Criterion summary

Criterion goals

Criterion 1 constitutes the base for monitoring sustainable forest management as it sets out to describe the state of surface area, timber and carbon resources in French forests.

The indicators under Criterion 1 monitor the issue of the **sustainability of forest management** . This is assessed in relation to variations over time of the wooded surface and growing stocks (actual drains are described under Criterion 3 which deals with economic functions of the forest).

Criterion 1 also gives information on the contribution of forest ecosystems in combating the greenhouse gas effect. Through their atmospheric CO_2 sequestration, the forests help to mitigate the effects of climate change.

Criterion 1 therefore relies on four major international indicators dealing with the wooded surface area (***1.1***), the volume of growing stock (***1.2***), the maturity of the resource (***1.3***) and the carbon stock (***1.4***).

Given the huge diversity of French forests and the variability of factors influencing its evolution (climate, relief, history, socio-economic contexts, etc.), it is necessary to put the resource management analysis into context for each region, species, diameter class (to analyze the maturity of the resource) and, depending on circumstances, ownership category, structure and age class (for even-aged stands). Criterion 1 has therefore been enriched with eight national indicators which have a total of no less than 29 tables of figures (without counting the illustrations taken from them). The list of the Criterion 1 indicators is given after this summary.

All the Criterion 1 indicators are calculated with the results collected under the national foresty inventory program (NFI) which has been conducted in France since 2012 within the *Institut national de l'information géographique et forestière* (IGN - National Institute of Geographic and Forestry Information).

Analysis

All indicators for the state of the French forest resource remain first and foremost marked by the **transition** process that started for more than a century, which features an increase in the wooded surface area[1] and expanding volume of wood per hectare[2]. This basic long-term phenomenon originates in the 19th century industrial revolution. The result throughout the 20th century was, firstly, **agricultural abandonment** and land being reclaimed by the forests and, secondly, **rural abandonment**, which when associated with the upsurge in fossil energies, triggered a continuous drop in coppicing for heating purposes.

As deforestation remains limited, the result is a forest surface area increasing at the same pace as agricultural abandonment, which varies tremendously in intensity and age depending on the regions. In addition, the lengthening of forest revolutions following the gradual abandoning of coppicing and coppicing-with-standards increases the average diameter of trees in French forests and therefore the volume of wood. The increased surface areas and volumes are nevertheless governed by two different processes that are neither synchronous nor always correlated spatially.

Forests are currently expanding throughout the country basically as natural growth, but they have also benefited from large afforestation campaigns, such as the one undertaken by the *Fonds forestier national* (FFN - National Forestry Fund), which helped to plant one million hectares with conifer stands (spruce, Douglas fir, Corsican pine) between 1947 and the end of the 1990s. In the period between 1990 and 2010, the forest surface are increased by two million hectares due to the afforestation of shrubland (***Indicator 1.1***).

1. IGN, 2013. A century of expansion of French forests, from the Daubrée statistic to the IGN forestry inventory. *L'IF*, 31, Saint-Mandé, 8 p., <http://inventaire-forestier.ign.fr/spip/IMG/pdf/IF31.pdf> (consulted on 19 January 2016).
2. NFI, 2011. Volume of growing stock in French forests: 650 million additional cubic meters in a quarter of a century. *L'IF*, 27, Nogent-sur-Vernisson, 12 p., <http://inventaire-forestier.ign.fr/spip/IMG/pdf/web_IF_evol-vol.pdf> (consulted on 19 January 2016).

The increased surface areas and average tree size both help to generate a significant rise in the growing stock in French forests, with a gain of 800 million cubic meters between 1981 and 2010 (***Indicator 1.2***). The 46% increase in standing stock would be even more without the storms in December 1999 and January 2009. The growing stock is currently increasing faster than that of the wooded surface area, as the new forests, which basically comprise naturally-growing, broadleaved species, are still immature and as yet little capitalized. Trees in fact only achieve their maximum growth in volume after several decades. The volume of growing stock reached 163 cubic meters per hectare on average in 2010, a rise of 25% in the previous thirty years.

The growth in the stock of forest biomass helps to mitigate the greenhouse gas effect by acting as a carbon pump. Forest trees have removed about 50 million tonnes of CO2 every year on average from the atmosphere in the last thirty years (***Indicator 1.4***).

This forest expansion alters most features of French forests in depth. In terms of **forest structure**, ***Indicator 1.1.3*** shows an increase in the surface area of high forest, a decline in coppicing and relative stability of mixed high forest-coppice, in conjunction with the new afforestation (growth and plantings) and the gradual conversion of coppices and former coppices-with-standards. The **composition of species** is also changing gradually. ***Indicator 1.2.2*** describes a French resource where the broadleaved species still dominate in volume (two-thirds in 2010), especially pioneering species like ash or birch or coppicing species like hornbeam, pedunculate oak or southern oaks. **Private forests** are increasingly contributing to the national growing stock, reaching 72% in 2010 (***Indicator 1.2***). The afforestation during the 20th century, and which is still seen today, has above all involved private properties (***Indicator 1.1***). The stands are still immature and growing. They are marked by smallest-diameter trees (***Indicator 1.3***). The share of large- and very large-diameter trees in the total forest resource is increasing (***Indicator 1.3***), in conjunction with the gradual maturing of new broadleaved forests and conifer plantings (***Indicator 1.3.1***) and the difficulty in enhancing the economic value of large-diameter conifers.

All these changes are sharply contrasting depending on **geographical location**. Given the socio-economic origin of the expansion, exogenous to the forest itself, the regions are affected differently and non-exactly synchronously, depending on whether the agricultural abandonment has been more or less extensive or more or less early. Thus, by the side of the traditional forest regions of the South-West and North-East, where the surface area and standing volume are stable and where tensions can come to light in supplying wood industries with timber from the most easily exploitable resources, significant stocks are appearing in new forest regions that are not yet highly exploited like the Centre Region, Burgundy and the north of the Massif Central.

The forest surface area continues to grow at a rate of close to 100,000 hectares per year (see ***Indicator 1.1.a***, source IGN) in the regions to the south of the Massif Central (Languedoc-Roussillon and Midi-Pyrénées), Corsica and Brittany. This is mainly spontaneous afforestation on former grazing land and heathland.

Conclusion

The increase in the growing stock appears to be still accelerating and achieving values that are unprecedented in modern times. This is inherent to the dynamics of the forest transition introduced previously and must not be interpreted automatically as the global result of a drop in logging levels. Although it is clear that the harvesting volume has remained globally stable in France over the last twenty years, including the 1999 and 2009 storms (see ***Indicator 3.2***), this national trend conceals stark regional contrasts in terms of felling rate (see Criterion 3). The detailed analysis of the level of logging in French forests remains difficult to assess, however, without distinguishing between the respective inputs of new and ancient forests, and even between old and new high forestsin the ancient ones. Researchers are currently looking into this, especially at IGN based on the results of the Daubrée survey of 1912.

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Criterion summary

Summary of observations

The future of forests and their services to society are weighed down by environmental changes. Although media concerns are changing and tend to focus on a specific threat in each era (acid rain in the 1980s, climate change today), it is important to comprehend the effects of environmental changes as a whole by monitoring dominant pressures applied to the forest ecosystem (fires, storms, droughts, phytosanitary damage, atmospheric pollution, herbivorous pressure, climate change, mechanical damage to soils, etc.) and by monitoring the state of health of the ecosystem (tree defoliation, timber production, chemical fertility and carbon stock in soils, biodiversity of the ecosystem, etc.).

The sustainable management indicators provide us with information on some of the **pressures** which are being applied to the forest ecosystems in metropolitan France:

– acidifying atmospheric pollutions have been dropping for twenty years and this trend has continued in the last five, mainly depositions of sulfur and also to a lesser extent of nitrogen (***Indicator 2.1***);
– attacks from pathogens have changed in contrasting fashion. The main outbreaks have ended in the last five years: the responsible insects have returned to an endemic state either at the end of a regular cycle (pine processionary caterpillar, larch leafroller) or by natural control of the phenomenon (conifer bark beetles). Conversely, the impacts from new, exotic agents spread (e.g. ash dieback and chestnut gall wasp, seen for the first time in France in 2008 and 2010 respectively) (***Indicator 2.4***);
– the major increase in removals by hunting for the past thirty years mirrors a rise in populations of wild ungulates (both in terms of geographical expansion and in demographic growth) and therefore an increasing pressure applied by these animals on the forest environment (***Indicator 2.4.1***);
– there was little damage caused by wind and fire during the 2009-2014 period compared with the two previous periods (1999 and 2009 storms, 2003 drought-heatwave) (***Indicator 2.4***).

The indicators also provide us with information on the **state** of health of the ecosystem:

– without massive dieback of forests, the state of health of trees has deteriorated on average in terms of changes in their defoliation in the 16 km x 16 km systematic grid (***Indicator 2.3***). This global trend shows huge variations, however, according to the species and geographical contexts. The state of health of trees has deteriorated especially in Mediterranean forests. Contrastingly, the sessile and pedunculated oaks show a remarkably stable national tendency. The temporal trend in tree defoliation is influenced by many factors and cannot be attributed categorically to the effect of a change in climate. Nevertheless, intensive monitoring in the Renecofor network highlights the dominant role of variations in water supply from one year to the next. The 2003 drought-heatwave marked the observation period especially and seems to be the starting point for the deterioration of defoliation of the majority of species.
– the first temporal repetition of soil sampling in the Renecofor network reveals several significant changes during the last fifteen years (***Indicator 2.2***). Despite a huge reduction in acidifying atmospheric pollutions, the most acid soils have continued to acidify, without nevertheless getting poorer in nutrient cations (the magnesium that trees were potentially lacking in the 1980s has increased particularly in exchangeable stocks). The continuing fertility of the most acid soils is due to the increase in their nutrient retention capacity, mainly through organic carbon sequestration. Forest soils have indeed behaved like carbon sinks, a positive factor with respect to the climate change mitigation challenges. Total nitrogen stocks in the soils have also taken a significant downwards turn: an in-depth analysis of the incoming and outgoing ecosystem flows will be needed to determine the causes of this change and its implications (especially for the nutrition of trees).

In addition, timber production and the biodiversity of forests, major parameters in the state of health of forests, are qualified by Indicator 3.1 and indicators under Criterion 4, respectively.

To summarize, twenty years' monitoring of forest ecosystem vitality indicators have revealed major trends. Some were expected, like the drop in acidifying pollutions, others less so like carbon sequestration in the soils or the lack of massive dieback of forest trees, despite the unfavorable climate events (1999 and 2009 storms, 2003 drought-heatwave) and other noted pressures (appearance of exotic parasites). We see however the state of deteriorated health for species in the Mediterranean region.

Outlook

The changes illustrate the advantage of observation devices and their continuity with respect to current environmental changes. They also call for additional measuring of the pressure factors and impacts for which no information has been received so far.

– It would be useful initially to be able to monitor the pressures applied by climate change and their impacts on the forest ecosystems. There are nevertheless several difficulties in defining such indicators despite the existence of numerous data sources[1]. Firstly, it is difficult to select indicators for synthetic and relevant pressures in terms of the multitude of bioclimatic variables influencing the forest ecosystems. Secondly, although climate change is likely to affect many parameters noted within the ecosystems, it is, however, difficult to distinguish between its potential impacts and the impacts of other influential factors (atmospheric pollutions, forestry management, changes in the biodiversity and biotic interactions, etc.). Add to this the fact that the series of observation data available for forests still do not go back long enough to characterize the climate (at least thirty years). Indicators from models could be envisaged to counteract these difficulties and used to extrapolate observation series in the long term (e.g. tree phenology) or assess the effects which can be attributed specifically to climate change. This would however require a major development and validation effort.

– Another potential additional measurement relates to the pressure applied by the wild ungulates. The major increase in their populations is a huge cause for concern among slviculturists, who currently have no indicators for monitoring the actual impacts of these animals on the forest environment. Depending on population levels, the effects can be positive (e.g. rise in the specific wealth by disseminating seeds and controlling the development of invasive species) and negative (e.g. through consumption of vegetation, drop in the diversity of the flora and, through a cascade effect, of invertebrates and birds[2]). Economically, strong pressure on forest stands being renewed can generate forest damage, i.e. affect the yield of these stands or even raise doubts over the forestry objective assigned by the managers[3]. Indicators to supplement the existing ones will therefore have to be developed to characterize the effect of wild ungulates on the forest environment and assess their impact on such major issues as wood supply, adapting stands to climate change, conservation of species and habitats and even human health.

– Settling of soils is a third example of a topic of interest that is currently lacking in the sustainable forest management indicators. The increase in the frequency and intensity of machinery moving through forests poses a huge risk for the deterioration of the physical fertility of soils: reduced drainage capacity, congestion phenomena, constraint to rooting and biological activity, etc. It is difficult to reverse such deterioration, which can have major impacts on the ability of forest stands to regenerate and withstand episodes of stress. Forest managers attempt to prevent the risks of deterioration by channeling machinery movements onto specific tracks (partitions) and trying to restrict logging to periods when the soil can bear the load[4]. Nevertheless, there is a shortage of indicators on the topic, mainly through lack of a system for monitoring the state of soil settlement.

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2. Allombert S., Stockton S., Martin J.L., 2005. A natural experiment on the impact of overabundant deer on forest invertebrates. *Conservation Biology*, 19, 1917-1929.
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Criterion overview

Criterion goals

This criterion aims to assess the quantity and value of the produced goods and marketed services as well as to make sure that these productions are sustainable using multipurpose management.

The information compiled encompasses highly-contrasting local situations in terms of forest types, forest management (Aquitaine forests, Mediterranean forests, etc.) and of ownership.

The indicators proposed focus on matching the available resource and the annual timber harvest (***3.1***), the ease of access to the resource for logging purposes (***3.1.1***), the creation of value from marketing timber and non-timber resources and forest services (***3.2, 3.3, 3.4***) and the existence of sustainable management documents which ensure steady production of goods and services, forest regeneration and smooth functioning of the forest ecosystem (***3.5***).

Analysis

On average, 50% of the net timber production was felled in 2010 (mean year). The felling rate varies between regions and species: the felling rate of broadleaved species is highest (more than 60%) in the North and East of France whilst the rate for conifers is more than 70% in Alsace, Picardy and Franche-Comté and over 100% in Aquitaine. Conversely, felling rates are far lower in the South-East and Corsica. These globally low felling rates go hand-in-hand with a large increase in volume per hectare over the last thirty years. These capitalizations are the result of an increase in productivity per hectare, combined with expanding areas and a shortfall in fellings and stand renewal.

The forest logging potential reveals the technical and financial brakes on full mobilization of the available wood resources. About 60% of French forests (in surface and in volume) is easily accessible for timber harvest. Nevertheless, to the accessibility varies widely between regions, as reflected by the intensity and frequency of fellings.

An estimated 62 million cubic meters of timber were harvested in total in 2013, a level close to the annual average of the last twenty years, with the exception of 80 million cubic meters harvested after the December 1999 storms. Of the 62 million cubic meters harvested in 2014, 38 million cubic meters were marketed for a value of 1.8 billion euros, i.e. €49/m^3on average. Nearly half of the harvested volume is subject to sustainable management certification.

Due to their diversity, the multiplicity of players and the lack of systematic statistical monitoring, it is far more difficult to assess the harvest and marketing of non-timber forest products and the production of forest services. It goes without saying that non-timber products remain a primordial issue in sustainable development. Not only do they generate additional – sometimes substantial – revenue for the managers or other players in the sector, they also make a substantial contribution to regional development and maintaining landscapes and forest spaces. Their multiplicity illustrates the variety of goods and services provided by multipurpose forest management. Although most of the non-timber goods and services remain non-commercial (biodiversity, recreation, carbon storage, water quality preservation, etc.) – see Criterion 6 –, some can be marketed and therefore have a commercial value. This is especially true of venison, cork, truffles, forest seedlings and seeds, honey, Christmas trees and hunting licenses which generate a global commercial value of several tens of millions of euros every year.

Lastly, the total surface area of French forests with an approved sustainable management document accounts in 2014 for more than 48% of the wooded area in France. There is an overall upward trend over the period.

Overall, French forest management seems to ensure the sustainability of forest productions: the forests are fairly accessible, the felling rate remains lower than the biological production, revenues from marketing timber as well as other products and services are globally on the up, the surface areas subject to sustainable management are increasing.

However, the performance of the French forest management must be analysed more broadly: it is important to maintain non-commercial forest functions (see especially Criteria 4 and 6), to monitor the health of forest ecosystems (see Criterion 2) and to ensure the survival of the forest (see Criterion 1) whilst all the time seeking to optimize the timber harvest. Over-logging may well be prejudicial but under-logging is not necessarily a good idea either, as it deprives society of a renewable resource (material and energy) which could help improve the trade balance, employment and environmental performance.

Several factors contribute to limiting logging of the available resource. In a context of growing international competition, poorly-controlled mobilization costs can discourage from harvesting in certain forests. Thus, apart from the fragmentation and growth in logging costs, the proportion of forests (and growing stock) which are less accessible increases and the logging rates drop quickly with the difficulties. At the same time, the French and European forest sector is still very out-of-step with successful promotion of the broadleaved resource which is predominant in France. Thus, less logging takes place in broadleaved forests on average than in conifer forests and the resource increases steadily. Conifer forests are most in demand, except in difficult logging conditions (mountains). Lastly, the value creation distribution changes to the detriment of large trees due to a lack of suitable industrial tools in the country.

These observations are more or less acute according to the regional contexts, the species and types of timber, which justifies continuing reflections reconciling national interests and specific local features in line with the challenges and characteristics of the forests (region, massif, etc.).

Conclusion

The majority of the results presented in this criterion come from proven sources. However, their robustness can differ: the data are sometimes generalized from small samples, aggregated from varied or partial sources and methods, expert estimates, etc. (see Indicator 3.3 for example). Thus, despite the care and rigor in drawing up these sustainable management indicators (method exactness, presentation of confidence intervals, etc.), they must be handled and interpreted with care, mainly and perhaps above all when making international comparisons.

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Criterion summary

The forest ecosystem is a complex set of species interacting with each other and with their environment. Sustainable forest management protects the integrity of the ecosystem and the various components of the biodiversity (genetic diversity, specific diversity, functional diversity and diversity of ecosystems) for the smooth operation of the ecosystem.

Certain indicators in Criterion 4 provide information directly on the **state and changes of part of the forest biodiversity** (direct indicators).

- Of the trees, first and foremost. Metropolitan French forests have 194 species of trees grouped in 66 forest species, including 58% broadleaved species and 42% conifers. The number of species is stable and there are no records of indigenous forest trees being extinct. Three species, however, are considered threatened nationally among the four species assessed in the *National Red List* (***Indicator 4.8***). The genetic diversity of trees is known for being more extensive than that of other animal or plant species. In metropolitan France, experts consider it to be stable (the current indicators for Criterion 4 cannot assess this aspect). The local wealth of forest species is virtually five species on 20 ares (***Indicator 4.1***) and tends to increase regardless of the type of stand (broadleaved or conifer). Similarly, since 2006-2009, the wealthiest stands (seven species and more) tend to increase in surface area, regardless of the type of stand. The mix rate, conveyed by the proportion of main species (***Indicator 4.1.1***), is low and without significant change in the conifer stands (their main species accounts on average for 80% of the abundance). It is higher and growing in the broadleaved stands (despite the lack of notable trend towards diversification for the large species – beech and pedunculate and sessile oak). The current situation seems favorable and is improving in the broadleaved stands. In comparison, the mix rate in the stands of main conifer or exotic species remains low and from this point of view, there is no sign that the change favors the biodiversity especially
- Of the other species, subsequently. The state and changes in the forest biodiversity are still little known: forest species are only listed for a few taxonomic groups and are missing for groups making a major contribution to the diversity of forest species (saproxylic organisms, insects, fungi, bryophytes, lichens, micro- and meso-fauna in the soil, etc.). The proportion of threatened forest species (***Indicator 4.8***) is assessed partially for a few taxonomic groups on the basis of *National Red Lists.* The number of threatened species among birds, mammals, amphibians and reptiles, the only groups with full data available, is 17%, 7% and 8% of species respectively in 2015. It is impossible to comment on the changes in Indicator 4.8, as the successive editions of the SMI have been based on different lists to assess the forest nature of species.

Other indicators under Criterion 4 provide information on factors likely to influence the forest biodiversity, through available habitats which dictate the presence of forest species or certain ecotypes (indirect indicators).

- The forest areas and therefore the forest habitats are growing (***Indicator 1.1***), basically through natural growth.
- The metropolitan forests are mainly semi-natural (82% of the total forest area – ***Indicator 4.3***) and result from natural expansion or regeneration (76% of production areas – ***Indicator 4.2***): this encourages the diversity of forest species and the genetic diversity of stands. There is no noteworthy national trend towards increased pressure on the biodiversity through an increase in artificial regeneration.
- The introduced species (***Indicator 4.4***) have to be watched over for risks of genetic pollution and hybridization of nearby indigenous species. Only a small proportion of forest areas (7%) falls under stands where the main species is introduced.
- The diversity of forest species is linked strongly to the old stages. An estimated two-thirds of forest species depend on forest stages beyond the logging age, with a wealth of old and large trees. Silviculture tends logically to reduce the proportion of these habitats in logged forests, combined with the dimension of timber with market value. ***Indicator 4.3.1*** shows that there are few high forest surface areas with very old trees in forests available for wood supply. Nevertheless, the increased volumes of growing stock, noted by the Criterion 1 indicators, also involve the large and very large trees (***Indicator 1.3***) which are more likely to offer micro-habitats than the small and medium-sized trees;
- Deadwood (***Indicator 4.5***) is known for sheltering a quarter of the forest biodiversity in temperate forests: its availability and continuity over space and time are decisive factors for the biodiversity. On average, our forests have nearly 17 m^3/ha lying deadwood and 6 m^3/ha standing dead roundwood

(values stable since the 2010 edition), but more than 60% of these volumes are made up of timber less than 20 cm in diameter; deadwood of more than 25 cm in diameter accounts for 5 m^3/ha lying and 4.5 m^3/ha standing. Improving the balance in the volume distribution per diameter class would be a good idea in terms of the biodiversity. The volume distribution of lying deadwood per decomposition class is more balanced, which encourages the saproxylic biodiversity. Lastly, there are significant regional disparities and some large lowland forests show lower-than-average deadwood levels.

– The large majority of forest areas belong to vast forest massifs (68% of surface areas are part of massifs covering more than 100,000 ha, only 9% are in massifs of less than 500 ha): the situation is globally favorable to the forest species mobile enough to cross 200 m spaces free of large infrastructures between two stands (definition of massif retained for Indicator 4.7). Despite the changes in method, ***Indicator 4.7*** suggests a tendency towards aggregation rather than fragmentation of forest massifs.

The forest policy for biodiversity is firstly, to encourage the inclusion of conservation of the biodiversity in current forest management and, secondly, to create networks of protected areas or those known as an advantage for the biodiversity.

Thus, the national forest genetic resource conservation policy (***Indicator 4.6***) relies on:

– *in* and *ex situ* conservation networks of species, which were constructed from 1986 onwards and continue to be added to regularly: the National Register of Basic Material includes 98 entities representative of the intraspecific diversity of forest trees at national level, with the aim of conserving the genetic resources and their dynamics and limiting the risks of alteration of indigenous resources by introducing inappropriate planting material. The *in situ* networks of conservation units have added 21 conservation units (+ 29%) since 2010. The *ex situ* conservation collections are updated regularly and were supplemented in 2014 with a new Salzmann pine collection.
– raising awareness to taking genetic diversity into account in the current management and in the protected area networks.

This goes beyond just genetic diversity: the protected forest areas (***Indicator 4.9***), with protecting the biodiversity as their main goal cover, in 2015, less than 1% of the forest area for class 1.2 of the Ministerial Conference for the Protection of Forests in Europe (MCPFE) (minimum intervention) and about 25% for MCPFE class 1.3 (active biodiversity management). For species linked to the minimum intervention areas (forest specialists, species dependent on deadwood, etc.), the surface areas with long-term protection status are very small compared with the total forest area; this justifies linking to other measures for taking the biodiversity into account which are less restrictive but over wider areas, for example the measures taken to set up belts of old tree and senescent tree blocks. Areas where the goal is to protect landscapes and natural elements (class 2) cover nearly a quarter of the national forest area, but these status fall more under the multi-functional management directed towards preserving the landscape and natural elements than conserving the biodiversity (regional nature parks, national park surrounding areas, biosphere reserves, etc.).

Conclusion

Although the Indicators for the *Sustainable Management of Metropolitan French Forests* are tending globally towards the protection of the forest biodiversity, the assessment proposed by the current indicators under Criterion 4 is partial and fundamentally indirect. It could usefully be supplemented by introducing national direct taxonomic monitoring of the forest biodiversity as well as developing other existing data (temporal abundance monitoring of common birds by the *National Natural History Museum* and forest inventory data from the *National Institute of Geographic and Forestry Information*).

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Criterion summary

Criterion goals

Sustainable management Criterion 5 focuses on the protective functions of forests. Forests, by their very presence and operation, protect the natural resources within them, especially the soils and water which are the foundation of their functioning. Thus, the land protection of forests protects by definition the functions of the ecosystem. The protection level provided by forests is even clearer when they are used to protect human interests (protection of people, infrastructures, crops, etc.) against natural risks (avalanche, erosion, falling blocks, landslides, etc.). Criterion 5 focuses on all the protective functions provided by forests.

Analysis

Some forests set protection as a priority management objective. This is true of forests with surface areas stated in Indicator **5.1**. Given the non-availability of all potentially relevant data, Table 5.1.a includes only forests governed by special protection status (protection forests, forests in nature or coastal areas covered by protection agencies, forests within the drinking water catchment or mountain restoration perimeters).

The 350,000 hectares of forests dedicated to protection are therefore estimated by default: for example, no surface area of non-State-owned forests within a drinking water catchment perimeter is counted despite falling directly under this Indicator. In addition, a certain number of forests have a protection management objective without having a special legal status, but no statistics are available on this topic. For example, some State-owned forests outside mountain land restoration perimeters also play a major protective role. Then, without it being a priority management objective, forests all help to protect ecosystem functions by their very nature (recycling of minerals, absorption of carbonic gas, protection of the water quality, carbon storage, etc.) and to protect against natural risks (soil erosion through runoff, leaching, desertification, etc.).

Outlook

It could be interesting to acquire some information which could potentially feed new indicators: forest areas sensitive to fires and affected by the forest defenses against fire (raging or repeated fires which damage soils and ecosystems), forest areas with soils especially vulnerable to erosion, link between the forest canopy and the quality of water courses, etc.

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Criterion summary

Criterion goals

Criterion 6 – "socio-economic functions of forests" – supplements the Criterion 3 indicators on the productive function of forest by describing the economic and social benefits of forest spaces enjoyed by society. These benefits extend from the production and consumption of the raw material to the protection services, the well-being of populations and the development of rural regions.

This is therefore the most heterogeneous criterion. It counts fifteen indicators which provide information on a variety of topics, from the structure of the forest ownership to the forest's cultural and spiritual values via employment, health and training, economic performance of the forest sector, integration of forests with the regions, certification, access to forests for recreational purposes, etc. It is proposed to group indicators into four themes to give the information in this criterion some semblance of order: humans and forest regions (6 A), economic characteristics of the French forestry sector (6 B), investments and efforts for ecological or environmental purposes (6 C) and cultural, social and spiritual needs and values (6 D).

Analysis

6.A. Humans and forest regions

The 16 million odd hectares of French forests are territories marked by Man and his intervention. The information under Criteria 1 and 3 shows how Man has fashioned the forest through management and what benefits he gains from it, but now Criterion 6 provides details on the men who fashion the forests and process the timber and how they incorporate the forestry problem into the problems of development and sustainable management of regions through the following indicators:

6.1. Structure of the forest ownership

6.1.2. Training in the forestry sector,

6.5. Jobs in the forest-timber sector

6.6. Occupational health and safety in the forestry sector,

6.1.1. Integration of forests in local initiatives,

6.1.3. Voluntary sustainable management certification initiatives

The management goals and methods change according to whether the forest is publicly or privately owned, the size of the holding and the management operators (***Indicator 6.1***). These elements influence the timber mobilization capitalization capacity and the spatial organization of stands.

Three quarters of French forests are privately owned and one quarter publicly owned (municipalities and other communities, State). In 2012, there were 3.3 million owners for the 10.4 million hectares of private forests. Those owning 25 hectares or more hold slightly less than half the surface areas and account for just 2% of owners. In 2014, the 17,000 "public forest owners" shared 4.6 million hectares (for 37% State-owned). Public forests are mainly large (several hundred hectares on average against a few hectares only as private forest).

Proof of the appeal of the forestry sector and the sensitivity of players (owners and elected representatives) to sustainable management, between 2010 and 2014, training (***Indicator 6.1.2***) has tended to rise both in terms of diploma and non-diploma courses for owners; however, initial training courses are showing a slight drop in graduates.

At the same time, silviculture and logging provide almost thirty thousand full time equivalent jobs (***Indicator 6.5***). Despite the downward trend of employment in silviculture and logging in the period analyzed, it remains fairly stable, at around 14%, in the timber sector as a whole.

Mirroring the better working conditions, the work accident frequency rate in the forestry sector (***Indicator 6.6***) has been improving steadily since 2002. All the sectors are showing a downward trend and although logging has traditionally been the most risky activity, clear progress has been made as the accident frequency rate per million hours worked in this activity is now at the same level as for silviculture.

Forest regions are at the heart of rural area development and organization, testifying especially to the development of massif development plans (390 plans for 930,000 owners involved and about 2.9 million hectares) and territorial forest charters (140 charters in 6,800 municipalities for a forest area of 5 million hectares of which 68% is privately owned) (***Indicator 6.6.1***). Sustainable forestry dynamics within territories are also expressed through expanding certification (***Indicator 6.1.3***): over half the national forest areas are certified for their sustainable management, the guarantee of environmentally-friendly, socially beneficial and economically viable management.

Forests make a major contribution to rural economies, to the living environment and well-being of populations in the rural areas. Many situations encountered in French forests can be sources of wealth and diversity, mainly at the scale of landscapes, the diversity of stands, habitats and management (or non-management) methods; but they can also generate economic (timber mobilization costs, owner incentives, etc.) or ecological (fragmented habitats) difficulties.

6.B. Economic characteristics of the French forestry sector

Processed forest products are sources of trade and create value for the French economy. This section of Criterion 6 sets out a few macro-economic indicators of the forestry sector that can replace value within the French economy:

6.2. Formation of the added value of the forest-timber-paper-furniture sector,

6.3. Distribution of the added value of the forest-timber-paper-furniture sector,

6.7. Timber consumption

6.8. Imports and exports.

The added value created by the forest and timber activity is around 12 billion euros in 2012 (all sectors together, including over 18% for silviculture and logging). Overall, the contribution of the sector to the national wealth (share of the gross domestic product) is showing a downward trend (scarcely more than 0.5% in 2012 against nearly 1% in 1999) (***Indicator 6.2***). The gross logging surplus in the timber sector, which includes the profitability of the sector's production system, is around 3 billion euros every year, including over a billion for the silviculture and logging sector (***Indicator 6.3***).

An analysis of the apparent consumption in volume (production + imports – exports) and international trade in both volume and value (***Indicators 6.7 and 6.8***) indicates that France is a net importer of many products, mainly processed products with high added value. The trade balance in 2014 shows a deficit of 6.8 million cubic meters of roundwood equivalent and 4,497 million euros 2014, i.e. more than 10% of the global French foreign trade deficit (for 0.59% of the gross domestic product).

The macro-economic indicators are used to assess the economic vitality of a sector and its significance in the domestic economy. Although the silviculture and logging data appear to confirm the dynamics of forests, forestry workers and regions, the overall sector performances must be tempered due to lesser performances of other timber processing sectors.

6.C. Ecological or environmental actions

Although Criteria 1, 2 and 4 in particular have indicators reflecting the state of French forests and the pressures facing them, the indicators in this section of Criterion 6 provide (partial) information on the potential responses by society to certain environmental problems:

6.4. State expenditure on forests

6.7.1. Recycling and salvage,

6.9. Fuelwood.

Major public expenditure (***Indicator 6.4***) is granted to support sustainable forest management (annual figures of 140 million euros for non-State-owned public forests and 80 million for private forest management). Added to this are a variety of general interest missions fulfilled by the forests with human support (169 million euros for preventing and fighting fires, restoring the forest canopy after storms and conservation of soils and the biodiversity). Lastly, all the resources for expanding knowledge of forest ecosystems are more difficult to assess but are probably in the order of 100 to 200 million euros (on-going monitoring of resources and research means).

At the same time, public policies encourage the recycling and salvage of wood products and the use of renewable energy sources such as wood (***Indicators 6.7.1*** and ***6.9***). Thus, the sawmill by-products take on increasingly significant economic and ecological importance; they are no longer considered waste but as raw material for the crushing operations and energy production. Similarly, the main raw material used in the paper and paperboard industry is still (and this is consolidating in 2014) recycled paper and paperboard. In addition, the 46 million cubic meters of wood and by-products used for energy purposes account for 4% of the total primary energy consumed in 2013 and 47% of the renewable energy.

6.D. Cultural, social and spiritual needs and values

Lastly, Criterion 6 measures part of the social benefits which Man gains from forests through two indicators:

6.10. Public access to the forests,

6.11. Forests with cultural or spiritual value.

Opening forest spaces to the general public is a social issue of prime importance (***Indicator 6.10***). The metropolitan forest area counted in number of inhabitants is 0.26 hectare. More than half French people say that they go to the forest for recreational pursuits at least once a year. Public access is part of the missions and goals of public forests, but a large proportion of private forests is also open to the public, as 85% of owners say that they welcome visitors to their forests, i.e. nearly three quarters of private forest areas.

The cultural or spiritual value of forests is without doubt very important for the populations but also very difficult to measure (***Indicator 6.11***). Forest sites with strong cultural or symbolic value include classified sites, arboretums in public forests, biosphere reserves, world heritage sites, unusual trees and populations, peri-urban protection forests and *forêts d'exception (exceptional forests)* in State-owned forests.

Conclusion

The very actions of forest owners and managers provide a multitude of economic, social and environmental benefits. The most obvious are – perhaps – what society gains from timber production and timber processing industries. These values can be measured fairly easily, but are always partially limited by difficulties in separating out the proportion of value linked to the timber or the forests in activity sub-sectors or indirect fallout in terms of creating value or jobs, for example. But despite it being linked without question to the market mechanisms and formal economy, the forest cannot be reduced to this trade component alone. History and reason show that the forest have always been subject to complex interactions with the environment, regions and populations. Productions other than timber, tourist activity and ecological considerations, although difficult to measure, play a full role in the sustainable management of French forests.

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