A SYSTEMATIC NATIONWIDE INVENTORY

On the whole French metropolitan territory

IGN
INSTITUT NATIONAL
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ET FORESTIÈRE

Since 2005, the inventory has used a systematic survey covering all of mainland France. This methodology is used on other countries, such as Sweden, Norway, the United-States or Finland. Its main advantage is to be more flexible and easier to manipulate according to different territorial subdivisions and many purposes. Thereby accurate national and regional results are produced by aggregation of data taken from the last 5 annual campaigns.

AN OPTIMIZED SAMPLING

Each year a **representative sample** of the global territory is visited. It is combinable with the ones of the previous years, in order to produce well-founded results on several annual samples, according to the **principle of the sliding-window**. Thus, standard results are based on 5 successive years and give estimations for the median year within the window.

The forest inventory is based on a **1 km-square unit grid**, established to create ten different annual samples.
This 10-year grid is split into two 5-year subsets: the annual fractions are juxtaposed, so that the fraction 1 of the first 5-year cycle is next to the fraction 1 of the second one, and so on (figure 1).

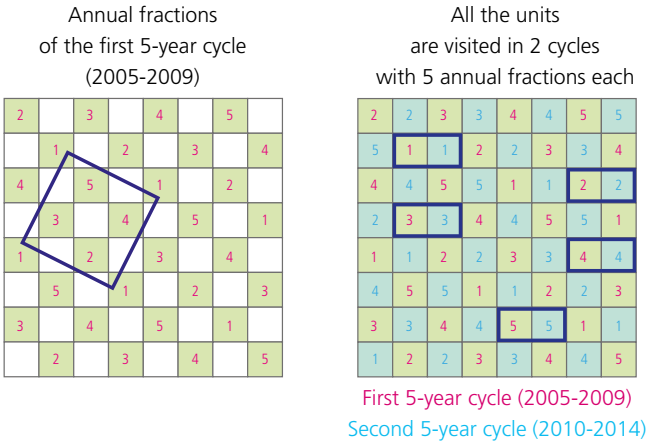


Figure 1: Inventory grid

Thus, a 5-part grid made of **rectangular links of 2 km²** appears (figure 1, grid 2), which allows to optimize the logistics between the 'first visit' and the 'second visit' points. Since 2010 the sample strategy is composed of **points systematically revisited 5 years after the first visit**.

In order to limit the data collection cost, the French territory has been divided into **different areas** in which the sampling density of the points can be divided by two or lead to a sampling optimization (figure 2).
For instance:

- Homogeneous forest areas, such as the massif of the Landes or the pubescent oak groves in the south-west of France;
- Garrigue or maquis forests, with low interest for wood production;
- Mountain forests (altitude > 1200 m and slope > 30% or altitude > 1700 m);
- Poplar groves areas with a high probability of presence of poplar groves.

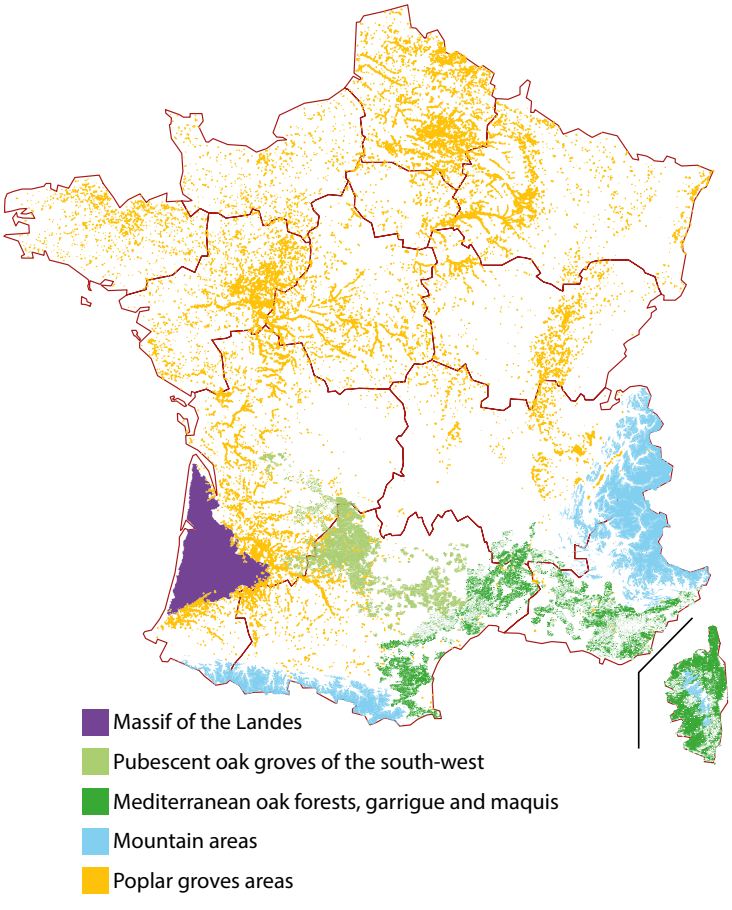


Figure 2: Divisions of the metropolitan territory for the optimization of the sampling

A DOUBLE AND ANNUAL PUNCTUAL PHOTO-INTERPRETATION

The first statistical inventory phase done each year is **punctual photo-interpretation**. Pieces of information about the **land cover** (close forest, open forest, moor, etc.), its **use** (agricultural, public welcoming, wood production, etc.) and the size of the wooded formations are extracted from the departmental orthophotography of reference (BD ORTHO® IRC), within a 25-meter radius plot around the inventory points (figure 3).

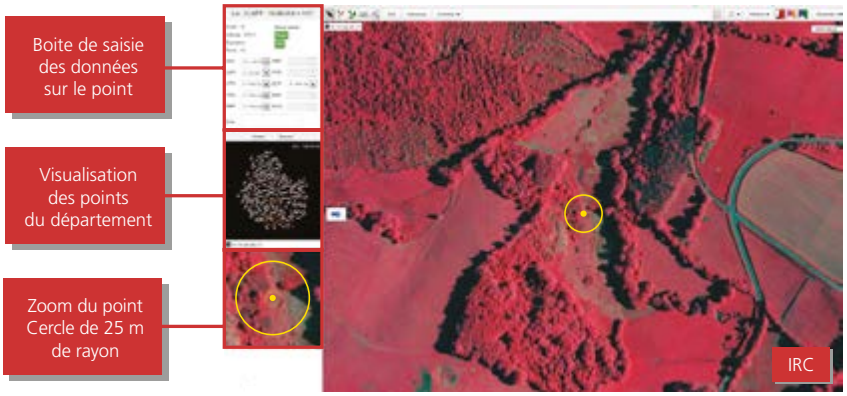


Figure 3 : Capture d'écran de l'application de photo-interprétation ponctuelle de la campagne 2018 (Nièvre)

The punctual photo-interpretation is made of two different sampling data sets, for a homogeneous photo-interpretation work: a first one of new points, composed of points photo-interpreted for the first time, and a second one of re-photo-interpreted points, composed of points photo-interpreted 5 years ago. In their workshops, photo-interpreters analyze more than 100 000 points each year.

EXHAUSTIVE FIELD MEASUREMENTS

The second phase of this statistical inventory consists in analyzing a **subsample** among the first-phase points: wooded areas and moors are inventoried in the field (which represent approximately 7 000 points visited every year), while agricultural and non-productive areas are not. During the fieldwork, observations and measurements (figure 4) on **the environment and the vegetation** are made on plots around the points, in order to get several dozens of descriptive and quantitative characteristics, about the forest stand, the vegetation and the site conditions (slope, exposition, soil, etc.). Measurements on the trees (such as height, diameter, growth increment, age, etc.) are also taken.

The size of the circular plots is optimized according to the trees diameter, in order to save time during the data collection (for instance, small trees (diameter < 7.5 cm), which are usually in a higher number, are measured on a smaller circular plot) and for the floristic survey.

Lying deadwood data are as well collected. A 12-meter transect, centered on the plot, is drawn and each piece of lying deadwood intersecting it is inventoried. The name of the species, the diameter of the wood piece and its decomposition state are collected. Moreover a forest habitats monitoring has been laid on, thanks to keys divided by biogeographic area or main ecological region. It is based on ecological and floristic indicators.

Because of the short distance between the links of the n and n-5 samples, the visit of the points of a new sample n allows the field operators to **come back on the points** of the n-5 sample (which represents more than 7 000 points per year). Since 2015 most of the information are measured again. This return gives a precise and reliable estimation of the **forest evolution (flows)**, such as the stand growth, the tree mortality or the amount of cut wood. Thereby the plots become "**half permanent**", because they are subject to a new measure, five years after their setting up.

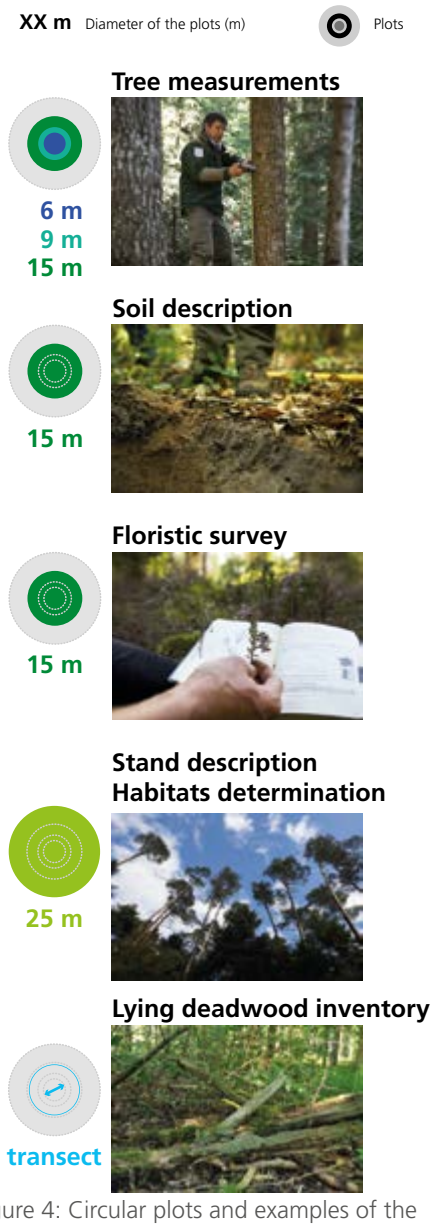


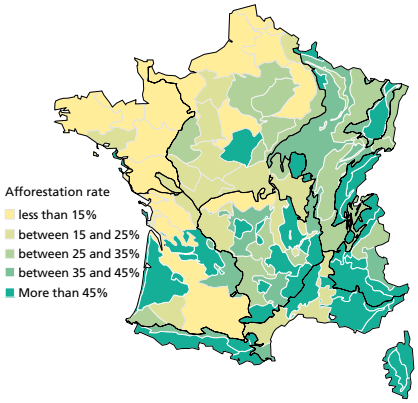
Figure 4: Circular plots and examples of the inventoried data

COMPLEX CALCULATIONS FOR VARIOUS RESULTS ADDRESSED TO MULTIPLE USERS

Complex calculations and processes of data treatment are implemented to increase the value of the collected data and gain an optimal results precision. Especially a *a posteriori* stratification (post-stratification) is applied, based on the photo-interpretation results and supplementary data (BD Forêt® V2) and leads to a decrease by 4 of the number of field points collected, for the same statistical precision. Researches are still going on and promise an even better results precision in the future.

Since the first inventory campaign following this new method (2005), the forest inventory publishes **data calculated** from the campaigns prior to the year of publication. Some of them are available every year and for free on the Internet, for instance the publication "**Le mémento**" or thanks to a web application allowing personalized calculations on the IGN website.
Raw data are also available on the website, mostly for research purposes.
Thanks to those results, specific studies on various fields (resource, carbon, biodiversity or climate change studies) are led by the IGN, often in collaboration with other actors (forest and wood network, research institutes, local collectivities, etc.).

"Le mémento" of the forest inventory



Map of the afforestation rate by forest ecoregions ("Le mémento")

Indicators for the Sustainable Management of Metropolitan French Forests

The role of French forests and the forestry sector in climate change mitigation (INRA, IGN)


Screenshot of the calculation app available on the NFI website

FOREST EUROPE, 2015: State of Europe's Forests 2015.

Figure 5: Examples of the use of the inventory data

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