The French Approach to Broadleaved Silviculture

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ABSTRACT

French forest land covers one quarter of the country (14 million hectares). Broadleaves represent two-thirds of this area, with oaks (34% of the total area) and beech (15%) as major species. When possible, oak silviculture aims at producing high quality wood which is obtained through a long (more than 200 years) and patient management. Such management incorporates within it the most recent understanding from science and the requirements of modern economic needs.

Beech is considered a good afforestation and reforestation species in many areas including alkaline soil. No more than 100 to 120 years should be needed to produce trees with an improved wood quality as compared with present and rather conservative management techniques.

For both these species, planting may have to replace natural regeneration. A strategy for future afforestation with broadleaves is discussed. It involves short and long lived species, industry wood and timber production, and use of a series of common or high wood quality species.

INTRODUCTION

Forest land covers a quarter of France (14 million hectares). Broadleaved forests represent two-thirds of this area. They are mainly composed of oak (34% of total forest land) and beech (15%) (Direction des Forets, 1967). Most aspects of the present management of broadleaved stands have been defined more than a century ago, thanks to the "méthode française" which was built up together with our German neighbours (Parde, 1986). Since that period it has been adapted to modern economic trends.

Therefore even-aged stands tend to be favoured against more versatile but certainly more labour consuming types of stand managment, like coppice and coppice with standards.

Management methods aim at producing a high quality wood which is the only product that will withstand all economic changes and all "hiccups" of history.

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In this paper information will be given on:

— silviculture of high yield class oak in Central France

— modern trends in beech silviculture.

In the conclusion, a strategy for the future is proposed for broadleaved production.

A Case Study — High Forest Oakstand Management

(1) With natural regeneration

Several oak species grow naturally in France (Becker *et al,* 1982):

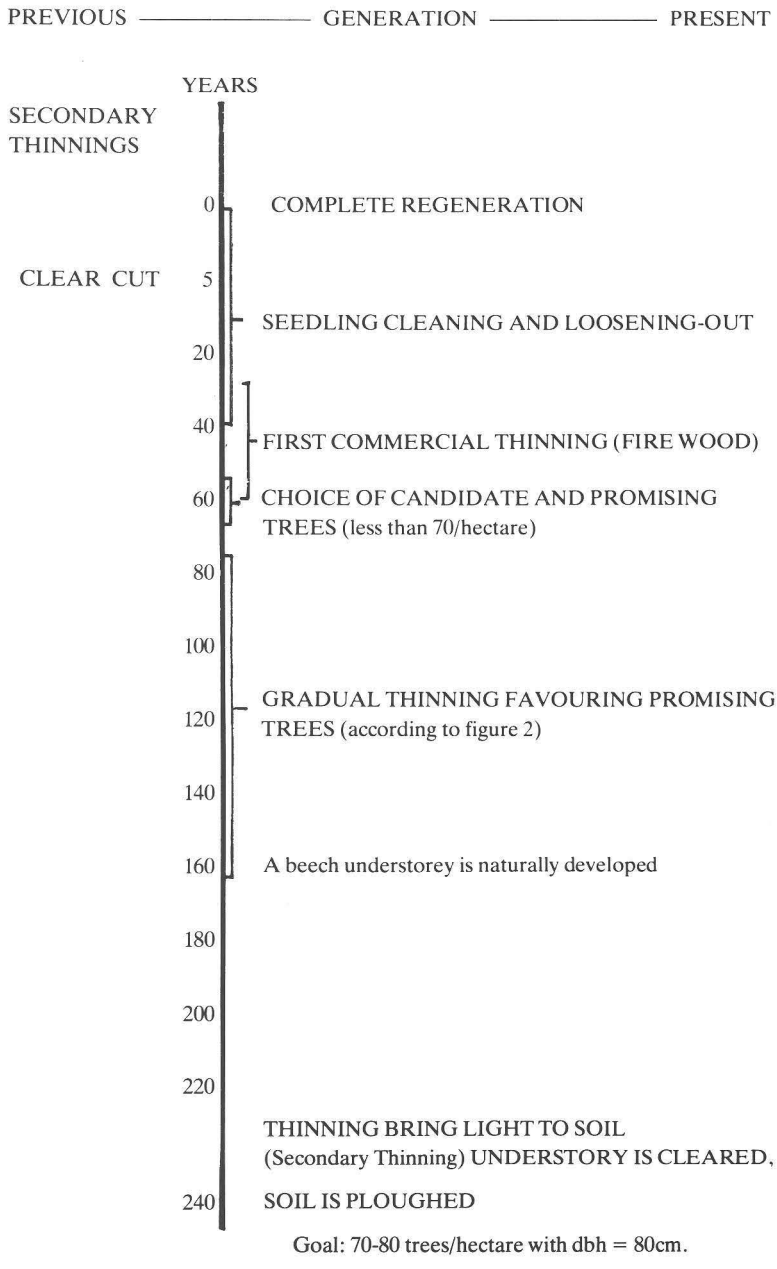
Quercus cerris L.
Quercus coccifera L. = Kermes oak
Quercus suber L. = Cork oak
Quercus robur L. = *Q. pedunculata* Ehrn. = pedunculate oak
Quercus pubescens Willd=durmast oak
Quercus rubra L. = *Q. borealis* Michx = American red oak
Quercus petraea (Mattuschka) Liebl = *Q. sessiliflora* Salisb. = sessile oak
Quercus pyrenaica Willd. = *Q. toza* Bast.
Quercus ilex L.
Quercus virgiliana (Ten.) in eastern Corsica.

The major species are pedunculate and sessile oak which the modern oak stand management generally refer to. The introduction of the American red oak and its present extension in reforestation should also be mentioned.

An example of French oak management will be given. It refers to methods currently applied in Central France which is the primary region for the production of oak veneer. The State Forest of Blois stands on a fertile soil with a mild climate and an evenly distributed rainfall. This distribution, leading to a deficit during summer, has a major consequence on wood quality. Growth rings are mostly composed of spring-wood which shows the best veneer quality of homogeneity, tenderness, low density, low shrinkage and with growth rings of 1-1.5mm (Lanier, 1986).

The main stages of oak stand management of Blois State forest are summarised in Figure 1. The natural regeneration is usually easy to obtain with an average good oak-mast every fourth year with lighter ones intervening. Therefore the period between seeding, thinning and clearfelling of the mature stand is generally rather short (5 years), whereas in other regions it is longer but should never exceed 10 to 15 years (Lanier, 1986), to bring full light to the

Fig. 1: A 240 year rotation in an oak stand.



seedlings. Thinning of seedling thickets may have to be rather severe and should be in favour of straight thin-branched trees. First commercial thinning for firewood or fence-poles may occur as early as 30 to 50 years after regeneration. Around year 60 promising trees are located and identified. If possible they should be evenly spaced (12 x 12 to 13 x 13m). During all subsequent thinnings most of the forester's attention will be paid to these trees while at the same time keeping in mind that their choice may have to be changed if any unexpected event should occur: disease, wind-damage, forking, etc.

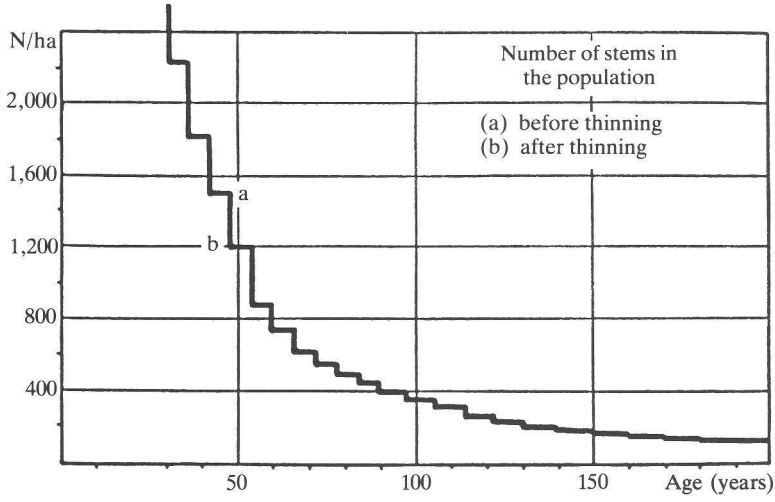
Experience has shown that absolutely pure stands do not look as healthy, and never re-generate as readily, as mixed stands. Therefore, high yield class oak stands should accept a certain percentage of a beech (or hornbeam in other regions) understorey.

At the end of the rotation, obtained after gradual thinnings (Figure 2), the stand contains 70 to 80 trees per hectare, including beech, with a 80cm dbh.

Modern silvicultural techniques show that a rapid regeneration can be obtained through understorey clearing and soil ploughing immediately after the seeding thinning. This will help bring acorns in close contact with soil and so will ensure a high germination.

A careful use of selective herbicides may be necessary where brambles or certain grasses tend to compete with seedlings for light.

Fig. 2: Gradual reduction of oak stand density with age. From Lanier (1986). N/ha = number of trees per hectare.



WITH PLANTATION

The high sale price of quality oak wood (more than 6,000 French Francs per standing cubic metre of prime log) and its price stability through all economic changes would suggest that foresters develop more oak stands when possible. Planting is therefore needed.

Most authors recommend planting 4,000 to 5,000 seedlings per hectare but many foresters recommend planting at even higher density. Different solutions are proposed:

Management and harvest paths. Frequent access to all parts of stands, especially when mechanisation is considered, will result in seedling damage and soil compaction unless such movement is limited. Therefore management and harvest paths are opened every 30 to 50 metres and kept in good maintenance until the next regeneration. Such paths do not have to be planted.

Patch Planting. In this method all trees of each patch, except one, will be thinned out. Therefore the number of patches should be roughly the same as the number of trees remaining at the end of the rotation. If each patch consists of 50 seedlings planted at a distance of 1 x 1 metre, 100 such patches will need roughly 5,000 trees per hectare. But there are several disadvantages in this method.

— high maintenance cost of unplanted area.
— strong competition by existing vegetation around patches if not controlled.
— low choice of selection in each patch: one tree in every 25 if outer rows are not considered.
— not adapted to slopes.

Strip planting. This involves 3 to 4 row strips of trees planted 1 x 1 metre spacing, with 9 metre unplanted strips. This leads to a distance of strip axis of 13 metres. The local density within strips remains at 10,000 per hectare whereas the general density is as low as 3,000 per hectare. This method has advantages and disadvantages:

— reduction of planting cost.
— greater choice within strips than with patches,
but
— enormous border effects.
— high maintenance cost of unplanted strips.

Mixed planting. The ideal solution would be to interplant strips (or patches) with trees or let the local tree and shrub vegetation develop and cover unplanted area. The difficulty is to find species which will not overgrow oak trees.

Conclusion

Any oak reforestation scheme should first consider species and provenance according to site and climate. Pedunculate oak is considered more flexible than sessile oak for climate but more demanding for soil. The former prefers fertile and moist soil with clay and sand, it withstands alkaline soils but should be replaced by the latter when soil becomes acid, dry or poor. (Becker *et al,* 1982). Good and updated information on silviculture may be found in a recent publication by Louis Lanier, Professor of Silviculture in Ecole Nationale du Génie Rural des Forêts, in Nancy (Lanier, 1986).

Silviculture of Beech (*Fagus sylvatica L.*)

Beech is the second most important and most common broadleaved species in France. Its ability to accommodate many types of climate and soil, including alkaline soils, makes it a suitable species in reforestation and afforestation. Unfortunately its wood never reaches as high a sale price as oak.

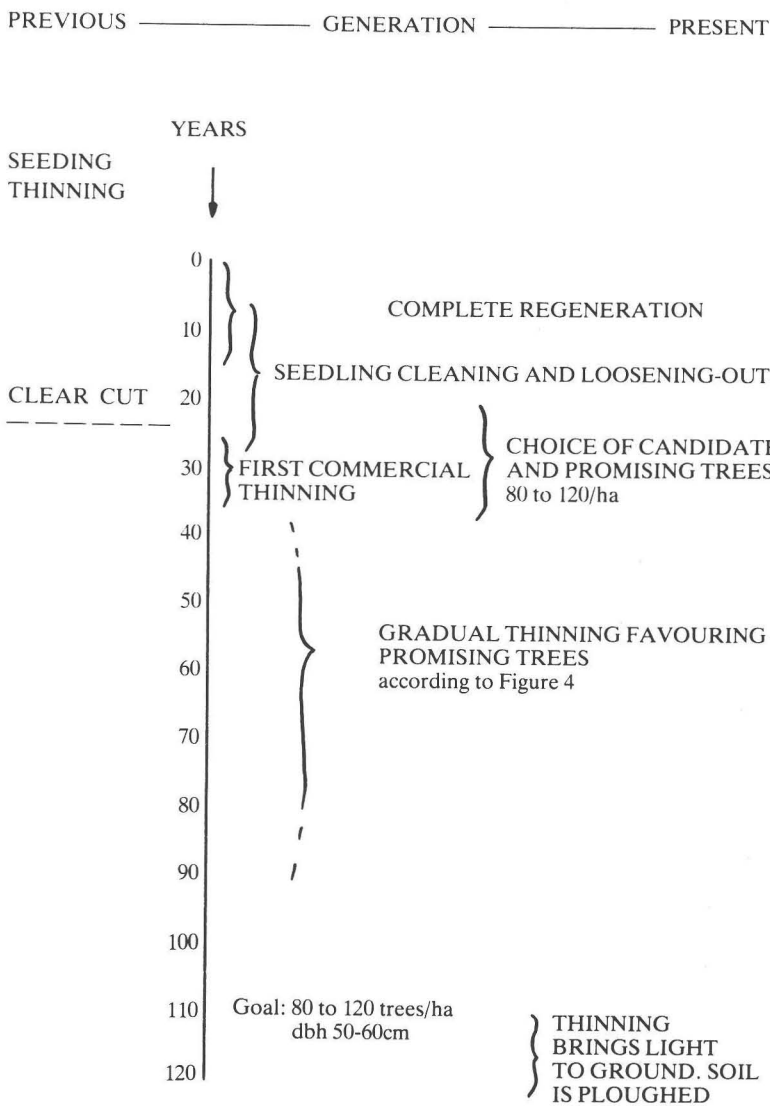
Different books have been devoted to this very important European hardwood: "Fagul" in Romania, "die Rotbuche" in Germany and, more recently "Le Hêtre" in France (Milescu *et al,* 1967; Schober, 1972; Teissier du Cros *et al,* 1981).

Many factors tend to prove that beech silviculture should be vigorous and stands should be submitted to shorter rotations than the current French average, which is generally 140 to 150 years. Authors suggest that rotations should not exceed 100 to 120 years through earlier and more vigorous thinning, leading to wider crowns, wider growth rings, lower wood density, and less internal wood constraints.

The main stages of beech stand management are summarised in Figure 3. A complete natural regeneration is seldom obtained unless one waits for 10 to 20 years, except in medium to high elevation areas and on slopes. Since beech does not suffer when covered by the canopy of the previous generation it is possible to keep it sheltered against excess of light and frost damage. This characteristic is probably the only important difference between oak and beech stand management. Therefore, no details will be given on this management which is considered classical in many Central and West European countries.

Beech may also be planted. In France planting is done to fill in incomplete natural regeneration. Planting is also done in reforestation programmes (1,000 to 1,500 ha a year). In this process, provenance choice is very important. Provenances with specific soil adaptation (Teissier du Cros and Lepoutre, 1984), late

Fig. 3: A 120 year rotation in a beech stand
(from Teissier du Cros *et al.*, 1981)



flushing and high vigour (Teissier du Cros and Thiebaut, 1986) are required. To avoid genetic pollution and degeneration, provenance transfer should be limited to areas far from natural beech stands, which is very rare in this country. Therefore local provenances will be preferred until provenance tests produce valuable results.

Planted beech trees, especially those planted at wide spacing and in fertile soils, tend to be forked (Dupre *et al,* 1986). This habit is probably partly related to polycyclism (Lammas-shoot) (Dupre *et al,* 1985). Therefore it is suggested to plant beech trees at a local density of at least 10,000 per hectare. As for oak, different planting schemes have been studied. But beech has the advantage of withstanding competition for light (which will improve its form). So, when possible, it is suggested to plant beech in strips with oak or with faster growing light demanding species such as wild cherry, ash, maple and others.

Naturally, regenerated or planted beech stands are thinned according to different schemes. However, French habits, which are certainly very conservative, have to be changed and should take into account the very valuable information available from northern European experience with beech siluvculture, showing that shorter boles and wider crowns may be obtained with earlier thinning and shorter rotations (Figure 4).

Strategy of the Future

Large scale planting of long rotation species are certainly not advisable if intermediate incomes are needed.

Figure 5 shows a very simplified afforestation scheme which can be proposed to any management unit of at least 20 to 50 hectares. It involves a large number of species and should be adaptable to a broad range of site conditions.

Short rotation intensive forestry is studied in many West European countries including Ireland. It has the advantage of being easily introduced on abandoned farmland and it should bring early incomes. Species involved are mainly willows and poplars. But the production is only oriented towards industry and should therefore be concentrated within a short distance of area of utilisations.

Timber producing poplar. Poplar cultivation is a tradition in most parts of temperate Europe. It is usually a very intensive system. It includes wide spacing, soil maintenance, fertilisation and pruning. Several outstanding clones have been released by research institutes in the Netherlands, West Germany, Belgium and Italy. Many of those are well adapted, disease resistant and vigorous. Rotations are variable being 12 to 15 years in Southern France, up

Fig. 4: Gradual reduction of beech stand density with age (Lanier 1986).

- 1=traditional in Normandy
- 2=according to Schober, class 1, yield tables
- 3="Danish" silviculture
- 4=possible silviculture in France with choice of candidate and promising trees
- ↓ =clearcut
- APS =promising trees
- APS+P =candidate trees chosen at age 50

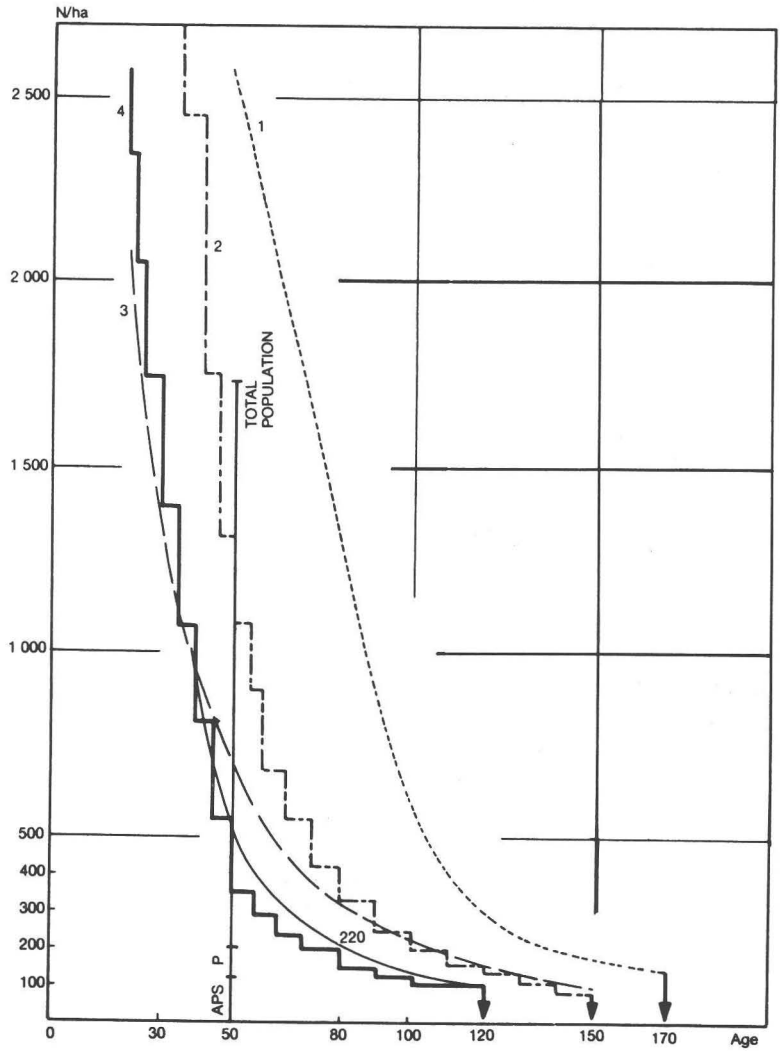


Fig. 5: A strategy for the future (SRIC = Short rotation intensive culture)

Industry wood →				
	← Timber →			
Willow	Poplar	Mazzard Maple	Beech American red oak	Oak
(SRIC)		Ash Yellow poplar		
5-10 years	20-30 years (70 in GFR)	50-80 years	120 years	200 years

to 25 years further north, but also up to 70 years with black cottonwood in Germany in beech stands partly damaged by tornadoes.

High wood quality may be produced with certain broadleaves in 50 to 80 years. French improvement and culture studies concern wild cherry (*Prunus avium*), yellow poplar (*Liriodendron tulipifera*), waved grained maple (*Acer pseudoplatanus*) and hybrid walnut (*Juglans nigra x regia*).

Medium to long rotations are needed for the production of beech, American red oak, pedunculate oak and sessile oak. Improvement studies of beech and American red oak were initiated in France over 10 years ago. First results are now becoming available. But little is known of the variability of Pedunculate and Sessile oak. Different studies including isozyme variability and provenance studies have recently been initiated.

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