration (“Plenterwald”). In addition , an shift towards more diverse and better balanced species composition would have to be realized. Environmental, biodiversity and sinks effects are clearly indicated, but socio-economic effects are only briefly touched. Risks are certainly low.

Remarks by the group were the following :

- Potential area is rather limited because of biogeographical range of the forest type concerned.
- This proposal has quite important political and social aspects that will have to be worked out in much more detail. Socio-economic effects and costs resulting from a production shortfall affecting forest owners and wood based industry during the “build-up period“ will have to be investigated.
- Important incentives might be necessary for practical implementation.

Several members of the WG have voiced reservations about the feasibility of applying “continuous cover” principles in other forest types and regions. There were

also different opinions about the marketing potential of the large dimension timber that is produced by this type of management.

CTM No. 12 : After the discussions about CTM no. 10 and a presentation about continuous cover forestry in private holdings in Denmark by Mr. Th. Harttung , president of Pro Silva, ELO (Mr. D. Viner and Mr. M. Sayer) made a contribution about applying continuous cover forest management to other forest types than the Central European mountain forests mentioned by the report from GFA, mainly based on French and British experience and relying on the Swiss control method for monitoring stand development. The arguments and conclusions of this contribution run very much in parallel with proposal no. 11 .

-While the principle of accepting continuous forest cover as a CTM was generally supported by the group, it was indicated that its application should take into account local biogeographical and social conditions. There were also reservations about the possibilities for applying these principles under all European conditions , with particular reference to the UK.

CTM No. 13 : The Univ. of Bayreuth (Mr. Berg) submitted a proposal for enhancing carbonstocks by building up a larger recalcitrant soil C-fraction through influencing trees species composition in existing forests. This measure is based on the principle that C-sequestration in forest soil OM can be maximized by choosing tree species for their potential to deliver OM that mineralizes only very slowly (“recalcitrant OM fraction”) and is in fact stored in the soil for very long periods. The argument is based on analysis of litter composition for only a limited number of tree species, GHG benefits are only explained in relative terms , and risks are not explained. No information about socio-economic effects, nor on technological readiness was submitted.

- The group concluded that this measure should not be retained as feasible because for lack of technical readiness and lack of knowledge about behaviour of non-biomass OM in forest soils in relation to disturbances.

CTM No. 14 : Biomass management for fire prevention

The Spanish forest owners organisation COSE (Mr. Botey) presented an experience with measures to restore the Mediterranean forest heritage by economically viable combination of the use of understorey biomass for E-production and protection of maturing stands against fires, thereby enhancing their carbon sink function.

This CTM appears especially interesting because from its double management perspective of E and biomass production , a wide range of benefits can follow, which are not only to be seen in GHG terms :

- selective removal of biomass from understories and brush layers can have positive effects on forest biodiversity, both by species selection and by the creation of a spatial mosaic with understories of different ages in large forest complexes;

- Mediterranean brush biomass is quite suitable for energy generation (easy handling size / high caloric value of species concerned);
- creating a discontinuous vertical stand structure limits the burning risk to ground fires and leaves the upper story intact, which means less GHG emission and higher standing volumes yielding more commercial timber;
- extending rotation length by avoiding fires leads to mature forest stands , meaning more C-sequestration in marketable products and more rural employment.

Cost calculations for using an average of 16 t of biomass / ha in a 6 year rotation cycle result in an estimated price of 0.16 €/kg of biomass ready for combustion, which is considered not to be competitive with actual fossil fuel prices . It was also mentioned that this type of forest management is in fact nothing else than using the same biomass fraction that used to go into household charcoal (which was replaced by LP gas, a fossil fuel) for large scale E-generation.

- This presentation was well received by the group because of its multifunctional approach to mobilize the production potential of the forests in S. Europe. It remains to be seen, however, in how far this CTM will be economically feasible, with or without incentives. Critical observations were made about the influence of this type of understorey management on nutrient availability for the main upper storey tree crops.

CTM No. 15 : Improved management of fast growing plantations in S. Europe

The Portuguese forest holding company CELPA (Mr. Canaveira) presented possibilities to enhance the permanent C-stocking in fast growing plantations in the Mediterranean Basin by increasing rotation length and stocking densities.

This measure is based on a series of extrapolations showing the expected effects of manipulating different forest management parameters towards increasing C-sequestration, based on CELPA's experiences with fast-growing plantations of Pinus and Eucalyptus spp. in Portugal. It indicates how making changes in felling age, stand density, site quality index , land use planning , tillage techniques, use of exploitation residues to build up soil OM etc.. can all be used to enhance permanent level of C-sequestration in the plantation cycle.

- CEPI and CELPA argued that this kind of interventions should be given priority over substitution of fossil fuel by biomass in energy generation, as they enhance production and possibilities C-sequestration in products with a longer lifetime. Other WG members questioned the additionality and verification problems related to this measures.

3.5 Other reactions (not using the template)

- CEPF submitted a series of general statements and questions about the list of measures from the presentation by Mr. Kapp of GFA. These comments were mostly of a political nature.

- The Federal Research Center for Forestry and Forest Products, Hamburg, (Mr. Dieter) also made general statements about the list of measures from the presentation by Mr. Kapp of GFA, which seems to be especially related to the German policy on each of the 18 measures concerned.

Mr. M. Olsson from the Swedish University of Agricultural Sciences (SLU) gave some comments on different proposals from the 2nd meeting of the WG. He indicated that a lot more research is still to be done to come to adequate understanding and satisfactory quantification of the effects of the proposed measures for afforestation and changes in forest management. He also expressed agreement with the indications of Ms. Freibauer about wetland restoration.

The Irish government submitted information about its National Climate Change Strategy in which forestry measures are targeted to contribute for 1 Mt CO₂ eq. to the annual reduction quatum of 15.4 Mt CO₂ eq. . It is expected that this objective can be met by maintaining the existing afforestation rate by plantations at 15.000 ha/yr up to the end of the first commitment period in 2012.

As a general conclusion to the CTM presentations and discussions, participants agreed that the proposed list should not be seen as exhaustive and that the non-final character of the WG report should be clearly indicated. It was mentioned that other possibilities to enhance carbon storage by using forest related sinks than those here retained may exist, e.g. nitrogen fertilisation, change of tree species, site adapted management etc. .

The group found that a need for more continuous CTM compilation and evaluations exists and advised the Commission to maintain an exchange forum for jointly considering future developments.

4. The carbon sequestration potential of EU forests as a contribution to the Kyoto objectives

The most frequently mentioned measure for establishing C-sinks in relation to forests is the creation of new, additional forest surfaces by planting or other reforestation techniques, in conformity with art. 3.3 of the KP.

The potential activities that can be classified as “management measures” according to art. 3.4 of the KP are less frequently mentioned. Nevertheless, it should be kept in mind that the existing rate of forest area extension of 340.000 ha/yr during the 1990-ies (cfr. supra) is only 0.3 % of the total forest area of 113 Mha. This implies that small improvements of C-uptake through adaptation of forest management and more effective forest protection (e.g. against fires) could result in important additional sequestration effects (of which the accountability is capped at 5.17 Mt C for 2008-2012 (see above).

4.1 The contribution of ARD activities in the EU

4.1.1 Afforestation, reforestation and natural expansion of forests¹⁸

Data regarding the area available for aff-/reforestation vary greatly according to socio-economic scenario's for the future. TBFRA has indicated that in 10 years time, the EU forest area has increased 340.000ha annually, totalling 3.4 Mha net forest extension. These figures are only to be used as **average values**, as the evolution of the forest area is closely linked to the Mac Sharry reforms of the CAP, which only started taking effect some years after they were adopted in 1992. Although important afforestation programmes took place, a large part of the growth of the forest area does however come from spontaneous recolonisation by forest tree species of former pasture and agricultural land, and this mainly in France and Spain during the second half of the decade. The effect of this process is not always clearly visible in the statistically aggregated data, as natural expansion of forests sometimes proceeds only slowly (depending on soil and climatic conditions) and can even be recorded as growth in the area of OWL in its early stages (which implies that a given area may only be recorded as forest once its crown cover and mean height meet the criteria). Although forest expansion after 1990 is clearly additional in terms of the KP, some doubts were voiced about recognition as a human induced activity of spontaneous recolonisation by natural succession of vegetation cover after land abandonment. The question on accountability of natural expansion of forests on abandoned land has not yet been taken up separately by IPCC, as it does not figure in the draft GPG on LULUCF that are currently being circulated for comments. Most participants

¹⁸ According to the definitions of agreed at COP7 (“Marrakesh Agreements”), natural expansion of forests falls under aff-/reforestation. It is mentioned here as another category of ARD because it is dealt with separately in TBFRA and to stress its importance in the EU and CEEC context. It should be noted that an exception may have to be made for situations where invasive exotic tree species take over naturally treeless habitats in which case no purposeful human intervention can be defined.

however, agreed that natural forest expansion implying land use change should be considered as a human induced activity¹⁹.

With regard to abandoned and previously managed land becoming forest or OWL, parties can decide not to report this under ARD by applying the relevant land cover criteria. In theory they may then choose to report on it under KP art. 3.4, as forest management, cropland management, grazing land management or revegetation. Accounting for these actions would presuppose directly human induced guiding 'managing' of the process, like favouring seed trees, fencing against browsing by game, completing vegetation cover through partial planting, favouring certain species over other ones by selective thinning or clearing etc.. .)

The evaluation report of the Community aid scheme for forestry measures in agriculture under Regulation 2080/92 (IDF, 2001) concludes that 1.04 Million ha (or 173.600 ha/yr) has been afforested under this European scheme in the 6 years, from 1994 to 1999. From this, it can be deduced that the remainder of the total afforestation area mentioned by TBFRA during 1990-2000 the period (approximately 2.4 million ha, see section 2.2) resulted from non EU-funded planting efforts and (most of all) from leaving former agricultural area, pasture or uncultivated land to be rewooded by natural expansion of forests. These figures are in line with the new orientations of the CAP towards diversification and extensification of production systems and reduction of agricultural surpluses in the EU. They also indicate that intensification in certain regions with more favourable production conditions has led to giving up cultivation and grazing at higher elevations in several Member States.

THE AFFOREST PROJECT : <http://www.fsl.dk/afforest/>

("Afforestation management in north-western Europe – influence on nitrogen leaching, groundwater recharge, and carbon sequestration" Funded by DG Research of the EC, Contract No. EVK1-CT-1999-00020)

The overall aim of AFFOREST is to elaborate guidelines for afforestation of former agricultural land in NW Europe as to account for a number of environmental impact categories: atmospheric deposition, the leaching of nitrate, groundwater recharge, and carbon sequestration.

The guidelines will be based on

- i) exploitation of existing research data complemented by data to be collected on issues where the present scientific knowledge is insufficient,
- ii) use and development of process-based models and (iii) a GIS-based system for scenario-analysis and decision support (AFFOREST-DSS). The objective of the guidelines and AFFOREST-DSS is to support end-users like landscape planners (on a local level) and policy makers (on a national/regional level) scheming future afforestation projects in an environmental sound way.

The project involves five workpackages, each with a well defined content and deliverables but presenting important added-value through integration.

The project is a Danish-Dutch-Swedish-Belgian co-operation funded by the EC.

¹⁹ WWF holds the position that without purposeful and direct human action to assist the process, natural forest expansion cannot be considered under ARD.

Looking at the future (2000-2008), an area equivalent to the already existing area of set aside land is often mentioned as the potential area for additional afforestation, which would involve 5-6 Mha (AFFOREST project). It is unlikely, however, that this full potential would be realised in the period 2000-2008 because this would require a substantial increase in both planting efforts and natural forest expansion. Nevertheless, individual countries are already aiming for even more ambitious targets in the long term: Spain, for instance, has set a target of 3.8 Mha in 30 years and Poland has mentioned that a potential 4 Mha could become available as a result of the expected transformations in its agricultural sector after accession to the EU.

Estimation of C-uptake from afforestation that may be accounted for by the EU for the first commitment period 2008-2012 :

A. Short term

If the following preliminary assumptions²⁰ stand :

1. The pace of afforestation during the period 2000-2008 will remain the same as during the nineties (340.000 ha /yr = plantations + succession), Total afforestation up to 2008 would thus be 3.4 Mha('90-99) + 3.06 Mha (2000-2008) or 6.46 Mha.;
2. The average annual carbon uptake is 0.6 t C/ha/yr. (2.2 t CO₂)²¹ in the first 10 to 20 years of the life of a plantation or a new natural forest ;

then approximately 3.84 Mt C (14 Mt CO₂eq.) could be sequestered annually , provided that growth rates remain stable..

This is about 4.4% of the EU emission annual reduction of 337 Mt CO₂eq. by 2008-2012 with respect to the 1990 base levels.

This estimate does not take into account the progression of OWL (26 Mha total EU area according to TBFRA) to forests during the same period. Inventory practices may lead to reclassification from OWL to forest once the crown cover exceeds the applicable threshold.

B. Long term

The AFFOREST project has produced extrapolations of these data for the longer term, based on the following assumptions :

- (1) the full potential for afforestation and spontaneous recolonisation of abandoned land has been reached
- (2) the new forests cover has acquired the age of full carbon sequestration potential with an feasible average carbon uptake of 2.5t/ha.year
- (3) a potential of 4 Mha of new post-1990 forests in 10 accession countries will have been included in EU accounts,

²⁰ These figures are rough estimates for all types of forests, soils and climatic conditions, which indicate the practical difficulties caused by our current lack of knowledge.

²¹ See CTMs of AFFOREST project in section 3

From this , it is concluded that a potential uptake of 34 Mt C per year (124 Mt CO₂/year) over an additional forest area of 13.6 Mha²² would be feasible under a sustained, long term strategy scenario.

4.1.2 Deforestation

Deforestation is generally not a problem in the EU²³. Nevertheless, reporting on it remains part of the obligations under art. 3.3 KP requiring the three categories of activities (A – R - D) to be listed separately. As already mentioned EU forest cover is on the rise, but there is no readily available information about the figures leading to the overall positive balance, as forest inventory systems and related resource assessments such as TBFRA only list net loss or gain.

A recent study²⁴ by the Dutch National Institute for Public Health and Environment and the European Topic Centre on Air and Climate Change has tried to gauge MS's intentions after the Marrakesh agreements to use sinks for achieving their KP targets during the first commitment period. From this paper, it appears that Austria, Belgium, Finland Germany and Sweden will report small deforestation debits (< 1 MtC) which will not always be compensated by national art. 3.4 credits (national caps). The findings also confirm the somewhat outstanding position of France, already mentioned in the IPCC Special Report on LULUCF²⁵, which will possibly submit a somewhat higher figure (1-2 Mt C). This leads to the conclusion that the total expected EU deforestation debit will remain limited to 3.33 Mt C. Most deforestation in the EU is related to urban and infrastructure development but in some regions forest fires and deliberate restoration of non-wooded habitats may continue to play a role in this process.

4.1.3 Fossil fuel substitution by using biomass from SRTP

Short rotation tree plantations (SRTP) on former agricultural land, are a special case of afforestation because of their intermediate position between agriculture and forestry. Given the potentially non permanent nature of land use SRTP may not be considered as forests nor as OWL. Nevertheless, they fall within the constraints of the Kyoto/Marrakesh LULUCF definitions and should therefore be considered here.

It was observed that short rotation tree plantations are not necessarily aimed at acting as sustainable forests and that they do qualify under FAO forest definitions Moreover their re-conversion into cropland may be in accordance with the MS laws, in which cases using SRTP should be classified as cropland management, according to FCCC/CP/2001/L.11. It was also mentioned that SRTP classification as forest or as cropland may differ depend on national systems for classification of land use. Concerning the high costs for monitoring SRTP sinks effects it could be considered to

²² Existing post 1990 forest expansion + potential of 6 Mha in EU15 + potential of 4 Mha in 10 CEECs

²³ The only EU country with net forest area decrease from 1990-2000 is Belgium (1260 ha/TBFRA)

²⁴ Sinks as an option to meet CO₂ reduction targets in Europe, by T. Petroula, RIVM Report 50000/5001, Bilthoven (NL), 2002

²⁵ The ARD chapter of this report mentions a "loss to other uses" of 60.000 ha/yr during the 1980s, but this is largely compensated by forest extension elsewhere, so that on balance there is still a net gain.

exclude SRTP from the LULUCF activities. In this case benefits from the SRTP would appear only in terms of substitution of fossil fuel by biomass.

When establishing such systems, their specific nature needs to be taken into account when assessing their ancillary effects on biodiversity, hydrology and soil condition. On one hand the average potential to store carbon in such plantations themselves is more limited due to the short rotation period of 5-10 years. On the other hand, they can provide biomass for **energy substitution**, and in this way contribute to the effective reduction of accounted greenhouse gas emissions that would occur if the same amounts of energy would have to be produced from fossil fuel sources.

The 1997 White Paper²⁶ on EU energy policy stresses the importance of securing energy supply while reducing CO₂ emissions and proposes to raise energy production from renewable sources from 6 % in 1998 to 12 % of total primary energy production in 2010.

Taking into account the indicative objective of the RES-E Directive of 2001²⁷ to come to generation from renewable sources of 22 % of total EU electricity production, it is clear that this will lead to increased demand for biomass in general and woody biomass in particular for energy production. From this perspective, the establishment of SRTP would make an important contribution to meet both the climate related energy objectives.

Compared to conventional agriculture this could also have positive environmental effects, for instance lower use of herbicides and insecticides and bio-diversity enhancement. From a rural development perspective, SRTP could also represent alternative sources of revenue for farmers, like it is the case with yearly E-crops such as rapeseed for bio-diesel.

When originating from conversion of existing, conventional forests SRTP can present risks:

- environmental benefits are less likely to occur because conversion to SRTP would mean considerable intensification of forestry practices;
- if the increase in demand for the use of biomass for E-substitution develops faster than supply, this could lead to pressures on raw material supply for existing wood-based industries and to a shortcut in the useful life (and C-stock) of forest products .

In general, SRTP should only be established on currently non-forested land, under economical and social conditions that are compatible with sustainable development principles. Development of GPG for this type of activities can be recommended to IPCC.

On the basis of :

- a sequestration rate in the order of 3 to 6 tC/ha/yr (above ground biomass)

²⁶ COM(97)599 final of 26.11.1997 “Energy for the future : renewable sources of energy”

²⁷ Dir. 2001/77/EC of 27.09.2001 “Directive on the promotion of electricity produced from renewable energy sources”, comprising RES-E (electricity) and RES-H (heat) dispositions

- the restriction of proposed CAP incentives for SRTP on set-aside land to an area of 1.5M ha (see proposal from the Commission for CAP mid-term review²⁸)

the potential of sequestered carbon arising from energy crops and available to substitute fossil fuel during in the first commitment period is estimated in the range of 4.5 to 9 Mt C/year (16.5 to 33 Mt CO₂eq.). This figure does not take into account potential biomass accumulation in the root system, nor does it consider C-release from soil biomass produced by the same SRTP. The ECCP working group on agricultural soils has addressed the question of soil carbon buildup under SRTP.

Conclusion

Based on the above analysis, directly human induced ARD activities in the EU can provide a contribution in terms of C-sinks to the GHG accounts for the first KP commitment period of 2008-2012. Still, **during this first commitment period, their contribution is quite limited**, but with an obvious potential for improvement. Considering the need to think in the longer run, it may be investigated in how far this contribution could be more significant during following commitment periods. In any case, ARD as well as forest management measures can only be seen as **a temporary supplement to other measures aiming at the effective reduction of greenhouse gas emissions**.

Depending on the scale of development, short rotation tree plantations can have a substantial impact already in the first commitment period through direct substitution of fossil fuel for energy production. However, this would need to be supported by additional measures on the demand side (promotion of biomass for renewable energy, electricity and heat). As already mentioned above the sink effect of SRTP is quite limited, but the fuel switching that could occur by effectively using the biomass produced for E generation would have a substitution effect.

4.2 The contribution of forest management in the EU

There is a significant potential for additional carbon sequestration and improved C-conservation in existing EU forests, in particular because this can in principle be applied to a much larger area than it is the case with increasing the forest surface. Indeed, even if forest extension rates were to increase significantly from the current 340.000 ha /yr EU15 average, it is hardly conceivable that they would attain an annual rate of over 1 % of the total forest area. Some forest management practices could also accumulate significant removals more quickly than afforestation by planting. This is because the latter starts from a zero base and may have to go through a net emission phase of some years due, for example, to soil disturbance. However, it should be recognised that some management practices may also be slow to take effect (underplanting and transition to continuous cover for example) whereas under other circumstances (natural regeneration on mineral soils for example), reforestation may also lead to rapid carbon accumulation. However, the contribution of forest management to GHG reduction objectives was capped 5.17 Mt C (19Mt CO₂ eq.) for

²⁸ COM(2002)349final of 10.01.2002 “Mid-Term Review of the Common Agricultural Policy”

in the first commitment period, representing 5.5 % of the reduction of 8 % of 1990 emissions required during that same period.

The Working group has identified several categories of interesting forest management CTMs, both in terms of the (currently non accountable) conservation of existing carbon stocks as for the enhancement of carbon storage by changing management measures where appropriate (see section 3 for more details):

- Setting aside forest areas with low management interventions ,like designated forest reserves or other protected forest areas (CTM no. 7);
- Forest wetland restoration, mainly improving soil C content by counteracting mineralisation caused by drainage (CTM no. 8) ;
- Forest fire prevention and combat as an integrated part of management planning, *inter alia* by making judicious use of biomass before it can disappear in unexpected fires or by prevention through adequate monitoring (CTM no. 14, see also section 4.3)
- Continuous cover forest management, which may increases the time average volume of the growing stock (CTMs no. 10, 11,12);
- Improving management of fast growing plantations (CTM no. 15).

In general, these measures have a potential for additional positive environmental effects, such as improved preservation of biodiversity and natural landscape features, soil conservation, protection of hydrological balance, etc... As already mentioned the list of proposed CTMs is not meant to be exhaustive and their practical application should take account of local socio-economic conditions.

As the scientific literature on the C-sequestration effects of forest management measures is still quite limited, actual information on the quantitative importance of such measures is rather fragmentary and results mostly from specific case studies. Therefore, the indications about quantitative impacts that are given in the relevant CTMs (section 3) should be viewed with some caution.

Notwithstanding the difficulties to describe the potential of carbon stock changes through adapted forest management by extrapolation , the IPCC Special Report on LULUCF has presented an attempt to do this by picturing the potential situation in 2010 , as shown in the table below for countries listed in Annex I of the KP.

The model does not account for GHG benefits of energy production from biomass or enhanced use of wood products and it also ignores possible side-effects on non CO2 greenhouse gases resulting from changes in land use related to the measures.

These – purely indicative - figures suggest that , among the different activities considered, forest management gives a good return per unit area and has the largest potential for total net change in carbon stocks.

These measures can also have considerable consequences in terms of the socio-economic effects of proposed changes in management and use of the forest resources. The most obvious among these secondary consequences are the potential reduction of availability of raw material to wood processing industry, potential redirection of biomass flows to other uses and the income forgone to landowners that may result

from a (temporary) decrease in economic activity. On the other hand , increased demand for forest products and services from new activities could result in better prices for forest owners and better economic viability of SFM.

Table : Relative potential in 2010 for net change in carbon stocks through some improved management and changed land-use activities (IPCC)²⁹

Activity	Area (1) <i>(M ha)</i>	% of (1) Under Activity	Net annual change of C-stock <i>(t C /ha/yr.)</i>	Total net ch. of C-stock <i>(Mt C/yr.)</i>
<i>(a) Improved Management only</i>				
Forest Management	1 900	10	0.5	100
Cropland Management	600	40	0.3	75
Grazing Land Management	1 300	10	0.5	70
Agroforestry	83	30	0.5	12
Rice Paddies	4	80	0.1	<1
Urban Land Management	50	5	0.3	1
<i>(b) Land-Use Change</i>				
Conversion of Crops to Grassl.	600	5	0.8	24
Agroforestry	<1	0	0	0
Wetland Restoration	230	5	0.4	4
Restoring Degraded Land	12	5	0.25	1

The model was based on the following premises :

- The actual estimations for land areas under different kinds of use (forest / agro / grazing / wetlands...etc)
- A hypothetical scenario in which an ambitious political agenda promotes the application of activities to part of the land area above the level that is currently occurring;
- The assumption that there is agreement on definitions of additional activities to be listed under KP art. 3.4;
- Research based estimates of the rate of C-uptake per ha and year of under the the different land use forms

²⁹ The authors have indicated that all of the provided figures were deliberately rounded to avoid giving an impression of precision . It has to be noted that most of the data come from Russia and N.America.

4.3 Forest biomass use, fire protection and climate issues in S. Europe

The area of Mediterranean forest biomes (Forest & OWL) roughly equals the forest area of the Nordic countries. Given the specific geological, biological and climatological features of the Mediterranean basin, the forests of S. Europe harbour a largely untapped potential for realizing productive, ecological and social forest functions, especially when taking into account that much of the actual OWL could be restored to forest when the necessary investments are made. Realizing this potential for enhancement of forest functions depends to an important extent on the attention given to forest fire prevention and fire-related management measures, as demonstrated by the CTMs that were proposed to the group.

Two main types of measures for enhancing carbon sequestration in forests, and other forest functions, in Mediterranean region should be recommended :

- Prevention/limitation of forest fires by monitoring and combating fires. This type of measures is relatively straightforward and a lot of experience already exists (see CTM no. 9)
- Management of vertical structure of stands to avoid fuel buildup on the forest floor and development of crown fires. This type of measure could be given more importance, as it has the best potential for multifunctional benefits (carbon storage in remaining stands, use of understorey biomass for E-generation, biodiversity enhancement by adequate spatial distribution of interventions – see CTM no. 14)

Conclusion

It will be necessary to establish effective incentives, information campaigns, training facilities and pilot schemes in order to demonstrate FM possibilities and make them attractive for forest owners. Council Regulation 2080/92 already included aid for “improving existing forests”, but this was little used and did not specifically target at improving carbon sequestration. Council Regulation 1257/99 on Rural Development measures (RDR) aims to promote sustainable development of rural areas and provides the possibility for “support for investments in forests aimed at significantly improving their economic, ecological or social value” (see also section 6 “Instruments for Implementation”).

The Commission’s CAP mid-term review proposal, “*A long term perspective for sustainable agriculture*”³⁰.and the upcoming discussions about the use of the EAGGF during the next budgetary period should be seen a important opportunities for integrating climate mitigation objectives in major policy instruments.

³⁰ Adopted on 21 January 2003.

4.4 Outlook

The success of the implementation of ARD and Forest Management activities and their contribution to climate change mitigation objectives in the longer term will require them to be based on a continuous strategy to ensure the sustainable management, use and growth of the newly created forest resources.

Looking at ARD and forest management activities from a even longer perspective, there remains considerable doubt if forest related sinks can be further enhanced by increasing forest area and increasing carbon uptake in forests. For this reason forest sink analysis must not be restricted to the forest growth only. The closer forest carbon stock approaches its maximum level, the more important it becomes what kind of use by long term storage in wood products, substitution of other materials and fossil fuel by woody biomass becomes.

In addition, a number of uncertainties make it very difficult to come to reliable long term projections for the use of forest sinks:

- Although many experimental studies have demonstrated that increasing CO₂ availability in a controlled environment enhances carbon uptake by vegetation, it is uncertain if more carbon will be finally stored in trees and soil as a result of raising CO₂ concentration in the atmosphere although increasing biomass yields may be expected.
- Other studies have demonstrated that temperate forests are quite responsive to increased N and P availability. This has led to the belief that deposits from the atmosphere may act as a fertilizer, but at the same time also may cause problems of acidification, leading to ecosystem damage, reduced growth and biodiversity loss.
- The rate of mineralisation of non-biomass organic material and the speed of humification of biomass is positively correlated to ambient temperature but this relationship is non linear. Investigations have indicated that small rises in temperature may have effects on these transformation processes that ultimately yield GHG and may affect existing sinks, both in a positive and in a negative way.
- Sink effects may decrease or even disappear for some time because of large natural catastrophes, widespread tree mortality as a result of climate change and uncontrolled deforestation (which is unlikely under EU conditions).

Because of these uncertainties in our understanding with respect to acclimatisation of tree physiology and forest ecosystem processes, particularly in relation to underground carbon dynamics, projecting sinks effectiveness beyond a few decades is highly uncertain. Given the imperative long term approach of all climate change mitigation measures, the question of permanence of the results of LULUCF projects will also have to be examined by IPCC and other scientific circles in the future.

As a result, LULUCF activities for compliance with Kyoto objectives still remain an open issue in operational terms. Most EU countries have not decided yet whether they are going to make use of KP art. 3.4 activities, CDM projects or JI. In this context, the new improved good practice guidelines currently under preparation at the IPCC and expected to be ready in the course of 2003 will certainly open a lot of perspectives.

5. The relationship of C-sinks in forests with upstream and downstream activities

5.1 Considerations about upstream activities

The CTMs that have been proposed by the group give indications about possible answers to the question how EU countries can integrate forest related measures in their policies to meet the Kyoto emission reduction targets.

An overview of the CTMs that are listed in section 3 leads to the conclusion that the many of the activities currently undertaken to ensure the fulfilment of different forest functions – “upstream” activities - can in fact be adapted to make them contribute more specifically to agreed climate change mitigation objectives although they cannot be seen as effective emission reduction measures.

From this, it follows that for countries to arrive at more climate-friendly approaches to forest management in its broadest sense, it would be valuable to examine existing practices – that is all actions undertaken to deliver a forest function- , for their climate implications. Similar proposals have already been discussed under the label “farm audits” for the agricultural sector.

On one hand, actions such as extension of forest areas (both naturally or by planting/seeding, including preparative work) , forest regeneration after harvesting , forest exploitation techniques, forest soil management, thinning of forest stands, forest grazing, recreational use, the protection of already existing carbon stocks in forests against insect outbreaks, as well as changes in species composition to increase resilience could be analysed and subsequently reoriented in a more climate friendly way.

On the other hand, decisions on the final product mix to be delivered and the balance between different forest functions may also be (re)-considered against their (potential) climate impacts. This looks especially relevant in the case of competition for the same products, frequently mentioned concerning the use of small dimension material such as thinnings or by-products and residues from wood-processing. In the case that such competition effectively develops, it would be advisable to base the necessary trade-offs on a broader analysis of the “upstream” requirements for production of biomass.

In a long term perspective, measures for enhancing the amount of carbon sequestered in forests, as investigated in this WG, are a necessary pre-condition for the enhancement of the other uses. If not so, using more forest products could be heldup by limited carbon resources in forests.

5.2. The link between forest sinks and downstream activities

The fact that the EU wood harvest currently constitutes only 70 % of measured increment leads to the conclusion that there is room for increasing forest products consumption within a framework of sustainable forest management and increase of the forest area .

Carbon stocking in harvested wood products

Wood products are an integral part of the carbon cycle, in which they play three roles: as a physical pool of carbon, as a substitute for more energy-intensive materials and as a raw material to generate energy.

Options to increase carbon stocks in wood products include:

- increasing market share of existing wood products;
- substitution of more energy intensive³¹ materials by forest products
- improving the quality of wood products;
- improving processing efficiency of the forest based industry;
- enhancing recycling and re-use of wood and wood products.

While C storage in wood-based products can reach saturation because of their limited useful life, important GHG benefits may also result from substitution of more E intensive materials by wood or wood-based products. Although no reliable estimates on this exist, it has been advanced that the substitution impact from wood products may be larger than the storage impact. This means that carbon sinks in standing forests would have to be seen only as part of the potential to use the storage capacity of the forest biomes to meet the Kyoto objectives.. It also means that, once a tree is cut , the challenge will be to enhance the useful life of the forest products made from it and to recycle them as much as possible, in order to keep carbon fixed in the product. To prevent leakage , it should be avoided however, to diverge carbon from a pool that is not accounted for under the Kyoto Protocol (like wood based products) to other uses that are accounted for. Moreover, the promotion of forest sinks must not be carried out at the expenses of the other functions of forests.

Energy substitution by using forest products

As already mentioned in the section on SRTP (4.1.3), biomass has been identified as one of the most important future sources of renewable energy and the use of woody biomass plays an important part in the projections to meet the RES objectives. As there is currently no Community competence or legal basis for allocating forest products , this means that if wood becomes more attractive for certain uses than for others, market competitive conditions and opportunities will be the main drivers that will determine these biomass flows, whereby increased demand can be expected to lead to increased supply. In addition, national and regional energy policies may also influence the use of wood.

Without any intention for preemption of available products for existing uses at the expense of new uses, but conscious of the fact that an optimum will have to be found between carbon storage in growing stock, substitution of energy intensive materials by forest products and use of woody biomass for energy generation, the WG has come to the following considerations :

³¹ Energy intensity of a material relates to the amount of energy related to produce a quantity of it. This means that metals, glass, concrete, plastics etc. are more “energy intensive” than wood and thus less climate friendly to the extent that their production process depends on the use of fossil fuel.

Recommended biomass sources for energy substitution related to forests :

- afforestation / SRTP (new forest resources);
- end-of-life forest based products (taking into account environmental considerations of incineration);
- use of woody residues, both from the forest (possibility of co-benefit with prevention forest fires) and from processing;
- use of thinning products that have no other use or market.

Activities not to be recommended for energy substitution

- use of industrial quality wood from existing forest resources
- energy substitution that would replace recycling of forest based products
- replacement of existing forest resources with energy crop plantations

6. Instruments for implementation

6.1 General considerations

The CTMs that have been proposed by this WG will provide ideas for preparing decisions on how to use the dispositions of art. 3.3 and 3.4 of the KP to help meeting emission reduction targets. As the start of the 1st commitment period is drawing near, the question of financial and administrative resources to implement CTMs will gain more importance. As incentives from the Community budget are expected to play a role in the co-financing of climate related measures, the experiences with the use of these sources of funding calls for an early and broad approach to the issue.

After choices will have been made by MS administrations about which CTMs should be supported, the question will arise how to structure support for such measures. Should they be simple subventions for existing activities, incentives for new developments, compensations, grants, tax breaks, market mechanisms... and what should be the level of interventions? As a lot of information about the real costs of the CTMs proposed is still lacking, coming to a reliable estimate of these costs seems to be one of the first concerns.

Such a cost estimation exercise could consist of the following steps:

1. More precise description of the activities to be supported

The CTMs present a wide range of potential measures and activities for which start-up funding may be required. Activities can relate to the preparation of measures, or only follow after adoption of rules and regulations. They can be one-off 'investment'-type actions, such as land acquisition or the restoration of certain features, or they may involve actions over extended periods, such as the regular active management of vegetation and site monitoring. They can be directly related to on-the-ground action, or they may involve broader administration and educational or awareness-raising activities which ensure that forestry operators and landowners are aware of strategic impacts and economic gains. The question can be raised if certain activities (eg compensation for loss of land value) preclude the use of others (eg management schemes) or if some activities are simply more appropriate and amenable to EU funding or deserving of a higher priority. At the same time, there is also a need to consider the necessary flexibility Member States should have in selecting activities to develop a programmed approach to funding climate related forestry measures which is both appropriate to specific national circumstances and encourages innovation and best practice in management.

2. Establishing reliable estimates of costs of measures to be taken

To do this, several tracks can be followed:

- *Top-down approach* – estimates are based on calculated potential costs for a small sample of sites and specific measures and then extrapolated to the total surfaces concerned . This can provide a broad but acceptable estimate of costs based on a limited number of experiences over a given time period.

Bottom-up approach – an overall estimate is calculated by adding up real costs for all areas concerned by a measure. This approach is the ideal, since it takes better account of local situations, including long term management costs. However, it relies on adequate information being available, which is currently not the case in all Member States.

Combined approach – in which bottom-up estimates are calculated where data permits, while a top-down approach is used to estimate costs where data is not available. This is a pragmatic way to arrive at estimates that are relatively reliable.

In order to draw a general picture of the potential involvement of the Community budget during future budgetary periods, data on costs of CTMs could be collected by the Commission on the basis of questionnaires sent to MS.

3. Making a choice on what kind of instruments to use

Two basic options exist :

- **Option 1** – using existing EU funds e.g. RDR, Structural Funds, etc, but adapt these as necessary in order to deliver against climate related needs;
- **Option 2** - establishing a new funding instrument dedicated to actions in the field of creating and enhancing forest sinks.

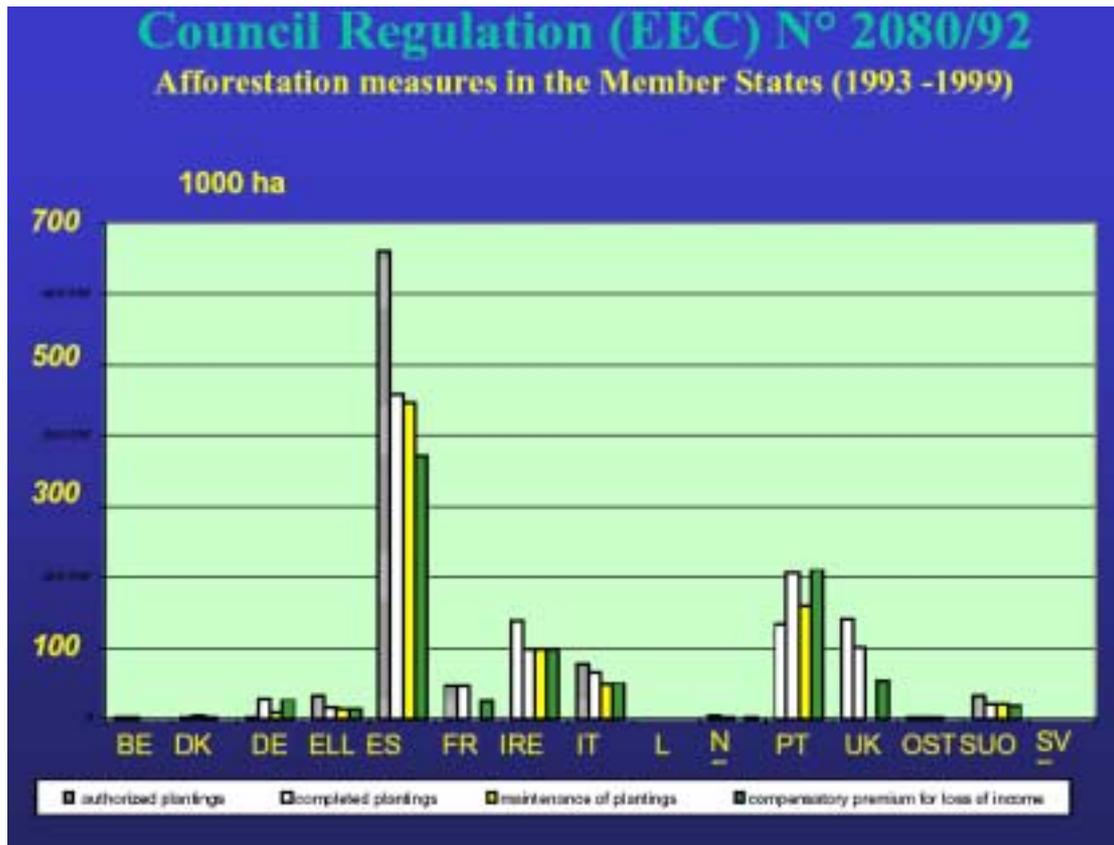
As the Community budget already operates through a considerable number of separate budget lines and as the creation of a new budget instrument is a very cumbersome procedure, option 1 appears to be the one that has to be recommended.

6.2 Overview of of different instruments

6.2.1. Learning from Regulation 2080/92 (no longer in force)

The “Community aid scheme for forestry measures in agriculture” that was part of the accompanying measures resulting from the Mc Sharry reform of the CAP in 1991 has been operational throughout the budgetary period 1992-99. As already indicated above, it has co-financed over 1 M ha of plantations between 1994 and 1999.

The evaluation of the 2080 scheme that was published in 2001 contains conclusions and recommendations that are important for the further development of other instruments.



As shown in the graph above, funding for afforestation under the 2080/92 Regulation has been taken up mainly by Mediterranean MS and also by Ireland.

An evaluation report commissioned by DG AGRI has estimated that approx. 2.7 Mt C will be stocked from 2030 by all plantations resulting from the 2080/92 scheme.

6.2.2 Possibilities for forestry measures under EU Rural Development policy :

For the budget period 2000-2006, all “accompanying measures” that came with the ’91 CAP reform were merged in the RDR 1257/99, establishing the “second pillar” of the CAP.

With the adoption of the the Rural Development Regulation (1257/99) and the second implementing regulation (445/2002³²), new possibilities for supporting forestry have been created, within the overall aim to promote sustainable development of rural areas. These possibilities consist of both compensation measures for loss of farming income in the case of afforestation and of support for investment, to be financed through the European Agricultural Guidance and Guarantee Fund (EAGGF). As far as forestry is concerned, this regulation brings

³²[Regulation 445/2002 was adopted on 26.02.2002 to replace the first implementing regulation 1750/99](http://europa.eu.int/eur-lex/de/index.html). All community legislation of the EU is accessible in all community languages on the Europa server: <http://europa.eu.int/eur-lex/de/index.html>.

together economic, social and environmental objectives in a coherent set of measures, which promote in particular the following objectives: (i) sustainable forest management, (ii) maintenance and development of forest resources, and (iii) extension of woodland areas. In addition, the regulation provides also support for training to improve the occupational skills and competence of persons involved in forestry activities.

In promoting sustainable forest management, the rural development regulation puts a great emphasis on inter-linkages between forestry and other policy areas and land uses, as well as on the consideration of specific socio-economic and ecological factors in line with the following basic principles:

- Interdependence of different sectoral and horizontal policy areas. The need to combine different interests and to achieve economic, social and environmental objectives in a coherent way
- Regional diversity. An acknowledgement of locally distinctive characteristics, priorities, problems and opportunities;
- Bottom-up approach. An emphasis on active involvement and participation of local communities and self-help, rather reliance on external action.

These measures aim to facilitate and support the implementation of the national or sub-national programmes of the Member States in areas where the MS are identifying a synergy between the forestry incentives in the framework of their national or regional policies and the objectives of the rural development policy as laid down in the Council Regulation.

Under the Rural Development Regulation, support may be granted to private forest owners or municipalities for the sustainable management and development of forests, the preservation of natural resources and the extension of woodland areas, with a view to maintaining the economic, ecological and social functions of forestry in rural areas. For the co-financing of RDR measures related to prevention of forest fires and natural disasters, public forest owners other than municipalities are also eligible.

In how far forestry measures will be co-financed by the Community budget will have to be decided in each Member State by negotiations of the stakeholders (landowners, municipalities, lease holders, holders of users rights, local interest groups, etc..) with the administrations. The RDR therefore promotes the participation of rural communities in the preparation and design of the Rural Development Programmes. This could open new possibilities for promoting climate change mitigation measures in forestry within the Rural Development Plans. In the perspective of the upcoming CAP review however, the forest sector might benefit from the introduction on compulsory shifts of resources from pillar I to pillar II of the CAP.

Possibilities for supporting forestry measures under the RDR :

1. Article 30 of the RDR :

- Afforestation of non-agricultural land (non-eligible under art. 31)

- Investments in forests.(Actions are focused on real investment measures, normal silvicultural management operations are excluded)
- Investments to improve and rationalise forestry operations (prior to industrial processing)
- Restoration of production potential damaged by natural disasters and fires and introducing appropriate prevention measures (public forest owners other than municipalities are also eligible (1ST PT. RELATED TO KP ART. 3.3 , OTHER POINTS TO KP ART. 3.4)

II.Article 31 of the RDR : (continuation of 2080-scheme – KP art. 3.3)

- Afforestation of agricultural land
- Support for loss of income from afforested land

III.Article 32 of the RDR concerns measures aimed at maintaining and improving the ecological stability of forests where the protection and ecological role of these forests are of public interests. The measures to be carried out must be specified in a contract between the beneficiaries and regional authorities.

6.2.3 Possibilities for forestry measures under EU regional policy

The Structural Funds Regulation 1260/99 for the period 2000-2006 allows for the funding of environmental measures in forestry.

The structural funds³³ include the European Regional Development Fund (ERDF), the Cohesion Fund, the European Agricultural Guidance and Guarantee Fund (EAGGF) and the European Social Fund (ESF). For the 2000-2006 programming period, the Structural Funds regulation (1260/99), adopted by Council on 21 June 1999, stipulates the objectives of the structural actions.

The European Regional Development Fund (ERDF) co-finances multiannual programmes to assist regional development. Between 2000 and 2006, these programmes will support:

- the development of the most disadvantaged regions (Objective 1);
- the conversion of regions facing structural difficulties (Objective 2);
- interregional co-operation (Interreg III);
- the sustainable development of urban areas in crisis (Urban II);
- the development of innovative strategies to support regional competitiveness (innovative actions).

ERDF resources are mainly used to co-finance:

- productive investment leading to the creation or maintenance of jobs;
- infrastructure;
- local development initiatives and the business activities of small and medium-sized enterprises.

In theory, all development areas are covered: transport, communication technologies, **energy, the environment**, research and innovation, social infrastructure, training, urban redevelopment and the conversion of industrial sites, **rural development**, the fishing industry, **tourism** and culture.

³³ More information is available at http://europa.eu.int/comm/regional_policy/index_en.htm

The Cohesion Fund is a complementary funding instrument which supports investment in the environment and in transport in the four least prosperous Member States (in the present budgetary period Spain, Greece, Ireland and Portugal).

Concerning forestry , structural funds interventions are used exclusively as a source of financing for infrastructure, while all rural development actions are covered by the EAGGF. For the budgetary period starting in 2007 however, the same type of discussions as for the use of the EAGGF will have to be held and could be an opportunity for MS to consider using the regional funds for (co-) financing climate related measures in forestry and in the energy sector that start during the 1st commitment period.

6.2.4 Nature conservation measures

Directive 92/43/EEC (“Habitats Directive”) from 1992 sets the goal of establishing a European ecological network for nature conservation, called Natura 2000 and consisting of the “Special Protection Areas” (SPA) under the Birds Directive 79/409/EEC and the forthcoming “Special Areas of Conservation” (SAC) under the Habitats Directive.

As over half of all proposed sites for the EU-wide ecological network Natura 2000 will include forest areas, and as sustainable forest management and enhancement of C-sinks can be complementary , the implementation of Community Nature protection measures can contribute to climate change mitigation. **This means that the financial instruments that exist (LIFE programme) or will be created to support Natura 2000 can also yield climate benefits without sacrificing their primary objective of funding conservation measures. In this way , carbon sinks can be enhanced through non-intervention in existing forests, wetland restoration, giving up of age-class forestry etc... These principles can be applied by MS through their own National Parks or Nature Reserves support instruments.**

6.2.5 Carbon credits for energy crops

The Commission proposed to replace existing set-aside arrangements with a “carbon credit” , introducing a non crop-specific subsidy of 45 €/ha (limited to a surface of 1.5 Mha) for achieving energy carrier substitution under the 2nd pillar of the CAP . It is clear that this would perfectly fit for SRTPs. With an estimated potential uptake of 3 to 6 tC/ha/yr, this would encompass an incentive of **7.5 to 15 €/tC or 2 to 4 €/t CO₂eq.** (on the assumption that the carbon can replace an equivalent amount of fossil carbon)

It has to be observed that SRTP’s would have certain environmental advantages over annual energy crops such as rapeseed because of the lower level of agricultural intrants and the better energy balance in the processing operations for producing the final energy carriers. Also in this case , GPG from IPCC would be a welcome tool for achieving sustainable performance.

6.3 Importance of reporting requirements under the Kyoto Protocol

On basis of the experience gathered during various stages of the GHG inventory review activities of UNFCCC in the period 2000-2002 , it appears that that the effective use of LULUCF activities by EU Member States to meet KP objectives could be held up by lack of capacity to comply with the reporting procedures required by the KP. This means that even if practical application of the above mentioned CTMs would succeed , some parties may fail to report properly on them for not having developed the necessary inventory, monitoring and reporting systems with corresponding organizational structures . Other countries may choose not to account for optional activities because the burden of doing so is disproportionate to the benefits available.

Current lack of capacity of many EU countries' reporting may even prevent them from accounting for forest sinks because possible changes in certain carbon pools (such as soil organic matter) may have to be considered as producing GHG emissions (including non-CO₂ gases) due to the requirement in the Marrakesh agreements to demonstrate that they are not sources.

This implies that all CTMs mentioned here are only valuable in KP terms if proper reporting techniques satisfying all formal requirements are used by the parties. Taking into account the formal character of reporting under the KP and the importance that could be given to accounting of carbon credits from LULUCF activities , the EU may need to consider establishing separate initiatives for dealing with these matters.

6.4 Conclusions

The WG recommends that :

- Existing instruments for funding LULUCF activities be used in a more climate conscious way and for climate specific project objectives such as the enhancement of carbon sinks in forests and other components of the biosphere that are related to forests and forestry.
- Carbon sequestration be explicitly included among the objectives of the operations to be (co-)funded when the above mentioned existing instruments are being reviewed (e.g. CAP mid-term review) or when their future functioning is being negotiated (e.g. for the next budgetary period starting 2007). – This may imply future revision of the objectives or targets of the RD and Structural Funds Regulations so that they consider in an appropriate way the development of future land-use policies and measures aiming at maintaining the carbon stock and enhancing carbon sequestration of forests in Europe. Thereby, it would be necessary to ensure that environmental benefits be balanced with socio-economic ones when using these funds so that, for example, it should be possible to fund forest management or forest extension which does not directly create jobs or support farmers' incomes. Such funding should be justified on the basis that it is increasingly recognized that a healthy environment is a pre-requisite for sustainable economic development.
- The necessary budgetary adaptations in the context of the upcoming EU enlargement be foreseen for financing instruments that can be used to help meeting the Kyoto commitments.

7. General conclusions and recommendations

Afforestation and Reforestation activities have extended the total EU forest area of 113 M ha by **340000 ha/yr.** or 3 % from 1990 to 2000, resulting from nearly equal surfaces of planted forests and natural expansion. The WG estimates that , if this process continues unabated during the present decade , it may result in a sequestration potential of approximately 3.84 Mt C/yr. (14 Mt CO₂ eq./yr) during the 1st CP. In the long term and considering an extended EU of 25 MS, this sequestration potential may reach up to 34 Mt C/yr. (125 Mt CO₂ eq.)

Deforestation is not considered to be a serious problem in the EU , as it usually takes place on a small and localized scale and is mostly linked to infrastructure or urban development. Only a limited number of EU countries have reported, generally small, deforestation debits .

Forest management measures have a very large potential for application as they can cover the entire EU forest area of 113 M ha. This means that small GHG benefits per unit area may yield large impacts with little lead time. Very rough IPCC estimates of the quantitative impact of forest management measures indicate a potential for an average gain of 20 % in carbon uptake by adapting management but no reliable figures are available for the EU. The socio-economic impacts of adapting forest management are expected to be important. Like in the case of ARD measures they may touch the livelihoods of many rural people.

Many issues concerning the practical application and the expected results of the proposed CTMs are still in a research phase such as carbon content in forest soils permanence of forest sinks and saturation of the forest carbon pool . Carbon in non-biomass organic matter in forest soils has not been considered in this report, although it may constitute an important part of the total C in the forest ecosystem under certain climate conditions.

The proposed list of CTMs is by no means final. It will have to be further developed and completed, thereby taking into account scientific developments. The considerable geographical differentiation of local conditions across the EU will be very important for practical implementation of any of the listed measures.

To improve accuracy of the quantitative estimates of the GHG benefits and to reduce the present uncertainties, more research will be needed on the effects of the proposed CTMs, both in terms of their climate related impact and of their socio-economic consequences. More research will also be needed on the economic aspects of climate related measures in forestry, whereby economic modelling may play an important role. [The research needs are well summarised in the report "The carbon sink: Absorption capacity of the European terrestrial biosphere", European Commission, 2001, EUR19883.](#)

Climate conscious forest use supposes the integration of “upstream“ activities to enhance carbon storage in living forests and making best use of their increment , while at the same time “downstream” actions to enhance the use of forest products for long life applications should be considered.

EU forest sinks can contribute to the realization of emission reduction targets, but they are only to be regarded as **temporary relief** for effective reductions of GHG emissions in the long term. During the first commitment period 2008-2012, a maximum sequestration of approx. 33 Mt CO₂eq./yr or 9 Mt C/yr resulting from ARD and forest management activities may be expected. This corresponds with roughly 10% of the required yearly GHG reduction target of the EU for the same period. In the long term over 100Mt CO₂eq./yr or more than 27 Mt C/yr could be sequestered by forests in an EU of 25 Member States if strong and continued policies and incentives are effectively pursued.

Climate conscious forest use that enhances the sink function can be integrated in existing concepts of multifunctional forestry, rural development and use of forest products, provided that certain management priorities are adapted and if the ensuing socio-economic consequences are being compensated or offset by new developments.

It is recommended that existing Community instruments for incentives in the forestry sector be screened for possible adaptations to make them suit climate change mitigation objectives in the future.

The role of the EC in further EU actions to realize the Kyoto objectives can be :

- to adapt and develop financing mechanisms and corresponding rules for facilitating incentives to test and promote forestry measures that yield GHG benefits;
- to maintain an exchange forum allowing MS to evaluate and exchange experiences concerning such measures.
- to encourage the development of monitoring and reporting facilities that will be needed to comply with the formal requirements of the Kyoto Protocol.

Annex I : list of participants

1. Forest owners – Forest Industry

- Natalie Hufnagl, Tiina Ryttilä, Juan Botey : CEPF (Confederation of European Forest owners)
- B. de Galembert : Forest Director of CEPI (paper industry association – but only in their capacity of large forest owner)
- P. Canaveira (CELPA forest holdings, Portugal)
- D. VINER and M SAYER (ELO – European Landowners' Organisation)
- Pekka Kallio Mannila (Finnish Forest Industries)

2. Member States experts -representatives

- S. Gregory (Forestry Commission, UK)
- D. Mc Aree (Ministry National Resources, IRL)
- M. Olsson (Swedish University of Agricultural Sciences, SW)
- J. Pereira (Instituto Superior de Agronomia, PO)
- Cristina Garcia (Min. of Environment , ES)
- Antonio Lumicisi (Min. of environment and Territory, ITA)

3. NGO's

CAN Europe

- Jutta Kill – Fern
- Zoltan Raconczay - WWF
- John Lansberry - RSPB
- Elizabeth Guttenstein - WWF
- Saskia Ozinga - Fern

4. Research

- A. Freibauer (Max Plank Institute for bio geochemistry, scientific coordinator CarboEurope cluster, member ECCP WG agriculture and subgroup research –sinks')
- M. Dieter (Federal Research Centre for Forestry and Forest Products , Hamburg)

5. CEEC's (EU candidate countries)

- Wojciech Galinski (UNFCCC expert on IPCC Good Practice Guidelines)

6. European Commission

- S. Vergote, chair (ENV E1)
- J. Van de Velde, technical co-ordination (ENV B2)
- I. Seoane (AGRI)
- C. Dargnies-Pierce (ENTR)
- K. Maniatis / J. Riesgo (TREN)
- C. Bruening (RTD)

Annex II : overview of Candidate Technical Measures for enhancement of forest related Carbon sinks and other reactions by WG members

Candidate Technical Measures					
CTM no.	Author	Full Title	KP art.	Category	WG Comments
1	AFFORES T project	Afforestation of former agricultural lands	3,3	Afforestation	Large area available and information about costs easy to retrieve. More information to be gathered about socio-economic impacts
2	Govmt. of Poland	Increasing the Afforestation rate in Poland on private and public agricultural land	3,3	Afforestation	Large area available and comparativel low operationaly costs. Important contribution to Kyoto objectives to be expected.
3	Govmt. of Spain	"Afforestation & Reforestation" according to Spanish National Forest Plan	3,3	Afforestation & reforestation	Large area available and important potential for multifunctional appraoch, including combat against erosion and desertification. Practical implementation depending on support from RD budget.
4	German Federal Research Center for Forests and Forest Products	Fast-growing tree plantations on cropland	3,3 or 3,4	Short rotation tree plantations	Largest GHG benefit expected from energy substitution, not from sinks in situ. May be reported on as forest or non-forest according to different national legislation. Potential area for application very important.
5	Govmt. of UK	Afforestation of agricultural and derelict land	3,3	Afforestation	Application possible to a large variety of site conditions, including abandoned industrial sites. Costs may be comparatively high.
6	Govmt. of Italy	Forest extension by natural regeneration	3,3	Reforestation	Important potential for Southern Europe if compliance with requirements for "human induced" nature assured . Mentioned as ARD in Marrakesh Agreement but not treated by IPCC GPG.
7	CARBO-EUROPE	Forest Reserve Areas	3,4	Carbon conservation	Sequestration dat from research very promising but practical application limited to areas designated under nature protection legislation.
8	CARBO-EUROPE	Forest Wetland Restoration	3,4	Carbon conservation	Area for applicationn potentially important but important compensations to economic operators may be required.
9	CELPA	Prevention of forest fires	3,4	Carbon conservation	Application limited to Southern Europe. Generally low costs per unit area.
10	Govmt. of Spain	Adaptation of Forest Management according to the Spanish NFP	3,4	Carbon sink enhancement	Interesting possibilities to make multifunctional use of abandoned agricultural or formerly grazed areas. Important LT investment needed.
11	GFA Consultants	Restoring Mountain Selection Forest	3,4	Carbon sink enhancement	Good potential for multifunctional forest use but limited geographical application and possibly important socio-economic effects which have to be investigated further.

12	European Landowners Office	Transition to continuous cover forest management	3,4	Carbon sink enhancement	Application of traditional selection forest management practices to different forest types. Good potential for multifunctionality but critical remarks about feasibility under different circumstances across the EU.
13	Univ. of Bayreuth	Enhancement of carbon sequestration in humic layers by appropriate species selection	3,4	Carbon sink enhancement	Not retained for lack of technical readiness.
14	COSE	Biomass management for fire protection	3,4	Carbon sink enhancement	Important potential for a multifunctional approach to mobilize production capacities in Southern Europe. Economic feasibility and need for incentives to be investigated further.
15	CELPA	Improved management of fast-growing plantations	3,4	Carbon sink enhancement	Straightforward measures to enhance the total carbon sequestration during the plantation cycle. Can be applied to all types of plantations.
Other reactions					
	<u>Author</u>	<u>Full Title</u>	<u>KP art.</u>	<u>Category</u>	<u>Short description</u>
	M. Dieter	"Comments on technical measures proposed"	-		Consists of mainly of description of German <u>policy</u> <u>legal comments</u> on the measures proposed in GFA presentation during 1st session.
	M. Olsson	"General Comments on measures proposed"	-		Pertinent remarks about necessity to come to more uniform use of measures and units , also mentions some gaps in the series of CTMs
	CEPF	"Comments on technical measures proposed"	-		<u>Policy statements</u> on all measures proposed in GFA presentation during 1st session.
	Govmt. of Ireland	"Contribution of afforestation plans to Kyoto objectives"	3,3	Afforestation	Short presentation of the contribution of forestry measures to the national emission reduction targets