# A SCIENTIFIC APPROACH FOR THE APPLICATION OF CRITERIA FOR SETTING UP MULTIANNUAL PROGRAMMES AND ZONAL AFFORESTATION PLANS IN THE FRAMEWORK OF THE COUNCIL REGULATION NO. 2080/92

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## ABSTRACT

A successful and justified multiannual afforestation programme requires a good insight into the objectives and awareness of the constraints of the new forests, a planning strategy and a thorough research on the missing aspects.
Socio-economic constraints mainly relate to social aspects of the farmers involved, who must be assured of a viable income.
Therefore the new forest types and silvicultural systems should produce a reasonable return, without neglecting however the global multiple use objective.
Planning has to deal with specific goals, the area of new forests, the location and size, accompanying measures and a time scale.

## 1. INTRODUCTION AND PROBLEMS

There are three **reasons** which make the Commission believe that **strengthening of afforestation** efforts within the European Union is necessary (Kremer, 1993).

1. The global context. According to the relevant principle (8A) of the UNCED declaration on forests (Rio, 1992), all countries should take actions towards afforestation. In Helsinki 1993 the EU agreed to collaborate on efforts to increase afforestation in Europe (resolution No.1, Art. 14)

2. The Common Agricultural Policy. With respect to the reform of the C.A.P., afforestation has become an reasonable and environmentally sound alternative use of agricultural land.

3. The growing demands for wood and non-wood services and products. Today the E.U. deficit in wood and wood derived products amounts to some 20 billion ECU per year. It is expected that in Europe the consumption will increase more than the production.

The European Parliament claims an afforestation goal of 10 % of the existing agricultural land before the year 2000, meaning a multiplication by 200 of the present afforestation rate in the Union. The question arises how this challenge will be met.

Natural forest ecosystems are stable habitats for all kind of organisms. This situation, however, is, unfortunately, not found in the actual forests in the E.U. Natural forests are almost completely absent and even semi-natural forests and mature forests are scarce. During centuries forests have been felled or have suffered by intensive logging, improper grazing and repeated fires. On the other hand huge **afforestations have been carried out** e.g. in Belgium, increasing the forest area from 14 % in 1866 to 21 % in 1970.
Important afforestations have taken place in mountain regions, in order to protect the soil against erosion and to regulate the water regime and avoid periodical floodings (Pardes, 1993). To overcome the problem of wood deficit, Mediterranean currently amounting to more than 50,000 ha/y. The great majority of forest areas burned each year, however, is estimated at 236,472 ha and thus exceeds by far the new forest area (Kailidis in : Papanastasis, 1993).

Presently European woodland covers a quarter of the E.U. territory, with 58 % of broadleaf and 36 % of conifer forests (CEE, 1987). Among these, exotics play an important role and no doubt, should continue to do.

The afforestations of the last century mainly aimed at an increase of the wood production and have often led to closely spaced monospecific plantations, with, in the Mediterranean regions, highly inflammable species such as pines and eucalyptus. They provided the people not only with high amounts of wood but also with serious ecological and environmental problems.

The risk exists that **new forests** will, at least partially, end up the same way. However, from the beginning, two **major differences** can be observed :

1. The new forests, on abandoned farmland, will be established on high potential agricultural soils.
2. New forests are supposed to have only a temporary character. Farm forests will probably be planted at final density and will not remain much longer than 15 to 60 years.

Due attention should be given to the edaphic **peculiarities of abandoned agricultural soils**. They are flatter, deeper and less stony than common forest soils. They have less organic matter and a lack of mycorrhiza. Physical and chemical conditions differ. The main constraints relate to the compaction of the soil, due to the long-lasting cultural uses and the low level of organic matter. Deep ploughing is often advised, yet provokes also unfavourable consequences. Normally no measures are taken to increase the content of organic matter before planting.

Chemical characteristics also can considerably influence the success of the forestry plantations, especially the calcareous level, the general nutrient content and the possible presence of toxic residues. Agricultural crops need calcareous land, whereas only few tree species tolerate the presence of this element. As agricultural land is often fertile, there is no need to fertilize. Bailly (1993), however, although underlining the high potential of the soils, stresses that fertilization is imperious for two reasons: on the one hand the preceding culture generally consumed the stock of assimilable elements (big lack of $P_2O_5$) and on the other hand the needs of the forestry plantations should not be underestimated during the first years of growth. Finally, the risk of accumulation of toxic elements, due to intensive use of biocides, may occur.

The **land suited for forest production** within the E.U. is more than three times the present area covered by closed exploitable forest. Hendriks et al. (1991) estimated that, if all the suited land would be afforested, the E.U. timber production could exceed the wood consumption at the level of the year 2,000 more than twice. To be self-supporting the forest area should be extended with about 10%, provided the net annual increment could be increased from the present level of 3.5 $m^3$/ha/y to 5 $m^3$/ha/y, which is possible if the afforestation takes place on fertile agricultural lands.

Experience show that **existing aid schemes** for promoting afforestation **are insufficient.** Pardos (1993) believes that the conversation of farmers to forestry and their maintenance in rural areas are the bottleneck to the success of the Council Regulation. He also points out that, regarding to private properties, profitability criteria should prevail.

The need of accompanying measures, especially regarding rural planning, is often discussed. In that concept we only need forests, by preference created and managed following a "close to nature" principle. However, this solution, although not completely to reject, expresses the absence of a real policy for the future. No doubt, multiannual programmes and zonal afforestation plans can be very helpful.

## 2. COUNCIL REGULATION 2080/92

As existing provisions to encourage afforestation of agricultural land were insufficient, the Council adapted the Regulation 2080/92, instituting a Community aid scheme for forestry measures in agriculture.
The Council stresses herewith that the **afforestation of agricultural land is especially important for four reasons :**

1. from the point of view of soil use;
2. for environmental reasons;
3. to reduce the shortage of forestry products;
4. to control agricultural production.

Therefore it formulates its **objectives** as follows :

- accompany the changes introduced under the market organization rules;
- contribute towards an improvement in forest resources;
- contribute towards forms of countryside management more compatible with environmental balance;
- combat the greenhouse effect and absorb carbon dioxide.

The **overall objective**, expressed in practical terms, is twofold :

1. the promotion of afforestation as an alternative use of agricultural land;
2. the promotion of the development of forestry activities on farms.

Although it is evident that the Regulation aims at the direct financial support of the farmers,it is also obvious that the policy is not only directed to "wood production", but to a kind of multiple use forestry, integrating agricultural, silvicultural, social, ecological and economic aspects.

To realize the objectives the Regulation prescribes an **impressive aid scheme,** comprising four measures :

a) aid for afforestation costs, with a distinction between eucalyptus plantations, conifer plantations and plantations of broadleaves;
b) an annual premium to cover maintenance costs in the first five years, with a distinction between conifers and broadleaves and also between the first two years and the following tree years;
c) an annual premium to cover losses of income resulting from afforestation of agricultural land; it is based upon the nature of the person involved : normal farmer or another legal person.
d) investment aid or the improvement of woodlands; the amount depends on the character of improvement : provision of shelterbelts, renovation and improvement of cork oak stands, forest roads, firebreaks and waterpoints.

The implementation of the aid programmes is left to the individual Member States. They shall execute it by means of **national or regional multiannual programmes,** covering the objectives laid down by the Regulation. These programmes shall set out in particular :

- the amount and the duration of the aid;
- the conditions for granting aid;
- the measures taken to evaluate and monitor environmental impact and compatibility with land use criteria;
- the accompanying measures;
- the measures taken to provide agricultural and rural operators with appropriate information.

It is evident that such-like measures require the full collaboration of the Member States. They even suppose the availability of means and know-how to monitor the environmental impact and also of criteria for the evaluation of land use. This way, discussion with other interest groups is unavoidable. Moreover, big differences between the insights and evaluation systems of the Member States may appear. It is obvious that the provisions concerning environmental impact of Eucalyptus plantations in Portugal are much softer than the one's for poplar in Flanders (Carvalho Oliveira, 1992; Buysse, 1993).

Next of the obligatory multiannual programmes, which must be examined and approved by the Commission, the Member States may also devise **zonal afforestation plans.** These zonal plans are needed to reflect the diversity of environmental situations, natural conditions and agricultural structures. The regulation clearly stipulates that zonal afforestation plans shall be concerned in particular with four basic principles, namely :

- the setting up of an afforestation objective;
- the conditions in respect of the location and grouping of areas which may be afforested;
- forestry practices to be complied with;
- selection of tree species adapted to local conditions.

As on the one hand it is not so simple to set up zonal afforestation plans, fulfilling the above wishes of the Commission, and on the other hand such plans are free, it may be expected that several States will fail to devise them.
The question arises, however, how it is possible to set up worthwhile multiannual afforestation plans, without clear objectives, and a good insight in the location of new forests, site suitability and silvicultural systems.

But above all, it remains remarkable that the Commission clearly stresses the new approach of rural management, trying to integrate agriculture, forestry and environment. Furthermore it is important that the implementation has to follow a "bottom to top" approach, meaning that the plans must be based on local and regional considerations, or in other words that local social, economic and environmental conditions must be taken into account. Herewith the Commission recognizes that there is no "passe-partout" or general solution. Every local situation requests particular solutions ( Kremer, 1993).

## 3. CONSTRAINTS FOR NEW FORESTS

It is quite clear that the forests in the far past, in the pre-industrial era, were used in a multiple way. On the contrary, the forests, established during the last 150 years, were almost unidirectionaly aimed at wood production. The future new forest, although they are established on agricultural lands and with the income of the farmers in mind, have also to function as multiple-use forests, at least according to the spirit of the Regulation.
Multiple-use forestry should be recognized and supported by the national Forest-Act, as in Belgium (Lust, 1992) and in Denmark (Nilson, 1993). It should take in mind both social-economic and environmental constraints.

## 3.1. Social and economic constraints

It is indisputable that, despite of the multiple-use objective of the new forests, two major principles prevail:

1. The most important group involved into the Regulation is the "farmers".
2. The socio-economic context of the reform requires a justified solution.

### 3.1.1. Social aspects

The regulations concern different partners, with often **contradictory wishes** :

- The farmers. Above all it is important to realize that many of them are not happy with the Regulation. Even more, they are hostile towards forests. Only on marginal sites, where the economic marginality of the agricultural use is clearly proved, an active and free cooperation can be expected. Especially here, farmers have, with some exceptions, to be involved into the new forestry activities. It is of prime importance that the local manpower, from agriculture, should be used for the establishment and maintenance of the new forests. They must be assured of an income from their land.
  A real problem, however, is, that the farmer is often not the owner of the land. In Flanders e.g., only 1/3 of the agricultural land is owned by the farmers themselves (Lust, 1992). The needs and the wishes of the farmers on he one hand and the landowners on the other hand are not the same. This requires appropriate judicial and financial solutions.

- The society. It is mainly represented by the local and regional authorities, but includes also ecologists and users of the open space. From this side, due attention is to be payed to topics as nature conservation, landscape, recreation and amenity. Members of the society can be either in favour of forests or against.

- The wood industry, especially the regional wood users. Extension of the forest area should contribute to a local wood activity and to the rural development, of which also the farmers should take profit. There should be a mutual link between the wood producers and the wood users : the forest yields products wanted by the industry, whereas the latter respects the primary silvicultural and ecological demands of a sustainable forest.

In this respect, here also should be referred to the **relationship between the nature of the ownership and the nature of the new forests**. Two points must be mentioned :

1. The ownership is often determinant to the function new forests have to fulfil. Environmental constraints should be preferently linked to public land, whereas on private land priority should be given to socio-economic aspects.

2. The ownership determines also the size of available land : private land will normally lead to small afforestations, while public entities can easily reach hundreds of hectares.

Pardos (1993) stresses that the **great challenge will be the maintenance of the rural population,** whose living habits and mentality have been linked from old times to farm activities, that now has to change in order to deal with forestry and to live from forestry. Herein lies a major task for rural operators, who have to provide the farmers with appropriate information. To overcome this challenge, **economic profitability must be assured.** It implies financial silvicultural and judicial means. The attractive aid scheme of the Regulation must be equally implemented by the regional authorities. So, the restriction of the period of compensation premium for income losses to e.g. 5 year (as proposed in Flanders), is to be considered as a real hamper. Notwithstanding justified remarks from the conservational point of view, short rotation systems, in combination with fast growing species, have to be accepted and even supported. At the same time there should be striving for an increase of the quality of commercial wood and for a decrease of all risks, such as wildfires and diseases.
The present objective in the framework of set-aside, viz. a temporary forest, can be discussed. However, it facilitates and stimulates new afforestation. Yet several questions remain, e.g. how to combine temporary forestry with multiple use forestry or how to keep the forest soil in a good agricultural condition ? It should be remembered that transition from forest areas to non-forest areas and the reverse has always been a usual practice, mainly imposed by socio-economic circumstances. To maintain soil fertility, special attention should be given to the tree species. Priority should be given to species which yield a mull humus, mainly being species characterized by a fast litter decomposition (Muys & Lust, 1993). In this respect, it is clear that poplar plantations, despite some criticism, are very favourable.

### 3.1.2. Economic aspects

It is quite clear that economic aspects, in the sense of profitability for the (private) owner, is of major importance. Profitability is not forbidden and is also not in contradiction with the principle of multiple-use forestry. In theory it is even quite difficult to draw a dividing line between sustainable forestry and wood plantation.
In practice, however, it is likely to distinguish between **two forest types : plantations that primarily aim to timber production and forests with a clear multiple-use purpose.**
"Plantation forestry" will try to achieve its goals by using specific means : choice of site and tree species, silvicultural systems and management, provenance, breeding and technology. Nevertheless, it has always to respect some minimum ecological conditions, which have to be determined in the multiannual programmes, taking into account the provisions concerning the monitoring of environmental impact and the compatibility with land use. In this respect one could think of criteria such as :

- choice of location: not on conservationally valuable sites;
- preparatory works : restrictions on drainage, irrigation and ploughing;
- choice of tree species : no negative impact on soil fertility;

- size : in function of landscape;
- abiotic and biotic risks : wildfires, pests and diseases;
- silvicultural techniques: spacin, rotation period, nature of exploitation (soil degradation; prohibition of total timber use);
- use of biocides.

All these criteria can be fixed on a regional basis, but should reflect an overall vision, respecting the principle of sustainability.

Pardos (1993) advises to **use the better land for timber production.** In Europe limitations for tree growth are mainly caused by a soil water deficit. If enough water is available, high productive poplar clones can be used for veneer production (Zsuffa et al., 1993). Willows and alders for biomass production and ashes for pollarding could be complementary options.

**Exotics** will conduct to special discussions. Among them, Eucalyptus species (mainly E. globulus) deserve special consideration. Their ecological diversity, elite clones resulting from breeding, capability of sprouting that allows coppicing, fast growth, short rotation and high yield for pulping are very valuable traits. Nevertheless barriers have to be set up on their use and a conversion of the present plantations would be beneficial (Wilson, 1992). Within the conifers, douglas fir will play an increasing role especially in Western Europe, for timber production. Also to mention are hybrid larch (Scandinavia and Central Europe), Picea sitchensis and Pinus radiata in the atlantic zone. Even with plantations of exotics a minimal diversity is needed.

Bailly (1993) concludes that the socio-economic constraints can be fulfilled by using the following **silvicultural systems:**

- Wide spacing cultivation for high quality wood production: 100 to 200 stems pro hectare, precious hardwood species such as Juglans nigra, Prunus avium, Fraxinus excelsior, Acer pseudoplatanus, etc., rotation periods of about 60 years, temporary combination with agricultural crops, specific maintenance techniques (pruning, phytosanitary treatments), valorizing rural manpower.
  However the production of high quality timber, also requested by many other authors, is often restricted by the site quality (water supply and soil depth).

- Short rotation high forest : products for wood industry, rotations of fifteen (South Europe) to twenty five (North Europe) years, mainly poplar cultivations, importance of tree breeding and choice of clones (adaptation to site and climate, resistance to biotic factors, yield and wood quality), easy return to agricultural land.

- Short rotation coppice : biomass for energy, pulp, fibre board industries, seven to ten years long rotations, three or four rotations on the same stump, Populus, Salix, Eucalyptus, importance of breeding and adapted cultural techniques.

The above forest types are undoubtedly the most attractive for farmers, but must be completed by more traditional forest-types, based on long term rotations with a high multiple-use value, mainly to realize on public land or with substantial financial aid on big private properties.

Apart form the typical features, connected with **agricultural soils**, some other **specific constraints** are to be taken into consideration with the afforestation of intensively cultivated agricultural land.

- Mycorrhiza, essential for a good tree growth, are absent. On the contrary pathogeneous fungal flora, typical for many annual cultures, are present. Over-fertilization may provoke harmful diseases, even on long term.

- The abundance of nematodes, responsible for the "soil tiring" phenomenon may cause certain difficulties. It can accelerate some soil degradation processes, also induced by not well adapted tree species.
  Next to the agricultural linked pedofauna, the macro fauna can lead to more direct damage (e.g. field-mice and voles), that is difficult to combat.

- Weed control on former agricultural land, based on manual or mechanical treatments, is often very time consuming and therefore too expensive. Control with herbicides, especially before ploughing and afforestation, is technically possible. Their use is, however, rightly restricted for environmental reasons. There is need for a European officially confirmed herbicide list for forest use.

Teissier du Cros (1993) claims that farm forestry deserves special **breeder's attention.**
Indeed it occurs in a specific content, consisting in large spacing which induces high yield, unlimited expression of tree architecture, strong impact on wood quality, new competition factors (crops and cattle), unknown effects of biotic and abiotic adversities.
Breeding should focus on high wood quality broadleaves and conifers. Apart from the usual selection goals, it should also consider the architecture, because of its unlimited expression due to low stand density.
A first mean is the choice of provenance, especially for exotics. Twenty to thirty percent difference of volume increment between the best and the average provenance can be obtained for many forest trees. Moreover stem and wood quality too can be improved significantly. Further genetic improvement can be obtained by selection of plus trees in stands of local and exotic species. This way a series of clonal seed orchards, like for poplars, Douglas fir and Scots pine, can be established. Pardoz (1993) pleads for the extension of clonal forestry to eucalyptus, radiata pine and some other species.
Finally, biotechnology is also already applied in tree breeding. Although the methods are quite sophisticated, plus trees of wild cherry (Prunus avium) have been micropropagated. In France, for a few years as many as 200,000 trees ( 20 % of nursery production ) originating from in vitro propagation were outplanted in nurseries (Teissier du Cros, 1993). Schulzke referred already in 1981 to the economically superior triploid aspen clone "Astria".

Farm forestry and breeding should mainly focus on high wood quality. Therefore several broadleaved and conifer species are available: wild cherry, maple, ash, walnut, poplar, American red oak, Douglas fir and hybrid larch. But even in areas, where high biomass production is preponderant (e.g. Eucalyptus in Portugal, maritime pine in France, Sitka spruce in Scotland or lodgepole pine in Scandinavia), the raw material quality is important for its transformation into pulp (fibre length and pulping yield) or timber (bole straightness or wood resistance).

### 3.1.3. Benefits of non-wood forest products and services (N.W.F.P.S.)

Unlike to former times, the economic role of forests in the last century was essentially focused on wood production. But nowadays it becomes apparent that, at a macro-economic level the importance of wood production in European traditional forests is decreasing, leaving space for other products and services.
A major reason for this change is urbanization and the growing demand for environmental goods and services.
In the past, **NWFPS were often underestimated** in woodland planning as they were not subject to economic exchange (FAO, 1991). Reasons of this are the generally low level of statistical data and the difficulty of putting a monetary value on many of the non-material benefits from woodland. However, Cesaro et al. (1993) concluded NWFPS may play a remarkable economic role in stabilizing income from forest ownership and are important niches in many rural contexts, especially in marginal areas and in the Mediterranean region. This is partially explained by the short length of the productive cycle : unlike wood production, NWFPS are collected on an annual basis, with a few exceptions (e.g. cork), thus reducing the expectation time and the connected risks.
Within the E.U. the **economic importance of NWFPS** is clearly of most significance in the Mediterranean area (ECE-FAO, 1993).
In Italy, chestnuts, mushrooms, truffles, walnuts, acorns, blue berries, pine seeds, bark, strawberries and raspberries have a total value of 123,231 millions LIRE, of which the first three products represent respectively 46 %, 14 % and 14 %. Truffles and mushrooms are very worthwhile for some regions. The Alba area (Piedmont region) is very famous for the collection and processing of truffles, leading to the highest employment and income rates. Especially important is the economy that revolves around this activity (food, processing industries, restaurants, on-farm tourism, etc.) According to the FAO (Lamb, 1993), the potential for mushroom production (Boletus edulis) in a hectare of woodland in the Borgo Val di Taro area is equal to 250 USD per annum.
In Spain the value of hunting meat prevails, closely followed by fish and by cork. Worth mentioning are also : chestnuts, pine seeds, resin and truffles (UN/ECE-FAO, 1993).
Cork oak plantations in Portugal represent about 22 % of the country's forest. The production value may be estimated at about 313 USD/ha. Industries connected with cork include more than 600 operational factories with about 14 thousand workers (Casquilho, 1990). The production can be improved by provenance research, early selection and breeding and a more appropriate plant stock production (Pardos, 1993).
In the other parts of the E.U. the NWFPS are apparently of very little importance. The scandinavian countries collect berries and mushrooms in amounts that are economically significant, while the northern most forests are important grazing areas for reindeer.

In Finland only some 5 % of the annual production is harvested, mainly for household consumption. Commercial trade in lichens, used e.g. in the production of food additives and industrial chemicals, is substantial. Herding of semi-domesticated reindeer as meat animal is a lucrative business and most Finnish forests are important as reindeer grazing ground (Lamb, 1993).
The potential for marketing NFWPS lies at a regional and national level (Cesaro, 1993).

Soil conservation, watershed protection, recreation and game provided for hunting have always been **services offered by forests.** Over the past decades the interest in these services has increased. According to data, given in the UN-ECE/FAO study (1991), 15-20 % of the forest land is, for almost the whole of Europe (with exception of the Scandinavian countries) very important for soil protection, whereas another 20 % is of medium importance. The protection value of the forest, together with other services provided, is often considered much more important than the direct economic value of wood and non-wood forest products (Lust, 1992).

FAO (1991) makes the following **suggestions to encourage the economic role of NWFPS** in regional development :

- improve basic knowledge regarding the means of production, collection and processing of NWFPS;
- define standard methods for collecting data regarding the availability and production of NWFPS;
- solve trade problems by market research;
- promote adequate instruments for public financing of production of NWFPS.

### 3.1.4. Recreation and amenity forests

Among the forest services, recreation takes a special place. UN-ECE/FAO (1991) estimates that in Central and Northern Europe almost 20 % of the forest have a high importance for recreation.
In Denmark, Koch & Kensen (1988) found that approximately 90 % of the adult Danish population visit the forest at least once a year. The common Dane spends about 30 hours in the forest each year, spread over 11 visits. About 10 % of the population visit the forest more than 50 times a year, whereas about 25 % visit the forest 4 times a year.

Quite the same exceptional **recreation pressure** has been assessed in the Dutch and Flemish forests (Meeles, 1982; Lust 1994). In Flanders, with a forest area of less than 10 % but with a population density of 420 inhabitants per $km^2$, it is estimated that yearly some 74 million forest visits occur on a accessible forest area of 21,000 ha, meaning daily more than 10 visits/ha. It is obvious that such recreation levels exceed by far the carrying capacity of a forest ecosystem and do not assure anymore the basic needs of a sound recreation pattern.

People mainly like forest recreation because it provides peace, quietness and a varied nature.
Colly (1988) stresses, that a variety of biotopes near urban areas is an important factor in the personal development of many people, especially children. The general understanding of nature and the ecological consciousness grow through access and close contact to nature and frequent visit to forest and lands through generations. With this in mind, it is important that everybody, especially children, has access to a variety of biotopes close to their homes. For this reason **distance is very important.** Koch & Jensen (1988) pointed out that more than 2/3 of the forest visits occur within a radius of 10 km from home and 1/3 within a radius of 2 km.
Similar results were obtained in Flanders (Lust, 1994) : it was stated that the Ename forest is known by 92 % of the population living on less than 500 m distance from the forests, whereas only 10 % of the people, living further than 3 à 4 km from the forest, still know it.

The location of new forests should be in function of the recreational needs of the local and regional communities, especially in densely populated but scarcely afforested area's.

### 3.1.5. Grazing and wildfires as specific threats

Due to special historical and socio-economic conditions on the one hand and the mediterranean climate on the other hand, the Mediterranean zone faces specific forest problems, namely grazing by livestock and wildfires.
Although livestock and especially goats are considered as the main cause for the destruction of the mediterranean forest (Thirgood, 1981), Papanastasis concludes that **grazing is no longer a threat to new forests** in most mediterranean countries. On the contrary, the lack or complete elimination of such grazing appears to become an important problem.

Due to soil preparation a lush herbaceous or woody vegetation is established in the forage plantations which compete the young trees for nutrients and especially for water. In addition, it creates an ideal fuel for burning, thus increasing the fire danger of the plantation. Livestock can efficiently control such a plantation, if properly used (Papanastasis, 1982).

In all cases, where still conflicts exists, a compromise must be found to accommodate both demands, forests and livestock. The solution will probably be a modern agroforestry approach, that requires both technical and socio-economic information (Challot, 1990).

Fire is an inherent part of the mediterranean climate. It happens to act as an agent for mineralization of the organic matter, thus ensuring the nutrient cycling and consequently the functioning and stability of ecosystems (Papanastasis, 1993). Wildfires, however, caused by human action, are usually destructive as they expose the soil to severe erosion. Closely spaced monospecific plantations, created with highly flammable species, such as

pines and eucalyptus, partially explain the upward trend of the forest fires.
Wildfires are serious threats to new forests. Therefore Papanastosis (1993) pleads for **an efficient fire prevention**. To protect forest plantations from wildfires he recommends to take into consideration the following criteria :

- the species, besides being fast growing, should be also fire resistant (promotion of cork oak and common acacia instead of pines and eucalyptus);
- mixed forest plantations : monospecific forest plantations, especially with exotic species, are an ecological disaster;
- cost effective and ecologically sound methods to control the competitive understorey vegetation, including the proper use of grazing livestock;
- combination of widely spaced, fast growing and high timber quality species with livestock farming.

### 3.2. Environmental constraints

The protection of flora and fauna, often wrongly entitled as the ecological function of the forest, the promotion of an attractive landscape and the combat of the greenhouse effect are also objectives of the Regulation.
Therefore they require due attention and certainly a lot more than in the past.

#### 3.2.1. Sustainable biodiversity

Forest ecosystems in Europe have lost and still lose natural species (Lust, 1993). Natural forests do not exist anymore, and even semi-natural forests or mature forests are scarce. Clear-cutting systems, combined with monospecific reforestation, led to restricted successional stages. Also the fragmentation of the stable old-growth forests destroyed the natural biodiversity.
Opdam (1993) stresses the **extinction risk of isolated populations** in fragmented forest areas. Although it is only poorly known to what extent genetical erosion occurs in completely isolated populations, Lande & Barrowclough (1987) estimate effective population sizes of at least 500 individuals for populations to be genetically sustainable.
The question should be put how large should forest be to contain viable populations of all characteristic species. For the large and very large species the minimal habitat area, required for a single reproductive unit, is rather several hundreds or even thousands of ha. For this reason the forest area needed to house a sustainable community in isolation, can be assumed in the order of size of 100,000 ha. Esseen et al. (1992) underline the **value of old forest stages,** with a lot of decaying wood, for some small to very small sized species. The White backed woodpecker has territories up to 200 ha, and by consequence a local population of 20 pairs need as much as 4,000 ha of natural or little managed forest.
For the Siberian jay, they advise areas of unmanaged forests of about 2,000 ha. Also small organisms, like forest insects and lichens, which are strictly bound to the pristine

forest, have been almost completely lost from managed forests, as they cannot cope with the dynamics caused by short clear cutting rotations.

However, such big forest areas are not strictly necessary for the **development of all successional stages**. Based upon research in remaining European "natural" forests, Koop (1981) suggested the following minimal areas as indispensable for the development of all structural phases in spontaneous forests : 10 ha for Oak-Hornbeam forests, 25 ha for Milio-Fagetum and 40 ha for Oak-Beech forest.

Tack et al. (1993) found positive correlations between the occurrence of plant species and the size of the forest area, in particular for the rarer species. As the area increases, the number of plant species also increases. However, the minimum forest sizes differ from species to species. It is therefore difficult to give a practical threshold which can be used for afforestation planning.

There are big **differences between ancient and recent forests** from the conservational point of view. The floristical and phytosociological significance of recent forests is very limited. Typical woodland species are absent. These species have only a limited reproductive capacity : they have large and heavy seeds, permanent seed banks are rare and short distance dispersal is the rule. It explains why many of them usually fail to colonize recent forests. New forests have many species from the former non-woodland communities. A lot of them are highly competitive, such as Urtica dioica, Holcus mollis, Rubus fructicosus, Epilobium angustifolium, Aegopodium podagraria, Molinea coerulea, etc. In recent woodlands or when invading ancient woodland, they tend to hamper the colonization and/or survival of ancient woodland species.

Tack et al. (1993) also stress the **importance of relict populations of woodland species** in small landscape elements (e.g. hedges) and even in grasslands. These refuges are an important starting point for a successful colonization of newly planted forests adjacent to these populations. Peterken & Game (1984) found that the occurrence of Mercurialis perennis in recent forests depends on the proximity to refuges in wood-relic hedges and in ancient forests. In general they noticed that recent forests, which have a physical contact with ancient woodlands, are significantly richer in species than isolated recent forests.

Similar problems as with flora in new forests are put by the fauna. Experiences have shown that **new forests impede the settlement of typical animals of the more mature** stages. The development is restricted to forest animal communities associated with the initial and intermediate forest stages. Telleria (1992) even considers the result as disastrous, when new forests are established on valuable faunistic biotopes. Nevertheless he (1993) concludes that afforestation may become a valuable tool for the recovery of forest fauna if two related ideas progress :

a) the need of clear objectives of fauna recovery in combination with other interests;

b) the improvement of methodology needed to reach the objectives.

Telleria (1993) distinguishes four criteria that should be considered when planning the role of new forests as fauna biotopes :

- Habitat suitability. In this respect it is important to determine in advance the species that should be favoured, conscious of the different requirements put by the animals linked to the initial stages on the one hand and to the animals typical for all the successional stages on the other hand.

- Size. It is known that the ability of forest animals to colonize and persist tends to decline as forest size falls. The size of the plantation can be a serious limiting factor in the reconstruction of the forest and its associated animal species.

- Isolation. A part of the ability of new forest to reestablish fauna depends on their degree of isolation. The speed of recolonization depends on the distance of the plantations from the source of the colonizers.

- Regional impact. Afforestation affects the fauna of the deforested land. The implications of such sudden landscape changes on fauna conservation must be analyzed in more depth. The risk exists that intensive reforestation seriously endangers the regional survival of species that are exclusive to these biotopes.

### 3.2.2. Adaption to the landscape

One of the objectives of the Regulation is to contribute to the management of the countryside. Forestry and Forest Acts have also to take into consideration the landscape function, as it happens in Denmark, but not in Flanders.
Actually the landscape value refers to two topics : the aesthetic development of the forest itself and the adaption to the landscape.
Nilsson (1993) explains **the basic terms in landscape aesthetics**.

- Form : distribution of the forest in proportion to the landscape forms. For example, is afforestation parallel or perpendicular to the height curves ?
- Pattern : Distribution of the forest in relation to the roads and boundaries of the landscape. Does the edge of a wood follow roads and streams or does it cross them ?
- Scale : the size of the forest stands in relation to size of other features in the surrounding landscape.
- Colour and texture : the colour and appearance of the forest trees compared to the landscape at different seasons and lighting. It is determined by the diversity in tree species and age distribution.

He also points out that contrast is another term of importance and stresses the decisive role of contrast in form, pattern, scale, colour and texture.

The Irish Forestry Operational Programme recommends the following **landscape guidelines while establishing new forests** (Gardiner & Ni Dhubhain, 1993) :

- The design of the forest should take into account the form and margins. On hills and mountains planting should conform to the overall pattern in the landscape, whether natural landform or field patterns. Overall straight or horizontal lines or geometric shapes should be avoided.

- Importance of diversity and open spaces. Variation leads to a rich flora and fauna. It is established through different tree species of different age and size, dense scrub and standard trees, glades and dense vegetation, etc. Radical actions like clear felling should be avoided. Small scale regeneration leaves a forest of great variation in age and density.

- The scale of planting : large open uplands are more suited to relatively large forested areas, while smaller more regular shapes may fit in better with a lowland pattern of fields and hedgerows.

### 3.2.3. New forests in function of climatic change

The net annual $CO_2$ emissions into the atmosphere during the last decade amount to 3,3 Gt. Atmospheric $CO_2$ concentration increased from a pre-industrial level of 280 to a present level of 350 ppm. Presuming a constant increase over the coming 50 years, a doubling of the original $CO_2$ concentration might happen round about the year 2070. (Muys & Lust, 1993).
Although various, partly contradictory, scenarios for global climatic change have been proposed, it is quite probable that an increase in temperature will occur. This will have a **tremendous impact on ecosystems and communities.** Zalvinski & Davis (in Opdam, 1993), modelling the movement of tree species northward in North America, have shown that species may move 500-1000 km north, assuming a doubling of the carbohydrate concentration in the atmosphere.
Forests can play a double role in the climatic change problems. On the one hand they act as an important carbon sink and on the other hand they facilitate the dispersal and establishment of species, forced to move northward by climatic change.
Forests can be used in several ways to **mitigate global warming.** Besides forest conservation and an adequate use of forest products, forest extension is a well suited mean to combat greenhouse effect and absorb carbon dioxide.
Forests although they cover only 30 % of the land surface, contain 90 % of the carbon stored in the living biomass and play a key role in the global C dynamics. It is nowadays thought that forests yearly absorb 2 Gt C, released in the atmosphere by human activities. The absorption mainly happens by the forests of the temperate and boreal zones and is partially explained by afforestation activities and partially by $CO_2$ fertilization.

Afforestation of 10 to 40 million ha of surplus agricultural lands in the E.U. could mean a significant contribution to the decrease of the greenhouse effect. Afforestation of fertile arable land with a short rotation (poplar type plantation) provokes a net carbon increase from 2 to 12 kg/$m_2$, thanks to an increase in both living biomass, wood products, detritus and soil. On the contrary, afforestation of peatland, a common practice in several (European) countries, leads to significant carbon release, as it is always coupled with dewatering, provoking aeration and decay of the peat layers (Muys & Lust, 1993).

## 4. PLANNING NEW FORESTS

After more than 30 years of Common Agricultural Policy, the Commission finally came to the conclusion that the conservation and the extension of forests are a central problem in the E.U. New forests should be established mainly in abandoned and set-aside agricultural land (Anz, 1992).
The question rises to what extent such new forest policy must be regulated. Although an over-regulation should be avoided, accepting that a comprehensive planning is not possible and even not wanted, it is desirable to formulate an afforestation strategy. A policy must be pursued both on a European and a regional level.
The main topics concern the amount, the objectives, the location (and size), the time-scale and the accompanying measures. Of course all this topics are partially interrelated.

### 4.1. Amount of new forest

A first important, but very disputable topic concern the amount of needed or desired new forests. The objective, as formulated by forest politicians, to strive for a forest area of 30 % in the lowlands and up to 50 % in the highlands, can just be considered as a theoretical guideline, that certainly must be adapted to regional constraints.

Mainly **two elements** seem to be of **significant importance** :

- The need of agricultural areas. As overproduction of agricultural products poses presently huge problems, it is claimed that less than 50 % of the present agricultural area is really needed for the production. In that case enormous areas could be, at least theoretically, afforested. The number of farmers will certainly still drastictly decrease, even in areas where the farmer population already dropped under 5 %. On the other hand more agricultural area is needed for environmentally friendly production systems.
  Anyway, the present state of knowledge permits to conclude that the potential forest area is not restricted by pure agricultural production systems.
  In this respect socio-economic items will prevail.

- The development of the society. Despite some official predictions, it looks uncertain how large the population density will be within 50 years.
  Nevertheless the need to forest products and services is likely to increase significantly. The human population development will differ from place to place both in number and social-status. Regional differences will be strengthened and require an appropriate approach. Population density and land use patterns are dominant factors. A regional policy must be set up.

The amount of wanted new forests is not a question of available area. It requires a thorough research on needs and possibilities, on a regional level, and suited accompanying measures.

### 4.2. Objectives for new forests

Although the overall objective for new forest should be **multiple use forestry,** local and temporary accents will play a major role.
The nature of ownership will be determinant for the extent of individual or social interests. The realization of a financial net-return on short term is a justified demand of private farmers. The protection of threatened sites is mainly restricted to mountainous regions, but forest will also be needed in the context of water supply. In many densely populated urbanized areas, the recreation and educational forest function requires urgent measures. And the contribution to a forest ecosystem network, to increase the conservational value, may not be neglected.
Moreover, farm forestry is faced with the **conflicting problems** of potential temporary forests on the one hand and durable development on the other. Although the continuous change of land use in the past and the explicit goal of set aside, it should be surprising to see that new forests will be transformed back towards agricultural lands.
One should also not forget, that **forestry objectives can change** in a relatively short term. Specific goals, such as the production of well determined forest products or the return to agricultural land, can be completely surpassed within twenty years. Therefore, new forests should not be too much unilaterally directed.

### 4.3. The location of new forests

It is likely that the most practical question will focus on the location of new forests. In theory, independent from social aspects (the occupation of the land by a user, e.g. a farmer), a lot of considerations can be made.

In this respect can be referred to the very interesting research of Hendriks (1993) about a regional analysis of **physical forest production potential** in the European Union. Different land use scenarios were developed using a model, taking into account Land Use Types and relevant Land Qualities, which are derived from a combination of Land Characteristics.

Due to significant differences in ecological requirements and yield potentials, three Land Use Types were distinghuised :

- fast growing tree species such as poplar, willow and eucalyptus; they need a high soil moisture and nutrient supply;
- normal growing more demanding tree species, such as european silver fir, western hemlock, ash and beech;
- normal growing less demanding tree species, mainly Pine species, such as Scots pine, Corsican pine, Austrian Pine and maritime pine, but also deciduous species, such as birch and oak.

Some relevant conclusions, on the E.U. level, were drawn from this study :

1. The land suited for forest production within the E.U. is more than three times the present area covered by closed exploitable forest (i.e. 17 %). A large part (1,083.000 $km_2$ or 48 %) is suited for less demanding tree species, while severe limitations occur on 52 %, mainly caused by severe soil water deficit (40 %).
   A smaller part (28 %) is also suited for normal growing more demanding tree species. Here, on 72 % severe limitations prevail, of which a severe soil water deficit (36 %) and a poor natural fertility status (25 %) are the most important restriction. Almost the same results are valid for fast growing tree species : 27 % of the land is suited and the restrictions are severe soil water deficit (38 %) and poor natural soil fertility (30 %).

2. Taking into account all land qualities, the southern regions of the E.U. are best suited for less demanding tree species, resisting to long periods of drought, normal growing more demanding tree species can be planned in the central region, while fast growing tree species can be best grown in the central regions of the E.U.

The above results are very valuable on the one hand (providing interesting information) but on the other hand the options look very dangerous. Indeed they mainly result from a strictly monofunctional point of view, neglecting all conservational, recreational and landscape considerations. For this reason too, they do not correspond to the present Land Use Types and the afforestation practices (e.g. *Eucalyptus* in Portugal).

From a general forestry point of view (including all multiple-use aspects) some valuable **recommendations** are easy to formulate.

1. **The connection with existing woodlands.** The increase of individual forest areas, both ancient of recent forests, highly contributes to the realization of the different aspects of the multiple-use forestry objectives. Especially the extension of ancient woodland is supported by conservationists, because it facilitates the colonization of plant and animal species and, consequently, it favours biodiversity.

2. **The restoration of ancient woods**. Peterken (1993) pleads for the creation of new woodlands on land which until the last 300 years carried ancient woodland. He especially pleads for the restoration of floodplain forests.
   The planting of floodplains of larger rivers would have many ecological advantages and would generate a distinctive, highly productive form of hardwood forest.
   These forests would fill a major ecological gap in the range of ancient woodland types and act as landscape-scale between ancient woods and new woodland.

3. **The connection of fragmented forest areas.** There should be a plea for a European network of forest ecosystems (Opdam, 1993). The network should permit the functioning of population networks of forest species, both for the large mammals and birds and for the specialized species of old-growth. At the same time, the network must form a landscape which permits the expansion of these species northwards, in case of

the expected climatic change. In this respect, one option is to design north-south directed belts with a high forest density throughout Europe, composed of core areas of forest which includes big core patches (at least hundreds of hectares) of unmanaged old-growth forest, smaller forest patches up to tens or hundreds of ha and narrow forest belts of 50-100 m wide.

4. **Creation of (recreation) forests near urbanized areas.**
   Priority must be given to the establishment of forest areas in regions with an obvious lack of outdoor recreation facilities. As a rule of thumb it can be accepted that 1 ha accessible forest per 100 persons is needed. It clearly means that a city of 250.000 inhabitants requires an accessible forest area of some 2.500 ha in the vicinity of the city. This area can be achieved in one or several locations, with the possibility of connection-patches.

5. **Protection of threatened sites.** Next to the classic mountain region, due attention should also be paid to afforestation of water winning areas and to very scarcely afforested areas. All regions with an afforestation index below 10 % deserve priority.

The forestry point of view, however, will often **conflict with the vision of** other sectorial plans, mainly of course with the **farmers**. The latter strive above all for a reasonable financial income. Consequently a resistance against afforestation can be expected as long as it causes financial losses. The farmers attitude towards forests is also determined by its familiarity to the forest. In regions where farm forests are not custom a great resistance is to be expected, the same as in regions where the market value of the land is unreasonably high. Landowners fear that afforestation will strongly diminish the market value of their lands. Farmers do not understand why they have to leave rich and well managed agricultural lands for unproductive and wild forests.
Policy is confronted with the question of **natural land quality**. Afforestation of poor (marginal) sites likes to be the most reasonable approach, yet the highest income can be reached on richer soils, with fast growing species. The least resistance is to be expected on farms without direct successor when the present farmer will retire. To realize such policy a long term strategy should be taken in mind.

Forest extension can also **conflict with some conservational visions**. Indeed, afforestation of conservational valuable sites is often entitled as disastrous. In Flanders, conflicts focus especially on floristicly rich meadow lands and on bird protection areas. Both zones often coincide with valley areas, leading to the following conflicting situation. The area is not attractive for the farmer, who is willing to leave it for afforestation. For this purpose he is supported by the forester, who normally likes to afforest all available areas. Yet, this area is claimed by nature conservation, aiming at a traditional or extensive agricultural land use, unliked by the farmers. It is evident that justified policy in this areas should be based on the weighing of the interests of all parties involved. Foresters will stress herewith, that the overall value of a forest is more than species protection and that even new forests, provided they are established on an close to nature basis, can generate many ecological and conservational advantages. In this respect it can be desirable to refer to Peterken's point of view concerning the restoration of floodplain forests.

The **size of new forests** is often treated in connection with the location. Anyway the size is of minor importance, at least when the location is right. Large scale afforestations are not to be expected as a general rule. Their realization, e.g. needed as recreational forests, will require special measures.
Anyway the reafforestation programme should avoid a meaningless further fragmentation of the landscape, keeping in mind however, that small woodland elements also can fulfil their role in a sustainable network. Therefore it is doubtful that restrictions on minimal forest size should be imposed.

### 4.4. Accompanying measures

The implementation of a vast reafforestation programme, based on farm forestry, will need appropriate accompanying measures of different nature.

1. **Above all the amount of direct financial aid** will be significant. In this respect, it appears that the maximum eligible amounts of aid, as fixed in the regulation, are promising. Yet, the different regions have to implement the provision and so they can strongly affect the results. By restricting e.g. the annual premium to cover losses of income to five years, instead of the possible twenty years, as proposed in Flanders, afforestations are discouraged.

   However, the agricultural aid programme will probably further prevail the Common Agricultural Policy. For this reason the farmer will not be inclined to afforestate by his own free will.

2. **Afforestation** of agricultural zones should be supported by legal provisions. Yet in reality it is **often forbidden by law.** Agricultural zones are protected and must keep their present destination. The Tenant Act hampers the afforestation of agricultural land. In Flanders, afforestation requires the agreement of both landlords and tenants.
   It also requires the approval of the local authorities, and in ecologically valuable sites also a favourable advise of Nature Conservation is needed.
   A successful action requires simple and clear rules.

3. **Logistic support** should be provided on all levels. The farmers must be advised and assisted both on technical and administrative problems : financial expectations, administrative regulations, afforestation techniques, maintenance and management, etc. Herewith flexibility could be a key word. Significant results can only be expected by a permanent education.

The management must be kept simple and therefore it risks to tend to plantation forestry. However **some principles of a close to nature forestry** should always be taken into consideration.

- sustained production of various wood products;
- "normal" age-class distribution;
- species mixtures of native trees and shrubs;
- regeneration by natural seedlings or by coppice.

This means that habitats and production must be diversified.
In this way Peterken (1993) pleads also for a combination of grazing and tree-growing.

### 4.5. The time-scale

Significant changes in land-use cannot occur suddenly. Both the transformation from forests to agricultural land and the reverse are **long-lasting processes.** At least one farmers generation must be taken in mind. The transformation rate will also be determined by the socio-economic evolution of both the rural and the non rural population.
The European Parliament claims for an afforestation goal of 10% of the existing agricultural land before the year 2000. This seems completely unrealistic and probably even not feasible. In this way the forest area in Flanders should increase with more than 50 % in less than 10 years.
The extremely successful reafforestation programme in Denmark needed more than 100 years to increase the forest area from 2% up to the present 10 %. It is expected that the forest area in 100 years again will cover 20 % of Denmark. Danish Parliament aims at a doubling of the forest area during one tree generation (Nilsson 1993).

## 5. GAPS IN KNOWLEDGE

A significant extension of the European forest area, especially by the afforestation of abandoned agricultural land is still hampered by a lot of gaps in knowledge, relating to different topics, such as : socio-economic involvement of the farmers, afforestation techniques and forest management, integration in landscape, environment and nature conservation. A major problem is undoubtedly related to the profitability and the income of the farmers.

- The rural population must be involved in the implementation of the afforestation programme. The silvicultural systems must be integrated in the farm practice.

- Different soil problems must be solved: forest potentiality of the site, soil compaction, absence of mycorrhiza, nutrition status, presence of toxic elements, development of competitive vegetation.

- Specific maintenance problems ask due attention: prevention of fire, grazing, control of pests and diseases.

- Selection of tree species adapted to farm forestry : disponibility of genetic adequate reproductive material, studies on control of provenances and seed, development of clonal forestry, breeding of existing and new species for large spacing.

- Requirements of silvicultural nature : development and application of silvicultural systems suited for yield, wood quality, combination with crops and cattle; development of ecologically sound methods.

- The realization of a multiple-use objective, integrating the farm forest in rural planning, landscape management and nature conservation. Many questions are waiting for an answer (Opdam, 1993; Hermy, 1993, Telleria, 1993, Peterken,1993) :
  . standards for minimum areas of units in the forest ecosystem network, for the maximal distances between the units and for the maximal size of the forest networks;
  . relationship between the size and species distribution of forests and the persistence of network populations of the species;
  . location of bottlenecks in the permeability of European landscapes to forest interior species;
  . historical-ecological knowledge;
  . remedies to enhance the colonization success of woodland species;
  . knowledge about the autoecology of animal species and management techniques for their populations;
  . optimal patterns of inserting new woods into landscapes.

## 6. SUMMARY

The E.U. aims at an increase of a spatially well structured forest area by the afforestation of superfluous agricultural land, while providing the rural population a viable income without neglecting the multiple use function of the forests.
The new forests show major differences with the former afforestations. They will be established on rich soils and are supposed to have a temporary character.
A well considered afforestation strategy must be developed based on the one hand on socio-economic and on the other hand on environmental constraints.

The great challenge consists in maintaining the rural population. Forest types and silvicultural systems must assure a reasonable profitability, also favoured by use of exotics and by breeding technology. Non-wood forest products and services can significantly contribute to rise the forest value. Especially recreation forest near urbanized areas are highly evaluated. Grazing and mainly wild fires, however, can threaten the often too artificial plantations, already threatened by natural features.
New forests are faced with the objective of sustainable biodiversity. Big differences appear between ancient woodlands and new forests. The latter impede the settlement of typical forest species, either plants or animals. Adaptation to the landscape will become a non negligible criterion. The contribution to mitigate the global warming may not be underestimated.

Establishment of new forests requires an adequate planning. Several questions have to be solved, based on a regional approach with respect of the overall objectives.

- The amount of new forests must be fixed. This answer will strongly differ according to regional potentials.
- The forestry objectives are faced with the different wishes of interest groups and the continuous changes in the society needs.
- Several valuable recommendations can be formulated for the location of new forests :
  . connection with existing woodlands;
  . restoration of ancient woods;
  . connection of fragmented forest areas;
  . creation of forests near urbanized areas;
  . protection of threatened sites.

A successful afforestation strategy requires appropriate accompanying measures, such as a direct substantial financial aid, encouraging legal provisions and a comprehensive logistic support. Planning must be aware of the long term processing, characteristic to land use changes from agriculture towards forestry.

The implementation of an afforestation programme is still hampered by many gaps in knowledge, related to all aspects involved : socio-economic and environmental constraints and forestry techniques. Research is a valuable accompanying measure for the realization of a successful afforestation strategy.

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