



ASKA FOR



REFERENCE FOREST IN CONTINUOUS COVER FORESTRY

Bois Aubry

A reference forest in continuous cover forestry is a forest area which illustrates this type of management on a full scale, directly within the ecosystem. It is also used as a place of research, training and exchange. Inventories ensure it is monitored and provide knowledge on the CCF and analyse, in space and time, the forest's resistance and resilience.

The different visit formats (conferences, training, days of reflection, technical visits, etc.) make it possible to discover the dynamics and meet the different actors involved in management in continuous cover forestry (CCF).

Continuous Cover Forestry

CCF constitutes a global approach to the forest integrating its ecological, economic and social dimensions. It is based on the natural processes which govern the forest ecosystem.

The CCF is based on:

1. The mix of species per tree or per group of trees (regardless of the size of the stand).
2. Natural regeneration (wherever that is possible and sufficient).
3. Continuous forest cover which avoids clearcutting and its disadvantages as much as possible.
4. Gradual irregularity of the structure (age) of the stands.
5. Management at the scale of the tree (or by group of trees), the only scale allowing the ecological and economic characteristics of each tree to be taken into account, with the aim of producing wood of different qualities, in particular large timber with high added value, and to preserve the best tree-habitats.
6. Sampling the increase in volume of stands, guaranteeing the supply of the timber industry.
7. Improving the room for biodiversity thanks to the presence of a forest understory composed of herbaceous and semi-woody plants distributed over the entire forest surface.

The private forest of Bois Aubry: an irregular forest of oak trees

The private forest of Bois Aubry is located in the department of la Meurthe-et-Moselle, in France. It extends over 129 ha including 103 ha of old oak coppiced woodland. The remaining stands are divided between coniferous plots or young even-aged stands.

The forest responds to an economic challenge for the owner, who expects a regular and long-term income from it, based on the production of very large oak timber and on a continuous renewal of the stands, by natural regeneration or artificial enrichments. Particular attention is brought to improve the forest's resilience. To respond to these objectives, the owner chose to apply continuous cover forestry, or irregular treatment, over the entire surface. The property is managed by a forestry expert.

The forest is entirely located in the so-called Woëvre region, in the silvo-eco-region of the plains and clay depressions of the North-East. The relief is slightly marked. Bois Aubry, like the public forests which surround it and in particular the Reine State Forest, is traversed by a network of ditches and drains, inherited from developments that may have been put in place since the Middle Ages. The soils are rich in clay and subject to temporary waterlogging, at a level that may vary according to the stands. Many forest ponds bear witness to this: full in winter, they can be completely dry in the middle of summer. These ponds are of moderate size — from a few metres to a few dozen metres in diameter — and well distributed in the forest.



Altitude	230 - 245 metres
Bioclimatic area	Plains and clay depressions in the North East
Forestry region (eco-region)	Woëvre and appendices
Climate	Continental oceanic
Relief	Plain

An inventory by “permanent plots” to know the forest

The objective of the inventory by permanent plots is to follow the evolution of the stands and to control the consequences of the management thanks to dendrometric data (linked to the trees), both economic and ecological.

A permanent plot is a point in the forest where all the trees are listed and remeasured periodically (approximately every 10 years). A considerable amount of data is collected both on the trees and on natural regeneration or the consequences of the browsing of seedlings by deer. This type of inventory therefore makes it possible to know the forest with more precision at the present time and in its evolution, for example in terms of composition in species, volumes of wood, value of capital, health, increments, ecological interest, etc.

103 permanent plots have been installed in the oak stands of Bois Aubry, over an area of 103 hectares. The inventory was carried out in 2022 by Pro Silva France and AgroParisTech. The statistical precision obtained is 6%, on the volume of living wood.

The values of the forest

Continuous cover forestry must make the most of the existing stand but foresters sometimes inherit an unbalanced situation. To anticipate the economic trajectory of stands, it is useful to look at their value: a distinction is made between the so-called “consumption” value, which is the value at the time of the inventory, and the so-called “potential” value, which corresponds to the value of the current young trees which have not yet achieved their dimensions and optimal qualities. This predicted future value is reduced to a current value (known as “potential”, since it is based on assumptions of increase in diameter and quality) by a discount rate of 3%/year.

In the forest of Bois Aubry, the potential value is lower than the consumption value. This reflects the presence of wood beyond their economic maturity, which will be able to be collected in the short term, but also the deficit in trees for the future. The forester must be attentive to small-sized and medium quality wood. In these oak stands which produce high-value timber, the owner also uses part of the current income to invest in the future, in the form of plantations in the gaps without satisfactory natural regeneration.

Consumption value

59 %

Potential value

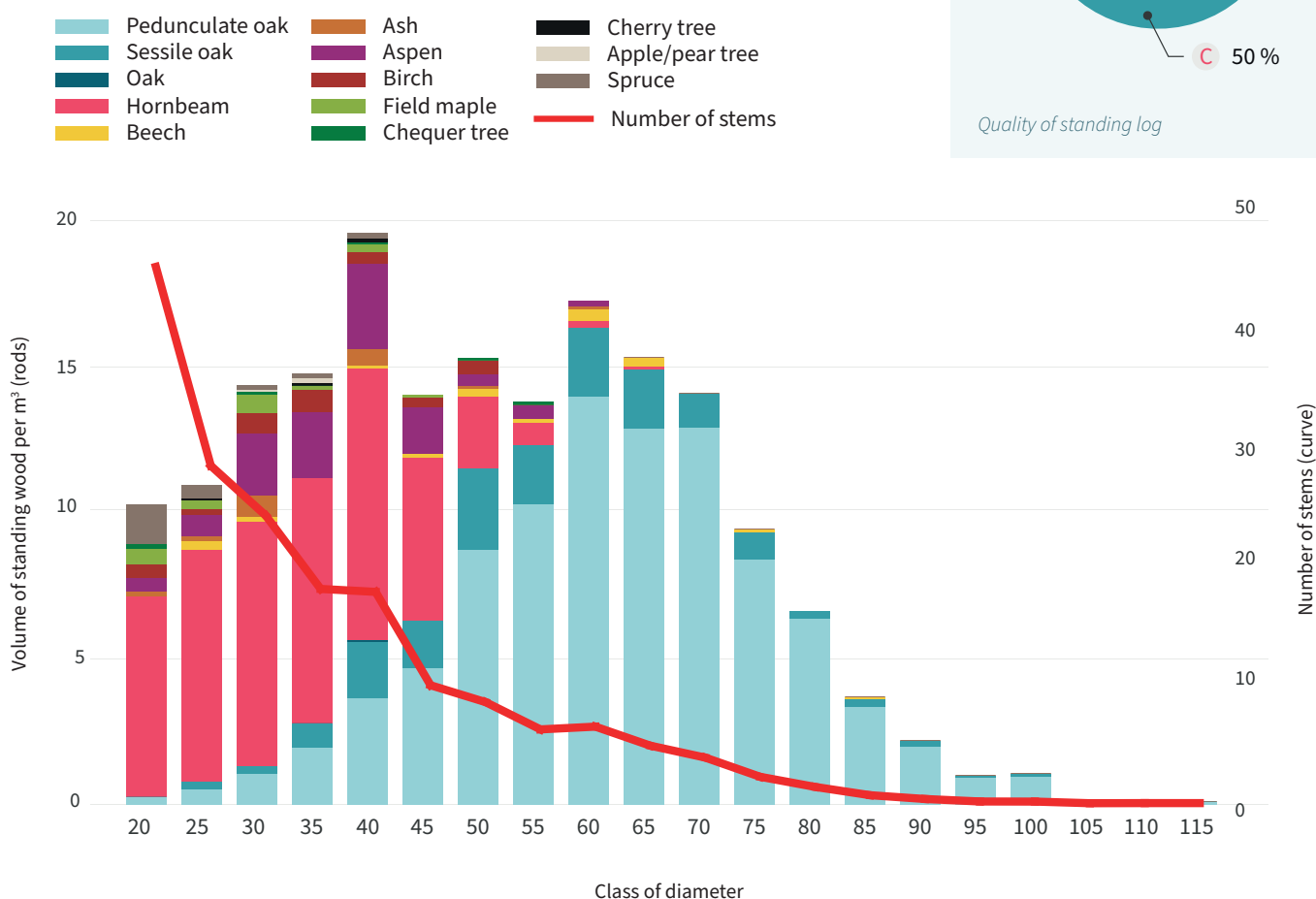
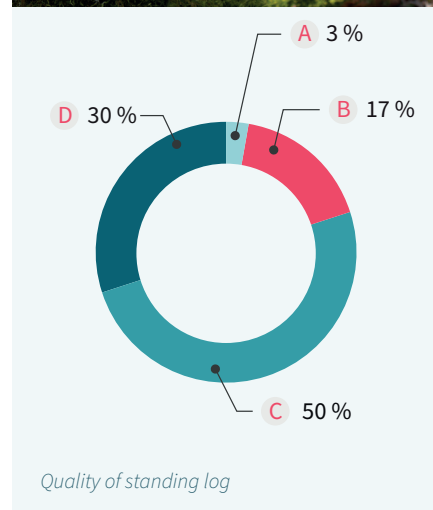
Values of the forest (in relative importance)



Managing the forest for continued production of high quality timber

Bois Aubry is characterised by the wealth of capital in timber and very large oak wood. This resource is the guarantee of sustained quality wood production over the long term: in irregular deciduous forests, a structure with 50% timber is usually considered to be balanced, i.e. one that can be maintained over time, despite the wood cutting. The harvesting of a few very large trees at each felling ensures a high and regular income through the sale of products with high added value. The value of the forest is not affected as this progressive harvest of older trees gives time to other individuals to grow and thus mature. Continuous cover forestry always maintains a productive capital, from which we periodically harvest the “interest”. Based on assumptions about tree growth and the timber market, it is possible to give an order of magnitude of the production value of the forest: at Bois Aubry, it is €140/ha/year.

The economic performance of the forest presumes the production of high quality timber. This, corresponding to classes A and B, represents 20% of the capital of Bois Aubry and is divided into all diameter classes. While the very large quality timbers are ripe for harvesting, the large and medium trees produce the value of the forest for the medium-term future. These differently sized trees co-inhabit within forest stands. Continuous Cover Forestry means that mature wood can be disseminated in the forest by preserving the trees which still deserve to grow, thus avoiding “sacrifices of exploitability”.



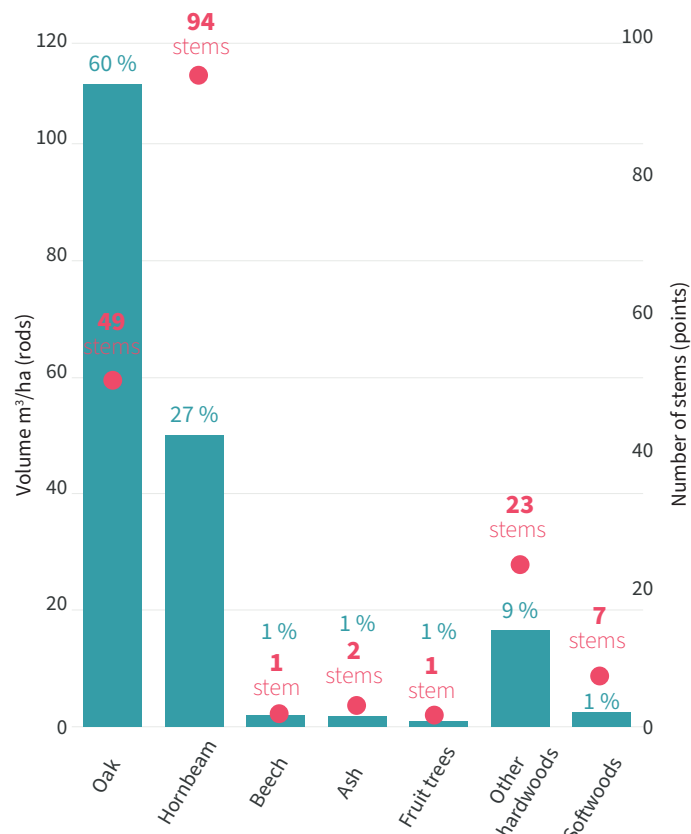
Curves by species and diameter classes

Converting an old coppiced woodland

The stands originating from coppiced woodland in the North east of France have frequently been marked by a phase of capitalisation. Coppice, often hornbeam which was managed as an under-story with frequent harvesting, took on a larger share in the stand. These strands of coppice then compete with the oaks and close the actual cover forestry, preventing the development of regeneration. Bois Aubry is characterised by the importance of hornbeam in small and medium-sized wood (while the amount of small-diameter coppice remains moderate). Unfortunately only 8% of these hornbeams are high quality.

The conversion to irregular high forest begins with a transition phase during which cutting removes a significant proportion of poor-quality wood. The owner invests in the future as the forest is capitalised in value.

Ultimately, keeping a few small-diameter coppice stems in the stands is ideal because they contribute to the forest atmosphere and allow light to be gauged. They also allow heating wood to be provided for needs of the territory (as well as the use of the crowns of very large timber collected).



Composition in species, volume and number of stems

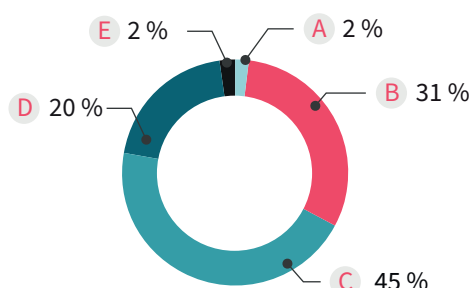
Renewing continuously, for sustainability and to adapt the forest to climate change

In Continuous Cover Forestry, the longevity of forest production presumes continual renewal of stands. Conditions are currently unfavourable for regeneration, in particular because of too high a standing volume, which closes the canopy and does not allow enough light for seedlings. This situation is not problematic in the short term, since the stands currently in place are able to provide continuous timber production in the medium term (see previous paragraph).

The conversion to an irregular forest will progressively open up areas for the appearance and development of seedlings.

Nevertheless, several points of vigilance can be considered:

- The nearby Reine state forest is known for the difficulty of installing oak regeneration (regardless of the forestry management practised);
- Hornbeam and aspen are extremely dynamic at the seedling stage and can be invasive on these sites. Mix management, especially for the oak, risks the need for early work.



Health status of the oaks*

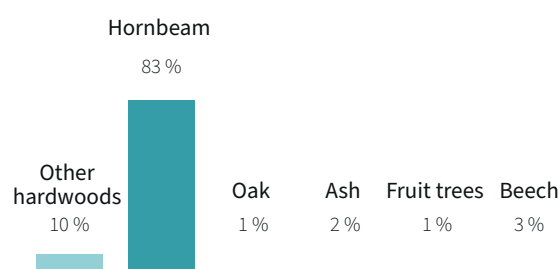
A: No degradation detected | B: Good | C: Average

D: Slight dieback | E: Strong dieback

*The health status has been measured in the conditions of a given year and must be checked over time. The permanent plots will make it possible to measure its evolution.

Despite a health situation which is currently more favourable than in other types of stands (beech forests, low-altitude spruce forests), the concentration of value in a single species – oak – is a weak point in relation to climate change.

To ensure continuous renewal and accelerate the diversification of the stands, the owner reinvests part of the revenue generated by cutting and has started plantations in small collectives within the stands, thanks to the use of one or more mature woods (very large oak wood, large or even medium hornbeam or aspen, depending on the quality). Continuous Cover Forestry allows plants to be periodically introduced to stands. Depending on observations or the evolution of knowledge, gradually the composition of the forest can be modified. The system therefore offers the possibility of “continuously” adapting stands.



Density of seedlings per species

Reconciling economy and ecology

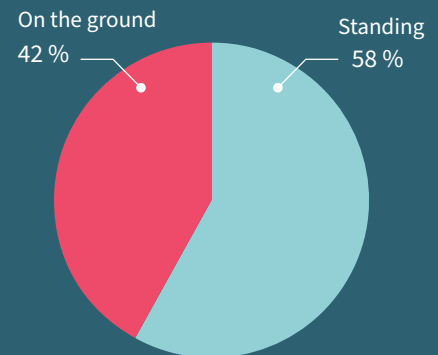
A healthy ecosystem is essential for sustaining forest production and ecosystem services.

Organisms which decompose deadwood are veritable forest engineers which fulfil essential missions for the forester, such as recycling organic matter to maintain soil fertility or decomposing dead branches to facilitate pruning. These organisms are also involved in the implementation of the carbon cycle and therefore the carbon sink function of forests. The management of the communal forest of Bois Aubry is therefore attentive to preserving deadwood in the forest, both standing and on the ground.

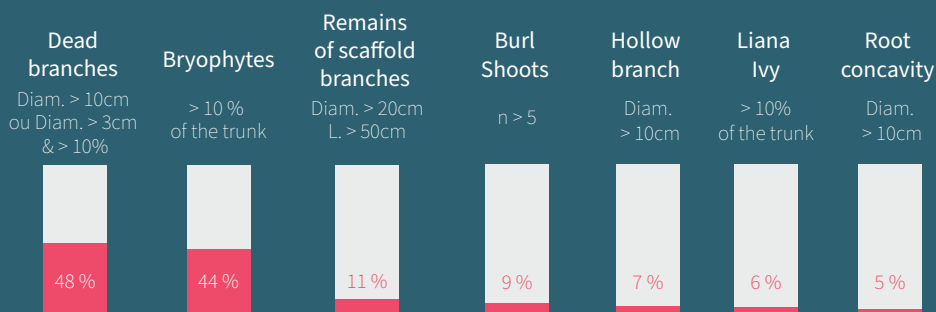
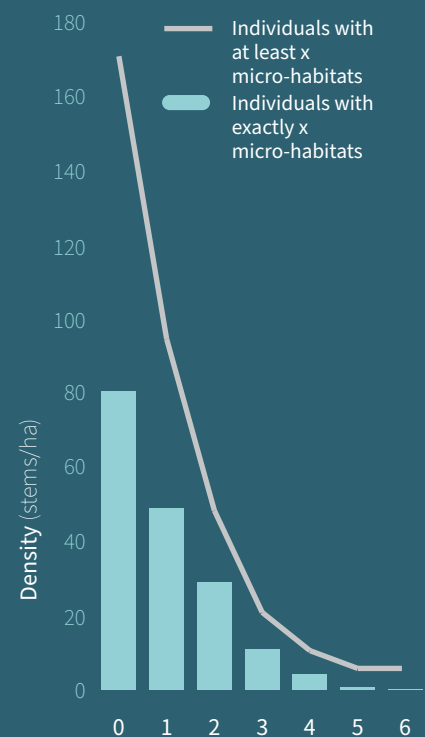
It is the large deadwood (diameter of more than 30 cm) which harbours the greatest number of species. It is estimated at 5 m³/ha in Bois Aubry.

Forest biodiversity plays an essential support role for many ecosystem services: pollination, seed dissemination, pest regulation, soil maintenance and slowing down of water flows, exchanges of organic compounds (notably via tree-mycorrhizae interactions), etc. The richness of the biodiversity and therefore the quality of these services is linked to the hosting potential of the environment. This potential is linked to several factors, some independent of management (presence of watercourses, rocky areas, etc.) but others linked to forestry practices: mixture of species, volume of deadwood or presence of “dendro-micro-habitats”. The latter are small structures in the trees that are used by forest species as a place of shade or shelter, a place of food, a place of reproduction, etc.: cavities, cracks... The forest owner is therefore careful to preserve a framework of tree-habitats. In Bois Aubry, there are about 93 trees per ha which provide at least one micro-habitat and over 15 trees per ha which provide at least 3. The most often observed micro-habitats are dead branches — this is the result of the closing of the canopy which led to the mortality of the main branches and the mosses on the trunk. Among the usually rare micro-habitats, the forest has many woodpecker lodges, observed on average on 1 in 50 trees.

Deadwood
> 30 cm



Volume of deadwood per category



Frequency of the main dendro-micro-habitats

Number of microhabitat types per tree

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Photo credits. Benoit Méheux

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