European Cooperation in the field of Scientific and Technical Research - COST -

Secretariat

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COST 261/06

MEMORANDUM OF UNDERSTANDING

Subject : Memorandum of Understanding (MoU) for the implementation of a European Concerted Research Action designated as COST Action 639 Greenhouse gas budget of soils under changing climate and land use (BurnOut)

Delegations will find attached the Memorandum of Understanding for COST Action 639 as approved by the COST Committee of Senior Officials (CSO) at its 165th meeting on 27/28 June 2006.

MEMORANDUM OF UNDERSTANDING
FOR THE IMPLEMENTATION OF A EUROPEAN CONCERTED RESEARCH ACTION DESIGNATED AS

COST ACTION 639

Greenhouse gas budget of soils under changing climate and land use (BurnOut)

The Signatories to this 'Memorandum of Understanding', declaring their common intention to participate in the concerted Action referred to above and described in the 'Technical Annex to the Memorandum', have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/01 'Rules and Procedures for Implementing COST Actions', or in any new document amending or replacing it, the contents of which the Signatories are fully aware of.

2. The main objective of the Action is the improved understanding of the management of greenhouse gas emissions from European soils under different forms of land use and in particular disturbance regimes.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at approximately 50 million EUR in 2005 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

COST ACTION 639

Greenhouse gas budget of soils under changing climate and land use (BurnOut)

A. ABSTRACT

This Action will assess the relationship of greenhouse gas emissions to the sink strength of soils under different forms of land use, especially under future climate conditions and in regimes of ecosystem disturbances that are typical for particular regions. First, the Action will build on the knowledge from CarboEurope and NitroEurope and focus on 'hot spots' of GHG emissions from soils (types of ecosystems, types of land management). The Action will employ a multidisciplinary approach, using the cooperation of people with expertise in forest ecology, agriculture, biology, geography and socio-economy. The main result will be improved understanding of the management of greenhouse gas emissions, and the elaboration of a meaningful proposal for the evaluation of GHG emissions from terrestrial ecosystems. This will serve as a useful contribution to guidelines for future European proposals in the field of environmental management.

Keywords: Greenhouse gases, soil, carbon sinks, terrestrial ecosystems, climate change

B. BACKGROUND

Current knowledge

Carbon (C) stored in soils represents the largest terrestrial organic carbon (C) pool. The biogeochemical cycles of C and nitrogen (N) are closely interwoven. Although the discussion on climate change focuses on CO_2, the coupled cycling of C and N deserves equally much attention. As a result of mineralisation processes, both elements are liberated from soil organic matter and can be lost from the soil via the aqueous or the gaseous phase. Both C and N occur in terrestrial ecosystems in several chemical forms and are potentially emitted as greenhouse gases (GHG). On the other hand, soils can act as a strong sink for GHGs. Considerable uncertainty exists regarding the sink strength of soils under different forms of land use, especially under future climate conditions and in regimes of ecosystem disturbances that are typical for particular regions. Because of the significance of the GHG exchange between the atmosphere and soils, C changes in terrestrial ecosystem pools are included in international treaties (Kyoto Protocol, UNFCCC).

The issue of soils acting as a GHG sink is controversial. Cultivated soils have lost a substantial part of their original C and N as a consequence of anthropogenic use. GHG emissions arising from land use change include those by deforestation, biomass burning, conversion to agricultural use of natural ecosystems, drainage of the wetlands and soil cultivation. The current sink strength of soils for the retention of C and N is bound to decline if no specific incentives for adapted forms of land use are provided. Crucial topics are the maintenance of the current sink activity of forests soils, agricultural forms of management that turn arable soils into GHG sinks, and the protection of pristine landscapes such as the wetlands and old forests that are currently large reservoirs of C and N.

Biogeochemical models indicate that forest soils will act as a slow and continuous sink for C and N. Agricultural soils are most likely a continuous source of GHGs. Modelling results are difficult to verify by field experiments because the spatial variability often exceeds the temporal trend. Only a few long-term research projects exist and the temporal trend of C and N pools in field experiments is less clear than in simulation models. Stock changes in soils are difficult to detect because the spatial variability of soil chemical properties is large and blurs the signal of a temporal trend. Soil inventory methods that allow the efficient detection of temporal changes in the C and N stocks are still to be developed.

Recognising that the required soil monitoring for a complete periodic assessment of soil C and N stocks throughout Europe is prohibitively expensive, the Action will focus on the identification of sites where stock changes are most likely, according to expert judgement. The Action will investigate (i) the probability of C and N stock changes within a certain type of land use, (ii) the extent of stock changes as a consequence of land-use change, and (iii) the impact of ecosystem disturbances on stock changes. The target is to identify site types and land management practices, where the stock changes are most likely to happen, because these are the areas where monitoring efforts need to be concentrated. The Action will focus on the interfaces of different land uses (agriculture, forestry, unmanaged land) that are often treated separately by researchers in different fields of environmental sciences.

Among the consequences of the lack of communication is that the effects of modification of land management within a certain type of land use are better understood than the effect of land-use changes. This is unfortunate, because land-use change (e.g. afforestation of agricultural land) is expected to have a major effect on the GHG sink strength of soils. The diversification among different scientific approaches is accentuated as the Good Practice Guidelines for GHG Reporting (IPCC Good Practice Guidance 2000) deal with direct N_2O emission from soils, while GPG LULUCF covers N_2O emissions and C emissions from management (including disturbances). However, not all processes have been covered by the default methodologies because of the lack of data.

Disturbance of ecosystems often leads to the release of GHGs into the atmosphere. The term 'slow in/fast out' has been coined for the fact that the increase of C and N stock in terrestrial ecosystems is a slow process (time scale of decades) that can be optimised by ingenious land management, but that disturbances as instantaneous events can lead to immediate losses of C and N (time scale of hours). In this context the Action focuses on disturbances that are typical for specific regions. In the Nordic countries and Western Europe, peatlands currently retain large quantities of C and N, because the decomposition of soil organic matter is slow under wet and cold conditions. Global warming and drainage of these wetlands could release large quantities of GHGs into the atmosphere. Drying of peatlands therefore is a slow but potentially extremely effective ecosystem disturbance and peatlands are therefore assumed to be hot spots for future GHG release.

In the temperate region, forests are currently a sink of GHGs and will continue to work as sinks for the foreseeable future (decades), but the future development of disturbances (wind throw, pest infestations) is difficult to predict. Secondary spruce plantations have been shown to be particularly vulnerable to disturbance. This forest type is quite common in regions where forestry already has a long history. The GHG sink strength of Mediterranean ecosystems is currently underexploited because degraded landscapes are widespread. Reversing the effect of past land disturbances is on the political agenda. This land-use change is believed to have a great potential for the sequestration of GHGs.

Existing projects

Numerous projects have dealt and are dealing with the quantification and thorough mechanistic understanding of C and N fixation in terrestrial ecosystems. The International Programme CarboEurope (Sixth Framework Programme, FP6, building on a project cluster in FP5) and the recently approved IP NitroEurope (FP6) are investigating greenhouse gas fluxes and inventory methods on various scales. The core of CarboEurope was built around a network of flux towers that enable the measurement of the CO_2-exchange between the biosphere and the atmosphere at the ecosystem level. The international programmes are supported by a plethora of national research projects. The COST Action E21[1] dealt with the greenhouse gas mitigation potential of forests, Action E43[2] currently deals with the harmonisation of forest inventories. An identified gap in these Actions is that soils could not be dealt with in the required detail. COST Action 627[3] improves the understanding of the C–N interactions in soils of grassland ecosystems and the impacts of land use in a changing environment on C and N emissions.

[1] COST Action E21: Contribution of Forests and forestry to Mitigate Greenhouse Gas Effects.
[2] COST Action E43: Harmonisation of National Inventories in Europe: Techniques for common Reporting.
[3] COST Action 627: Carbon Storage in European Grasslands.

Reporting of GHG fluxes in and out of terrestrial ecosystems is a global issue. The legally binding reduction of GHG-emissions requires substantial efforts by the member countries of the EU, and non-compliance with the negotiated national emission reductions will lead to substantial penalty payments at the end of the first commitment period (2012) of the Kyoto Protocol. The storage of C and N in terrestrial ecosystems has therefore both an economic and an ecological component. In the first commitment period of the Kyoto Protocol, land management includes afforestation, reforestation, deforestation (Article 3.3), whereas Article 3.4, dealing with further land management options, is optional. For future commitment periods, a more comprehensive treatment of land management is expected. It is therefore necessary to obtain a complete picture of GHG emissions early on.

To take this important step, the Action will build on the knowledge from CarboEurope and NitroEurope and focus on hot spots of GHG emissions from soils (types of ecosystems, types of land management). The diversity of landscapes and forms of land use within the EU is large and calls for an international platform of interaction. This will involve an interdisciplinary approach in the collaboration of people with expertise in forest ecology, agriculture, biology, geography and socio-economy. A meaningful proposal for the evaluation of GHG emissions from terrestrial ecosystems is a vital contribution to guidelines for future reporting rules. The challenge is to establish a dialogue between stakeholders in the scientific, administrative and political arena. To take these important steps, the Action builds on the outcome of EU projects and the Guidelines of the IPCC for GHG reporting. The COST Action as an international cooperation will give momentum to national research in this area.

The Action network here described will include:

- experts in specific types of land use
- experts in inventory methods
- modellers
- experts who are involved in the political negotiations
- authors of already finalised guidelines
- graduate students and early stage researchers.

C. OBJECTIVES AND BENEFITS

The main objective of the Action is the improved understanding of the management of greenhouse gas emissions from European soils under different forms of land use and in particular disturbance regimes.

Secondary objectives

1. The identification of hot spots of greenhouse gas emissions from soils.

2. The identification of soil and site conditions that are vulnerable to GHG emissions.

3. The development of an advanced reporting concept across different forms of land use and land use changes.

4. The delivery and communication policy relevant GHG reporting concepts.

5. The improvement of the communication between soil C experts.

The Action aims to identify gaps in previous projects such as the response of carbon and nitrogen pools in soils under typical regimes of ecosystem disturbances and land-use change. To achieve the objectives, the Action will establish a communication platform between experts in different forms of land use, modellers and statisticians, and the contributors to the existing framework of greenhouse gas reporting.

The immediate benefit of the Action is that shortcomings of existing GHG reporting (IPCC Good Practice Guidance) that are caused by the insufficient availability of data or difficulties in upscaling, can be identified and improvements can be elaborated. It is expected that the accounting system of GHG emissions that applies for the first commitment period of the Kyoto Protocol will be changed and, post-2012, a more coherent system will be used. The Action will deliver recommendations for a new data acquisition system.

Another benefit will be the establishment of a discussion platform for soil experts who are involved in biogeochemical studies of C and N. A long-term benefit of the Action will be an improved understanding of the effect of land-use change and ecosystem disturbance on GHG emissions from soils and therefore better guidance as to where monitoring efforts should be concentrated. Publication of the results will ensure that the work will be of a high scientific standard and establish a link between the network and a wider audience. Ideally, the network will contribute to the development of an EU-funded project of the Seventh Framework Programme.

D. SCIENTIFIC PROGRAMME

Four working groups (WGs) will be established. The WGs are distinguished from each other by scientific discipline and scientific aims. Each WG addresses a specific issue required to achieve consensus for the practical implementation of the Action's objectives.

WG1 Hot spots for effects of climate change on soil C and N

Research will focus on landforms and situations that are expected to respond strongly to climate change in a manner that is likely to turn these ecosystems into sources of GHGs. Landforms with a particular relevance for different regions in Europe have been selected. In addition, types of ecosystem disturbances that are believed to be of widespread importance will be chosen.

Landform peatland

In these ecosystems the biological activity of soil microorganisms is constrained by anaerobic conditions. Peatlands are a frequent landform in Nordic countries and Western Europe. As a soil type, they have unique properties. From the knowledge of processes and responses of upland (mineral) soils to global warming, only limited predictions can be deduced for peatlands. Even their delineation on soil maps is uncertain. There is growing concern about peatland degradation in response to climate change or land management and the deleterious effects of such degradation on GHG release, hydrology, water quality and ecosystems. Virgin peatlands (mires) accumulate atmospheric C and N, but emit methane. Nitrogen oxide emissions from natural mires are insignificant. However, peatlands are a heterogeneous group of soils with different emissions. Drainage can have a dramatic effect on GHG emissions. In the Nordic countries, approximately 15 million ha of peatland are used as managed forest land and have, to a certain extent, been drained. Following drainage the methane emissions decrease and the net primary production and N_2O and CO_2 emissions increase. An integrated assessment of research needs to include an understanding of the links between vegetation cover, hydrological processes, biogeochemistry, soil ecology, water flow paths, and the interactions between peatland and climate change.

Moreover, peatland is understood as a partly or slowly renewable source of energy. Therefore, peatland is in some places exploited as a source of fuel. The impact of land-use change of peatlands (e.g. afforestation, see WG2) and the natural aggradation of peatlands as a consequence of global warming requires a rigorous evaluation. A GHG budget of the entire ecosystem is required in order to establish the net response (i.e. sink of C and N in higher biomass production versus source of GHGs from soils). The loss of peatland also affects the richness of the landscape and needs to be treated in the context of biodiversity issues. The GHG emissions from peatland ask for a close cooperation between forest soil scientists and soil biologists. The Action will stimulate discussion on appropriate methods for coupling small-scale peatland studies with global- or regional-scale studies. Available soil inventories in e.g. Austria, Finland and Sweden may be used for upscaling.

High elevation/latitude ecosystems

In these ecosystems the biological activity of soil microorganisms is constrained by low temperatures and a short growing season. However, the loss of GHGs from soils can occasionally be rapid, because large amounts of C and N occur in chemically labile forms that are rapidly mineralised, provided temperature increases. Thawing of permafrost may in some areas have a profound impact of emissions of CO_2, N_2O and CH_4. The extent to which increased plant productivity will compensate for soil GHG emissions is unknown. Budgeting the overall effect of soil warming is impossible, as long as the mechanisms of stabilisation and the stock of readily decomposable soil C are unknown. The Action will collate soil C data from case studies where total C has been fractionated into a labile and a recalcitrant pool and will establish pedotransfer functions for the estimatation of the labile C pool from easily accessible site factors.

High elevation ecosystems are also undergoing a change because the land use is changing. Societal changes lead to the abandonment of pastures and subsequent reforestation. The consequences for GHG emissions are not yet quantified.

Mediterranean ecosystems

Simulation models predict a low C sequestration potential for Mediterranean forest soils, mainly because the productivity of sites with a prolonged summer drought is slow. More important than adapted forest management may be the effect of land-use change (afforestation), because it may reverse the effects of earlier soil degradation. Afforestations in the Mediterranean region have been shown to lead to considerable increases in soil C and N stocks. It needs to be shown how representative these results are for the entire region and how land-use changes can be communicated to land owners. An obstacle is that land use and soil data are scattered over institutions and are not yet harmonised. The Action is an incentive to exploit these data sets.

Experts on these landforms will identify the governing soil processes for each ecosystem and will identify similarities between ecosystem processes and responses that help to extrapolate results to a wider area. They will collect information on the spatial extent of these landform types and establish quantitative limits for the potential release of GHGs under future site conditions. The Action will deliver a set of default values of GHG emissions for several classes of landforms that are considered to be hot spots. These default values will be delivered with an estimate of their accuracies and are suggested for use in GHG emission reports where regionally valid data are unavailable. The focus of the Action is to derive such default values, but not the specification of different land-use forms. The approach of default values for different situations of interest was brought forward by Miko Kirschbaum (IPCC expert) during the IUFRO World Congress 2005 and has been received with great interest. Eventually (not an objective of the Action), the results of the Action can be incorporated in a Geographic Soil Information Systems such as the CORINE soil map. (http://dataservice.eea.eu.int/atlas/viewdata/viewpub.asp?id=11).

Natural and human induced disturbances

Forest ecosystems are subject to wind throw and fire with a certain region-specific periodicity. Within a short time, large quantities of soil C and N are converted to GHGs ('slow in/rapid out'). In central Europe, secondary Norway spruce forests are common. This forest type is highly productive and is the backbone of forestry in several regions. The production risk of spruce monocultures is considerable and storm events regularly destroy vast areas of spruce forests. Second, important aspects are insect infestations that often follow storm damage. As long as only the economic value of timber production is compared, this forest type is superior to mixed-species forests. Additional value is created in continuous-cover forestry; because of the maintenance of high stocks of C and N in the ecosystems. These forests have a higher value and they need to be re-evaluated. This assessment is to be the basis for scientifically funded incentives for the establishment of mixed-species forests, if they prove to have low GHG emissions.

The main reason for GHG emissions from agricultural soils is tillage, and adapted forms of agriculture have a great potential for the reduction of emissions. However, agricultural soils are also responsive to climatic change. A major problem is erosion, especially when soils are bare during a part of the year. Case studies will help to quantify how adapted land management can reduce erosion and how much erosion contributes to GHG emissions from soils.

Drought impacts and re-wetting

Soils emit GHGs especially during drying/re-wetting cycles. These pulse emissions are contributing a lot to the annual N oxide fluxes into the atmosphere. This knowledge has been soundly established on the basis of laboratory experiments and single case studies. The relevance for a national GHG budget is not clear. Preliminary results show that discontinuous monitoring of N oxide emissions can underestimate the annual emissions substantially, when the short drying/re-wetting cycles are missed. The Action will link this process-level knowledge with current land use in order to quantify their potential contribution to annual GHG emissions.

The Action will cover the effects of forest fires and their importance in GHG emissions from forests in the context of disturbances. An in-depth assessment will not be achieved because the topic is very complex.

Expertise on emissions of CO_2 and nitrogen oxides from different types of ecosystems and differently treated/disturbed ecosystems has been established in sectorial approaches, i.e. separately for agricultural and forest ecosystems and the wetlands, and either with emphasis on C or N. The Action aims at fostering the interfaces between these findings by means of joint data evaluations and by consultation with experts in these fields.

The data supporting WG1 are derived from existing databases in various research institutes. A preliminary screening has shown that the required data are available from case studies that have been pursued in another context, but have not yet been used from the perspective of potential hot spots of GHG emissions.

WG2 Relation of land use, land-use change, and land-use history on soil C and N

In the first commitment period (2008-12) of the Kyoto Protocol, different types of land use are treated separately (IPCC Good Practice Guidance). In order to avoid double accounting of GHG emissions and emission reductions across different forms of land use, a complex patchwork of reporting requirements has been established. It is anticipated that in the future, a transparent system, applicable to specific types of land use will be necessary. Soil experts for different types of ecosystems (peatland, agriculture, forestry) need to be prepared for this situation.

The Action will provide a discussion platform, where expertise on key soil processes under specific types of land use will be exchanged. This will foster the required mutual understanding for the seamless GHG accounting across different land-use types. Within each type of land use the Action will quantify the effect of specific types of management on soil C and N stocks (forestry: thinning, site amelioration, N fertilisation, stand conversion, continuous forest cover, and drainage regime; agriculture: tillage/no tillage; unmanaged: conversion of peatland), for common changes in land use the Action will compile the impacts on GHG emissions (afforestation of marginal agricultural land versus grassland, conversion grassland/agricultural land). Land-use history has a strong effect on the soil C and N stocks. For the relevance of land-use changes for GHG reports, it needs to be shown how long the transition periods are after a land-use change and how long an ecosystem takes to build up its C and N stocks in the soil until a new equilibrium is reached.

The aim of WG2 is to re-evaluate existing studies in the context of the questions that arose with GHG reporting. Close collaborative links between WG1 and WG2 will ensure that the relevant interfaces between land-use types are established. The importance of the contributions of the hot spots (WG1) for the soil-GHG emissions in a particular type of land use will be elaborated. Based on this analysis, suggestions for monitoring efforts for soil C and N stocks in specific regions will be made.

The data for WG2 also already exist. In several countries, forest soil scientists and agricultural soil experts have pursued projects side by side in regions that are of interest for the objectives of the Action, but the interface between the different forms of land use have never been established. Within the Action these data will be harmonised in order to allow for comparative studies. Moreover, the researchers of the Action have recognised the need for experiments across different types of land use and unpublished data are available for the Action.

WG3. Monitoring, statistics, simulation models

European forest soils are *monitored* in a harmonised way (ICP Forest, Forest Focus), but for other types of land use the harmonisation is less advanced. Peatlands are fundamentally different from mineral soils and require a specific monitoring method. The loss in C stocks is difficult to measure and less relevant in relation to emissions of CH_4 and N_2O. The Action foresees in this respect collaboration between WG1 (peatlands) and WG3. The detection of small changes in soil C and N stocks requires great sampling efforts. The Action will recommend specific sampling schemes with stratified sampling for the detection of relatively subtle (compared to the stock) soil C and N stock changes with a major impact on greenhouse gas budgets (sampling in hot spots/WG1).

The Action will evaluate already existing soil C and N *models* (CO2Fix, Century, DNDC and others) for the verification of stock changes. As an interaction between WG1 and WG3, the representation of ecosystem disturbance in a model framework is sought. It is crucial to show where models are currently failing and to improve the interface with experts in field research and modelling. The assessment of stock changes requires a *baseline* for comparison. The present baseline is, arbitrarily, the pool size in the year 1990. The Action will attempt to establish a more meaningful baseline based on land use, land-use history, and site properties.

Pool sizes for soil C and N are calculated from several input values. Each has an error that propagates. On top of the variability at the spot, the small- and medium-scale spatial variation has to be considered. The Action will clarify how the variability of C and N pools can be comprehensively assessed under different situations of data availabilities. The Action will address the size of soil C and N stock changes that are theoretically required in order to be relevant for GHG reporting purposes. An error budget for undisturbed forests has been established in the project CarboInvent (FP5) and the rules of accounting for errors are described in the Good Practice Guidance of the IPCC. Based on data that are available from WG1, error budgets of C and N pool changes will be presented for peatlands.

An additional task of WG3 is to develop a risk assessment for GHG emissions from ecosystems. Signatory countries of the Kyoto Protocol are including the sink strength of terrestrial ecosystems in their GHG budgets. Ecology teaches that ecosystems have an inherent stability, a typical life span, and have a certain probability of being subject to disturbances. A risk assessment needs to express the probability of ecosystem disturbances based on the knowledge of the past course of events and, with hindsight, of the possible effects of future changes (both with respect to land use and to climate). Within the WG, the data requirements for a risk assessment will be collected and compared with the availability of useful statistics in Europe (spatial/temporal resolution of records of wind damage, insect damage etc).

WG4. Implementation of results

End-users of the suggested methods (experts in greenhouse gas budgets) will be involved in this WG in order to communicate upcoming reporting needs, recommendations for improvements, feedback on the relevance of the suggestions, and testing of suggested methods. The accounting concept will use existing information on European soils. The IPCC Good Practice Guidance presents a balanced view of available methods and approaches, but has not the intention of developing new methods. Moreover, the soon to be initiated discussions on post-2012 Kyoto reporting requirements will make amendments of existing reporting guidelines necessary. The Action aims at the Tier 3 level of the IPCC-GPG in order to use available information from many countries for the optimisation of the level for reporting of soil changes.

Several cycles of feedback between WG 1, 2, 3 and WG4 are foreseen.

WGs 1-3 expect to receive information from the experts of WG4 on the ongoing political process with respect to land use, land-use change and forestry. Suggestions for a specific form of land management with the objective of retaining GHG in soils can be in conflict with aspects of nature conservancy (protection of rare ecosystems, biodiversity issues). These topics need to be resolved early on in order to avoid unrealistic suggestions for adapted land management.

A second target group are students. The findings of the individual WGs will be produced in documents that are suitable for classroom use. The discussion in a teaching environment represents an external discussion platform and is a suitable learning example for policy-driven science in classrooms.

The implementation of the outcome of the Action is facilitated by the fact that several participants are lead- or co-authors of previous technical IPCC documents, who expect to be invited in future IPCC tasks as well. Moreover, several participants are in charge of national GHG reports. The Management Committee of the Action will insist that the progress of the Action is communicated to government representatives of participating countries who are in charge of GHG policy. Progress will also be communicated to NGOs such as IUFRO and IPS (International Peat Association) and this is facilitated by the fact that many Action members are working in NGOs groups or have strong links to them. The Action will be in close contact with SOMNet (http://www.rothamsted.bbsrc.ac.uk/aen/somnet/), as the coordinator of that network participates in the Action.

In addition to the tasks described for the working groups, the Action includes three integration activities:

European integration: Collection of information for hot spots across different types of land use and climatic regions.

Regional integration: Collection of information on the effect of land-use change and disturbance within a specific region.

Policy integration: Delivery of information to experts in national GHG reports. Evaluation of results of the Action in the context of reporting requirements.

E. ORGANISATION

A Management Committee (MC) including the elected chairperson, vice-chairperson, WG coordinators and representatives appointed by the Signatories of the Memorandum of Understanding (MoU) will be set up following the signing of the appointed numbers of signatories to the MoU. The MC will work out its rule of operation at its first formal meeting in accordance with existing COST regulations.

The partners will elect a chairperson and a vice-chairperson who will be responsible for coordinating activities and ensuring that the Action direction meets the overall objectives.

Each WG will elect a coordinator and a deputy who will take responsibility for the progress and the quality of the work within the WG. Either the coordinator or the deputy should be a young scientist. Overseeing the activities of each WG will be the responsibility of the MC. The chairperson, vice-chairperson and WG coordinators, together with advisers representing end-users, will form the Steering Committee. (Figure 1).

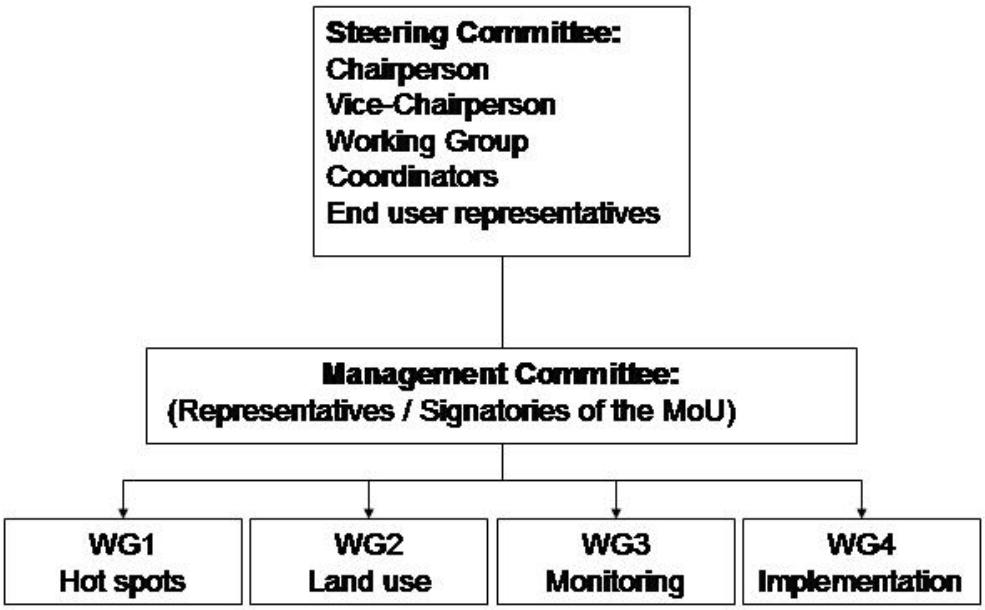

Figure 1. The organisational structure of the Action.

An inaugural MC meeting prior to the first annual workshop will elect coordinators for the WGs.

The chairperson, vice-chairperson and WG coordinators will form a Steering Committee to ensure collaboration between WGs and other national and international research groups. They will meet during the annual workshops. If needed, small group meetings will be organised. The Steering Committee will formulate several key topics for the up-coming meetings in order to ensure that the flow of information that is provided in joint meetings is indeed driven by the demands of the Action. After the meeting, a brief document on each of these key points (position papers) will be prepared by a designated expert .and be made available shortly after each meeting. The text will be reviewed by the Steering Committee and will be placed on the Action web site. Thereby, the current state of the COST Action with respect to deliverables is transparent at any time.

A web site for the Action will be set up. It will be used as a *communication platform* for participants, for communicating the aims and achievements of the Action to a wider scientific community and to ensure dissemination to other groups such as policy makers and stakeholders and the general public. The web site will contain information on the workshops so that those unable to attend can continue to participate with project activities. Material that has been created for *classroom use* will also be made available via the web site. Graduate students who have participated in the meetings will be invited to provide a summary of a selected suite of presented topics. These summaries will be edited in cooperation with a mature scientist and will be placed on the web site. By that it is expected to gain the attention of students and early stage researchers.

An additional outreach is to encourage students and early stage researchers at the institute hosting the meetings to actively participate. Gatherings within the Action will be thematically linked and with summer schools such as 'Experimental assessment of changes in soil organic matter pools in mountain forests' (sponsored by ESF, coordinated by Robert Jandl; http://bfw.ac.at/rz/bfwcms.web?dok=3346), where appropriate.

The liaison with already active COST Actions will be achieved by joint meetings. A close cooperation will be sought with COST 627 (grasslands), in order to give this type of land use the appropriate attention in WG2. One joint meeting is planned with COST E43 (harmonisation of national forest inventories). The Action will arrange its annual meeting as an open scientific meeting and will extend the invitation to the partners of the international programmes CarboEurope and NitroEurope. In order to attract an even wider audience, the Action plans to pursue joint meetings with the IUFRO Task Force 'Carbon Sequestration' and with the CarboEurope and NitroEurope networks.

The current status of the Action will also be represented in special sessions of the EuroSoil Congress 2008 (http://www.ecsss.net/congress.htm) and at meetings of the European Geophysical Union (EGU; http://www.copernicus.org/EGU/EGU.html) in order to seek scientific exchange with soil scientists that are not part of the Action.

F. TIMETABLE

The Action is planned for four years.

The WG meetings will be held in conjunction with national project meetings. For the joint open seminar in Year 3, speakers from outside the EU will be invited. See Table 1.

Table 1. Schedule of the Action

Year	*WG 1*	*WG 2*	*WG 3*	*WG 4*	*MC*
1	**Start up-Seminar**: agreement on working and specific tasks				Meeting
	Working Session	Working Session	Working Session	Working Session	
	Establishment of task groups	Establishment of task groups	Establishment of task groups	Establishment of task groups	
	Identification of interfaces between WGs				
2	Working Session	Working Session	Working Session	Working Session	Meeting
	Joint meeting of WG1, WG2 *Delivery of information of spatial extent of 'hot spots' and regions with specific disturbances; preliminary assessment of impact of land-use change on GHG sink/source strength of soils; report results to WG3*				
	Joint meeting of WG1, WG2 and WG3 *Delivery of (1) suggestions for modelling and monitoring of GHGs across disturbances and land use change; (2) assessment of data requirements and data availability for risk analysis for GHG retention/release from ecosystems; (3) report to policy stakeholders on full GHG accounting (across different forms of land use) and evaluation of feedback*				
3	Working Session	Working Session	Working Session	Working Session	Meeting
	Joint open international seminar: presentation of the progress in the cooperation between WGs / Feedback from political decision makers *Proposal for a meaningful baseline for soil changes; recommendation for a risk analysis system that can be operated with available data*				
4	Working Session	Working Session	Working Session	Working Session	Meeting
	Final joint workshop Presentation of deliverables *Reports, presentations, publications*				

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest:

Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Italy, Ireland, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

On the basis of national estimates provided by the representatives of these countries, the economic dimension of the activities to be carried out under the Action has been estimated, in 2005 prices, at approximately 50 million EUR.

This estimate is valid on the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

H. DISSEMINATION PLAN

The main objective of the Action is the improvement of the management of greenhouse gas emissions from European soils under different types of land use and in a particular disturbance regime, the identification of hot spots of greenhouse gas emissions from soils, the development of an advanced reporting concept across different types of land use and land-use changes.

The plan for disseminating of the knowledge addresses both the scientific community and the policy forum.

The Action addresses the following public:

- The scientific community by preparing a special issue of a scientific journal with a sufficiently broad scope (e.g. Geoderma/Elsevier) and by the maintenance of a web site that serves as a repository of presentations and reports. From the contents of the web site it will be possible to assess the progress of the Action and to contribute to its tasks.

- The participants of the Action, who are scientists themselves, will be encouraged to publish their results while making reference to the Action and to present their work at conferences (e.g. EuroSoil 2008, EGU).

- The scientific information will be specifically disseminated in the regions of interest. This means that reports of findings by WG1, which are oriented towards the audience in a specific region, will be produced.

- The specific demands of policy makers will be met in reports that point out the novel aspects of our GHG monitoring scheme. These reports will be available for the experts of the IPCC. (Note: Several participants of the Action are also IPCC authors). The management committee will foster the contact of the Action with government representatives who are in charge of GHG policy.

- The demands of specific user-groups (foresters, agriculturists, conservation biologists) can be satisfied with WG reports.

- Students and early stage researchers will be provided with lecture notes and presentations.

- Policy makers will be involved from the very beginning of the research process. They will be invited to attend all meetings of this COST Action.