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SUSTAINABILITY OF SOILS AND HARVESTING SYSTEMS: THE KEY ROLE OF THE FORESTRY INDUSTRY

Report of the workshop 2

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INTRODUCTION

Soil sustainability is an issue which has more effect locally than other forest functions, such as carbon storage, which have a global effect. Foresters have a determining effect on soil quality (in particular when felling trees and harvesting wood) which in turn affects the functioning and dynamics of forest stands.

Sustainable management of soils implies maintaining the soil fertility over time and preventing erosion, two widely recognized ecosystem services which should be given greater priority in decisions concerning natural resources in general and forest ecosystems in particular (TEEB, 2010).

In economic terms, forest soil has a “bare land value”, which is added to the value of the stand to estimate the value of the forest. According to the Faustmann's formula proposed in 1849 (Peyron and Maheut, 1999), the bare land value has a significant impact on the value of the forest and it is easy to understand the importance of sustainable qualitative and quantitative soil management. Although it can sometimes be difficult to quantify the costs and benefits linked to the sustainability of soil, it is nevertheless necessary to try to take them into account when taking decisions on forest management and harvesting. Economics can help to estimate these values based on the soil sustainability objectives of the various players involved. Taking account of economic aspects of environmental impacts related to soil management then gives a better understanding of the driving and limiting factors that may determine the acceptance of new practices in the field, by contributing to decision-making and communication tools for stakeholders.

A PARTICIPATORY WORKSHOP

Workshop 2, *Sustainability of soils and harvesting systems: the key role of the forestry industry*, set out to consider the attitudes of stakeholders towards sustainability of forest soils and whether this

could be improved when selecting and using harvesting systems and replanting methods, including soil preparation.

The introduction in the plenary session outlined the problems. This workshop began by presenting an economic point of view of the sustainability of soils, putting two questions to participants to start discussion: “What do you understand by *sustainability of soils*?” and “*How do you see this in practice*?” Participants were able to express their opinions which were frank and fruitful.

This was followed by presentations from three “practicing” forest operations giving feedback on their experience. The workshop ended with a lively, well-informed discussion between the eighteen participants, based on their concerns and varied experience in public and private forests. They work in consultancy and forest development, research into economics and ecology, higher education or local authorities (councilman from a forest commune), organization of regional natural parks, central government (forestry ministry), wood supplying companies for the pulp & paper industry and the energy sector, and forestry services (logging contractors).

This feedback was used as the basis for discussion on technical and organizational solutions that had already proved to be effective or that had failed to provide any new knowledge or promising avenues for the near future. Several issues were covered:

- Work organization, such as selecting the type of machinery and working methods to be used, preventing unnecessary passage of machines and compaction, coordination with soil preparation methods for replanting.
- Questions related to raising awareness, the organization and training of workers on good practices, for example, when should work stop, how should the wood be extracted and how should the various companies involved in the worksite be coordinated (typical case of felling and hauling).
- Economic aspects, in particular concerning who should be responsible for the costs of stopping operations in case of bad weather (machine idle time, shortage of stocks at downstream companies) and the indirect costs in the longer term (consequences of compaction and ruts in the forests, rehabilitation, etc.).

A summary of the presentations and discussions of this workshop is given below.

SUSTAINABILITY OF FOREST SOILS AS SEEN BY AN ECONOMIST

Soil can be considered as a non-renewable resource on which the impacts of management can be more or less irreversible and lead to a reduction in the future profitability of forest management. Forest soil is not just a support for wood production. Given the many intrinsic characteristics, the soil also serves as a support for a set of services provided by the forests, such as regulation services (carbon storage, water flows, etc.) and provisioning services for non-wood products (mushrooms, drinking water, venison, etc.). The value of the soil is, therefore, not only linked to the fact that it is an *input* for forest management: it is far more complex owing to the services provided to the whole of society, now and in the future.

The degradation of a soil can result from several simultaneous causes related to the growing demand for wood, in particular for fuel, to logistic constraints due to the conjuncture between just-in-time management and extreme weather events, and environmental change (climate change, atmospheric pollution). This can lead to different costs being incurred at the same time: private costs for forest owners (for example related to the loss in fertility of a property) and public costs for society (for example related to the erosion of a catchment area). The costs can also be classified depending on their temporal proximity to the causal factor: immediate costs or delayed costs. There are also the costs of preventive measures or rehabilitation.

The sustainability of soils is an essential part of sustainable forest management, more broadly of forest ecosystem management. The economic issues certainly help to raise awareness in the forestry industry but are not always sufficient to change practices. There are many challenges to be met to improve the organization of the industry and set up more efficient procedures, from marking the timber to be cut, selling it and delivering it to the factory. The sustainability of forest soils implies maintaining a level of production that is acceptable (or *sustainable*) for the owner while also taking account of the possible consequences on all the direct or indirect uses linked to the quality of the soil. This is a complex issue: the soil properties that cannot be manipulated must be conserved (see below) while minimizing the impacts, in particular those related to the wood harvesting systems. The sustainability of the soils requires the identification and quantification of the costs linked to the restoration of the soils as well as to their conservation. It also raises the question of the acceptance of the impact of harvesting.

CONCEPTIONS OF SOIL SUSTAINABILITY

The sustainability of soils was, in the general opinion of those taking part in the workshop, not an end in itself but one component of sustainable forest management, as defined in the Ministerial Conference on the Protection of Forests in Europe since: “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 fulfill, 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”.

The objectives for the sustainability of soils was considered to be highly variable: the emphasis placed on each soil sustainability criterion depends on the spatial scale and the periods of time considered, on the functions the soil required to provide in different situations and on the degree of acceptance of damage. In particular, the perception and acceptance of damage and, more broadly, the work undertaken in forests was raised. Particular reference was made to ruts, which are a source of annoyance to logging companies as well as to walkers because they make movement difficult or are visually unacceptable. This calls for discussion and communication between foresters and local authorities, users and forest-land owners. Talking about it does not resolve the problem but raises the issue is a step towards finding a solution. Ignoring the issue would only make sustainable forest management more difficult.

One final conclusion emerging from the discussions was that soil sustainability must also take account of economic aspects: sustainable forest management is based on the three functions of a forest and the economic function should not be masked. The question of damage to forest soils should be subject of economic analyses taking account of the profitability of timber production.

PRACTICES FOR SOIL SUSTAINABILITY

The replies given regarding the subject of *practical soil sustainability measures* could be divided into three groups.

Technical aspects. Attention was drawn to the need to distinguish between soil properties that could be manipulated by man (and which could be restored if damaged) and those that could not be manipulated (for which prevention measures must be taken). The practicality of technical and organizations solutions to be implemented should also be considered: although there are theoretical

methods, these would be too complex in real conditions (windfall, high risk of stock shortages, etc.). It should also be remembered that the selection of a harvesting system, i.e. the processes involved from felling timber to delivering the wood to the industrial site, is always a “decision subject to external constraints”, depending on many factors some of which might be outside the control of the harvesting company (length of timber required by the factory, characteristics of the stand, natural conditions of the land, infrastructure and distances concerned, machinery and human resources available, etc.).

Economic aspects. If the total value of the soils could be evaluated (which is not the case at the time although theoretical methods have been developed), this would provide a basis for decision-making by the timber business: without any quantitative data, taking decisions is at best arbitrary and at worst ideological.

Human or discussion aspects. It is necessary to put over a number of messages, the most important being that soil is not merely a support, as mentioned above. Another message is not to denigrate timber harvesting, in particular wood for fuel. Once a message has been selected, it would need to be communicated by appropriate means. On this subject, the feedback from the quarrying sector during the session was very encouraging: with the aim of preserving the top soil, techniques that were considered too demanding at the outset were finally put into practice, after much lobbying of the site managers and the provision of incentives.

THREE PRESENTATIONS OF FIELD EXPERIENCE

These three presentations provided a good illustration of the technical, human and economic considerations described above.

— The Comptoir des Bois de Brive (CBB), a subsidiary providing pulp logs for the International Paper group, is developing a decision-making tool to take account of risks from bad weather. Unlike the ADEME guide (2006) on “rational harvesting of forest residues” which considered soil sensitivity independently of the weather, the CBB is attempting to produce a dynamic map of the *instantaneous* sensitivity of soils to compaction, depending on recent meteorological conditions, in the west central France which is the main region supplying timber for the pulp factory in Saillat-sur-Vienne. The aim is to anticipate potential stock shortages due to bad weather and so avoid having to use haulage equipment on soil that has been made temporarily sensitive by rainfall – motor-manual felling being not problematic. The system takes account of the land profile, which affects the soil drainage. However, the developers come up against the problem of how to give an immediate assessment of how weather conditions (precipitation, wind, temperature), recent or forecast, would change the bearing capacity of the soils. Would it be possible to draw on existing methods developed elsewhere?

— The Research and Development department of the National Forests Office (ONF) has studied methods for preventing ruts (preventing compaction would be examined in a later stage). A review of existing techniques and recent innovations in Europe has been carried out. Contacts have been established with certain machinery manufacturers and field trials of several machines have been carried out. The technical solutions explored were known, such as using machinery being lighter and smaller than conventional machinery (but being also less effective), continuous tracks (photos 1 and 2, p. 145) and decks placed temporarily on the skid trails. They were effective but all increased costs and the National Forests Office raised the question of who would pay.

— The Forest Contractors Federation (FNEDT) has introduced several improvement measures such as good practices charters and the *Qualiterritoires* qualifications (<http://www.qualiterritoires.org>). These measures could be used by logging companies to take better account of the soil. However,



Photo 1. Hauling using a tracked tractor in the state forest of Abreschviller (Moselle) in 1950.

Photo:
Courtesy of Photothèque AgroParisTech –
centre de Nancy



Photo 2. Hauling using a tracked forwarder in the state forest of Der (Haute-Marne) in 2010.

Photo: Maryse Bigot

Tracked vehicles have come back into use in forests to provide better soil protection as weight for weight they exert less pressure on the ground than wheeled vehicles.

logging contractors have two other major challenges to face: on the one hand, gain recognition for the quality of their working practices, including higher prices, and, on the other, change the image of logging companies and timber harvesting which is somewhat tarnished.

COSTS

The discussions in this workshop revealed that there were already several ways of recovering the increased costs of measures to ensure soil sustainability but which could certainly be extended:

- Establishing long-term contracts between players, including foresters, to provide greater visibility for companies, mainly very small companies, in the future (improving opportunities for investment, limiting the financial risk, etc.).
- Increase the value of wood products by environmental labeling.
- Various ways of making companies more competitive, that have been known for a long time but which could be made to function more effectively.

RESEARCH SUBJECTS

Four domains were identified where science could help to improve the situation:

- Knowledge of the long-term impacts of mechanization on soil functions. The networks mentioned throughout REGEFOR 2013 would help to provide more knowledge in the future. They must be supported.
- Estimating the value of soils (see above).
- Change management in forest operations. Forestry is still closed to the ideas of sociology of organizations, which can offer many useful concepts, theories and measures.
- Collaboration between stakeholders, a subject much studied in management sciences and industrial ecology but, again, little known in the forestry/wood industry.

Some people see environmental protection merely as a source of constraints. However, forest soils, like other aspects of the environment, are essential for forest production. This simple truth put into perspective the efforts to make for sustainable management of forest soils.

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SUSTAINABILITY OF SOILS AND HARVESTING SYSTEMS: THE KEY ROLE OF THE FORESTRY INDUSTRY. Report of the workshop 2 (Abstract)

Workshop 2 *Sustainability of soils and harvesting systems: the key role of forest managers* was attended by eighteen people. It set out to explore the way in which the sustainability of forest soils was taken into account by the players in the forestry/wood industry, and how this could be improved during harvesting and replanting. There were three presentations of experience in the field. Some technical and organizational solutions had proved to be effective but others had failed. Avenues for progress were 1) forestry practices, 2) raising awareness, organization and training of all those involved in the industry and 3) taking account of both direct and indirect costs.
