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RESEARCH IN ECONOMICS AND RURAL SOCIOLOGY

French forest accounting:**An integrated tool for the assessment of goods and services produced by forests**

For society, the importance of the forest makes it necessary to assess the assets it represents, the goods and services it produces and the process and structuring of the sector. A regular integrated environmental and economic accounting system based on a specific methodology structures the information into a unique analysis tool to aid decision-making and assessment of public policies. The assessments made for France show that timber production is far from being the only source of profit linked to the forest. Carbon sequestration and recreational activities are some examples of the services that can be integrated into the accounts. Taking into account the non market functions of the French forest areas would, with the highest assumption, contribute to increasing five-fold the forest value limited to its function of wood supply.

At a time when the Stiglitz-Sen-Fitoussi commission on the measures of economic performances and social progress recommends that the physical indicators of environmental pressure be taken into account, the Integrated Environmental and Economic Accounting for Forestry (IEEAF) is an illustration of the way these concerns may be introduced into a sectoral accounting system. These accounts for forestry are a set of coherent statistical tables coordinated at European level by the European Communities office of statistics (EUROSTAT). They allow to grasp the spatial dimensions of the forest (accounting in surface-area), comparison of the annual level of harvested wood with the state of the resource (accounting in volume), integration of most of the goods and services produced by the sector (supply-use balance) and assessment of the carbon stored in the forest ecosystem (accounting in carbon). By their rigour, periodicity, international harmonization and thanks to the various indicators built (harvested wood rate, contribution to GDP etc.), the IEEAF can monitor the resources and activities linked to forests. They are a tool for economic analysis and assessment of

the consequences of the private or public decisions concerning the forest sector.

Accounts for an integrated representation of the goods and services produced by the forest

Accounts for the French forests are made by the laboratoire d'économie forestière of Nancy (LEF¹) in partnership with the main statistical bodies concerned by forestry (SOeS, IFN, SSP, INSEE²). Their elaboration is based on extensive work collecting, synthesizing and harmonizing data from various origins (table 1). The lack of some data is compensated for by the elaboration of original estimation methods or through additional surveys. Furthermore, the development of definitions and inventory and valuation methods involves regular consolidation of the methodology.

¹ Joint Research Unit INRA and Agroparistech-ENGREF

² SOeS: Department of environmental observation and statistics of the Ministry of the Environment.

IFN: National Forest Inventory.

SSP: Statistics and forecasting department of the Ministry of Agriculture.

Table 1: Main statistical sources by categories of activities

	Category	Sources		
		Domestic data		Foreign trade
		Physical	Monetary	Physical and monetary
Forest	Areas Volumes	IFN/LEF IFN/LEF	LEF/SAFER ONF/LEF	-
	Nonmarket or non-timber functions Carbon Recreation Preservation	IFN/INRA LEF IFN	LEF LEF	-
Harvesting	Round wood	SSP	Standing: ONF/LEF Harvested: MAP	Customs/SSP
First transformation	Veneer-sheets and plywood	FAO	INSEE	
	Sawn-wood	SSP		
	Wood chips, particles and residues	SSP		
Second transformation	Wood-based panels	UNECE/FAO		
	Wood pulp, paper, paperboard and paper waste	COPACEL FAO		
	Other products	SESSI		

FAO: Food and Agriculture Organization

IFN: National Forest Inventory

INSEE: French national institute of statistics and economic surveys

MAP: Ministry of agriculture and fishery

SAFER: French federation for the development of real estate and the rural area

SESSI: Department of industrial statistics

SSP: Statistics and forecasting department of the Ministry of agriculture and fishery

COPACEL: French union of paper, cardboard and cellulose manufacturers

A physical assessment of the goods and services provided by forests is usually based on the surveys conducted by professional or statistical bodies. Monetary assessment is based on the market prices if they exist (wood, small products, carbon...) or on the costs or expenses incurred (forest conservation, recreational activities...) when these values exist and are observable. When there is no information available, monetary assessment may be based on the construction of a hypothetical market. In this way, the value given to the protection of

biodiversity in the forest comes from a contingent valuation made by the LEF.

As well as updating the IFN data (frame 1) in order to respect the framework defined by Eurostat and compensate for the lack of information and harmonization, we developed original techniques for the calculation of an average value of French stands and the economic monitoring of the main goods and services throughout the sector.

Frame 1: Updating of IFN data

IFN is the main source of information for the evaluation of forestry assets in physical terms.

Before 2005, each French department used to be inventoried every 11 years on average. The data available at a given date did not reflect the real state of the forest. The LEF updated the data from those inventories in order to obtain an annual assessment of the state of French forests. For each department, the method consisted of linearly interpolating the data between two inventories and determining a general trend index of all the forest descriptors for national values.

From 2005, the implementation of a new inventory method by systematic spatial sampling will give us annual results over the whole territory, and ultimately, more direct assessments of harvested wood levels.

The value of stands

To assess the value of tree stands, Eurostat recommends using the stumpage value method. This approach is a simplification of the net present value, because it assumes that the discount rate is equal to the rate of natural growth. The only average price of harvested timber directly available is the one of the ONF (National Forestry Office) autumn sales: covering only public forests, it is partial and non-representative of the global harvest. Therefore, we implement a calculation method which consists in applying the average prices of ONF standing timber to global harvested wood (that is to say the total marketed harvesting and own consumption), differentiating the harvest structure by product and species. The result is a price per cubic meter, called the average harvesting price. We obtain the value of the global resource and flows by multiplying the stock of

standing timber by this estimation of the average crop price.

Monitoring forest goods and services

Monitoring of goods and services includes supply-use balances and a specific account for forestry and forest management (frame 2). These tables must be in accordance with the methodology of the National accounts drawn up by the INSEE while taking the specific features of forests into account. The IEEAF improve the assessment of the market and non market goods and services from the forest because they present finer results than the national accounts, and generate more precise indicators. For the paper industry in particular, pulp, paperboard (unprocessed and processed), and paper waste are set apart.

Frame 2: Supply-use balances

The use-resource balances are statements based on the equality between resources and uses. Resources (supply) are the goods and services produced and imported. Uses (demand) refer to the various uses of the supply: final or intermediate consumption, gross fixed capital formation, inventory-change, and exports. For the IEEAF, the LEF builds supply-use balances specific to the wood chain. To produce them, we disaggregate the usual INSEE accounts (level 60 of the European Statistical Classification of Economic Activities and level 5 (502 items) of the classification of products by activity (CPA)). The LEF also builds the equivalent in physical units. Thanks to this work we can precisely monitor the products within the wood-forestry sector and gain a better understanding of the issues related to its economy.

Timber is not the only source of value in the sector

Wood supply is the main market function of the forest. Wood is mainly sold standing. According to our estimates, the value of standing timber harvested yearly is close to a billion Euros, for an average 2004 price of 16€/m³ (table 2).³

Own-consumption timber (assumed to be fuelwood), the price of which is estimated at about 7.1€/m³, is taken into account in this estimate.

Therefore, in the harvested production, we integrate a non market use of the forest which weighs more than 30% in volume and 16% of the harvest value.

³ It is important to distinguish the value of the standing timber from the value of harvested timber. Standing timber is a forestry product, once harvested it becomes a logging product.

Table 2: Value of the timber harvest in 2004

	Harvest Million m3	Price of standing timber €/m ³	Value of harvested standing timber Million €
Hardwood timber	5.7	44.9	255
Coniferous timber	15.2	27.4	416
Pulp wood	11.7	7.2	84
Other marketed wood	2.8	7.1	20
Own-consumption wood	22.1	7.1	156
Total	57.5	16.1	931

SSP–ONF–LEF

To the 931 million Euros (M€) of harvested standing timber (table 2), we must add the valuation of the losses due to logging (93M€) in order to obtain the value of the harvest from the resource during the accounting period. In parallel, as the standing value of the natural growth of the

forest stock was assessed at 1,608 M€ (table 3: production of the forestry branch) in 2004, the global harvests represent 64% of the net production of standing timber. Therefore, the stock is rising.

Table 3: Wood sector production by branch in 2004 (extract from supply-use tables: in million €)

Products million €	Forestry and logging	Manufacture of wood products	Industry of pulp	Industry of paper	Total	Distribution of products
Standing timber (growingstock)	1 608				1 608	5%
Roundwood (harvested timber)	2 442				2 442	7%
Sawn wood and panels		4 702			4 702	13%
Other wood and wood- products		6 650			6 650	19%
Pulp			831		831	2%
Paperboard (unprocessed)				6 933	6 933	20%
Wood waste		95			95	0%
Paper waste				572	572	2%
Others (among which processed paper and paperboard)	1 167			10 475	11 669	33%
Total	5 217	11 447	831	17 980	35 475	100%
Distribution in branches	15%	32%	2%	51%	100%	

INSEE–Cinotti–ONF–LEF

How to read it: the ‘Woodworking’ branch produces, among others, 4702 M€ of sawn wood and panels

In addition to this wood production, the potential of non-wood forest products (herbs and medicinal plants, cork, picking or hunting products and so on) must not be neglected. For these products the rare information available comes from professional unions (Mediterranean Institute of cork, ONF etc.). They estimate their value at more than 100 M€ in 2003.

The global sector production (except for furniture, not considered by Eurostat) represents 35.5 billion € in 2004, only 15% of which comes from forestry and logging (table 3). Woodworking, with a higher added value, accounts for 32% of production while the paper industry weighs more than half with production around of 18 billion € in 2004.

Table 4: Annual carbon flows and value stored in forests

Unit: Millions tC	1981-1990	1991-1999	2000-2004
Initial stock	2061	2259	2393
Net average annual flow	20	15	13
<i>Including variation in surface areas</i>	6	4	7
<i>Including variation in volumes</i>	14	11	5
Final stock	2259	2393	2458
Average annual value (M€) at 62.33 €/tC (17 €/tCO₂)	-	-	805

IFN-LEF-INRA

The social and environmental role of the forest: growing importance

The forest also contributes to the major natural equilibriums (water, carbon, soils, biodiversity). These services, most of which are non market, are difficult to assess monetarily. However, we may determine some value indicators for some of them like carbon (frame 3), recreation and biodiversity.

Carbon sequestration: at the heart of the global warming issues

Forests directly contribute to the fight against

global warming through carbon sequestration and indirectly via artificial “sinks” (e.g. structural wood) or via biomass energy.

The variation in carbon stored in forests result from the variations in the wooded land and the volume of wood. Both types of flows are estimated by application of coefficients given by the CARBOFOR project (GICC 2004).

Over the 2000-2004 period, the annual value of carbon sequestration was around 800 M€, slightly down on the previous years, if the same price were applied (frame 3).

Frame 3: The valuation of carbon stocks in the forest environment

Since 01/01/2005, CO₂ has been the object of a European market. On this recent and partial market, the observed prices are quite variable. Moreover, it does not necessarily reflect the social value -uncertain and controversial- of the sequestered carbon in forests, that is to say the value of the damage linked to climate and avoided change thanks to the storage of one ton. We chose to keep the value attributed to the carbon tax by the French government in September 2009, i.e. 17 €/tCO₂. In practice, foresters are not paid for this service. However, this value is a good indicator of what society would be willing to pay to avoid emissions and store carbon, thus getting closer to the social value of carbon.

The forest as a recreational area: recreational value

The measurement of the forest’s recreational value is based on the travel cost method which consists of estimating the surplus of individuals⁴ who go into the forest for a recreational purpose on the basis of their travelling costs. The analysis of the results of the 2002 survey (Peyron *et al.*, 2002) showed that two thirds of French people declare

they are users of the forest for a recreational purpose (14 visits a year on average).

The individual surplus per visit comes to 22.61 € on average with large regional disparities (from 0 to 47€). Therefore, for France, the global surplus⁵ linked to recreation in forests would be close to 9 billion € per year (Garcia & Jacob, 2009).

⁴The difference between the value of use of a good or service (the utility they get from it) by an individual and the actual expense.

⁵ For each large forest region defined by the IFN, we determine the surplus by multiplying the individual surplus by the average number of visits and by the population going into forests. The surplus for France is obtained by adding together the regional surpluses.

Ecological functions

About one household in two accepts the idea of paying for biodiversity in French forests with an average contribution of 15.2€/household/year. Compared with the number of households on the territory, we would obtain a global annual willingness to pay of 364 M€ (Peyron *et al.*, 2002).

More than a quarter of French forests contribute to the combat against erosion or avalanches. As a minimum, we approach the value given to this service by the amount of the works planned for the maintenance of this function (restoration of mountain lands, fixing of coastal sand dunes...). These public expenses go up to 17.5 M€ in 2003 (MAP/IFN, 2005).

Last, the forest plays a role in the protection of the quality and quantity of the water resource. This service is only partially valued. The heterogeneousness of the operations to be taken into account makes it difficult to estimate the costs linked to this service. For example, in 2004, the maintenance of river banks and the management of water catchment perimeters cost the ONF 1.5 M€, while in 2005 the Rhône-Mediterranean-Corsica Water Agency itself spent 13 M€ on the maintenance of the riparian forests. Works are in progress to gain a better understanding of the value of this service at national level.

If we add together the various values mentioned - harvested timber (harvest): 2,442 M€; non-wood forest products: 100 M€; carbon storage: 805 M€; biodiversity: 364 M€; protection (water and others): 30 M€ and recreation: 8528 M€ - we obtain a global value of 12,270 M€. The wood supply function (marketed and non-marketed) would then represent 20% of the total.

Non-market functions which go well beyond the value of wood supply

The forest accounts draw up a physical and monetary balance sheet of the goods and services supplied by the forest ecosystem. Though the estimates presented are all expressed in monetary units, the variety of the methods used to determine them, the nature of the various estimates and the variable levels of uncertainty surrounding the figures make any attempts at comparison and aggregation difficult. The estimates presented here highlight the importance of the non-market functions of the French forest areas which, in the highest hypothesis, are five times greater in value than harvested timber.

Claire Montagné, Alexandra Niedzwiedz, Anne Stenger.

UMR356. Laboratoire d'Economie Forestière, F-Nancy

montagne@nancy-engref.inra.fr, niedzwiedz@nancy-engref.inra.fr, stenger@nancy-engref.inra.fr

Pour en savoir plus

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