

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 CO₂ 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 forestry 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 area¹ and expanding volume of wood per hectare². 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-withstandards 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 area 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 forests in the ancient ones. Researchers are currently looking into this, especially at IGN based on the results of the Daubrée survey of 1912.