

## Ecotechnologies in Silviculture

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### Abstract

In european silviculture, forests have been managed, for the last 200 years, following the principle of the wood production continuity (durability). Forest management uses special ecotechnologies involving territorial organisation, planning and execution, regeneration, then attendance and protection of stands over long periods of time (more than 100 years). Several such technologies are described.

**Key words:** forest ecotechnologies.

### Introduction

Silviculture is an important economical branche, which, by a reasonable management of forests, ensures the production of numerous goods, especially wood, but also environment services which only forests can generate.

Silviculture, as a science and a practice, emerged in Europe in the late 1700's-early 1800's, when forests in the west of the continent were in a desastruous state and wood production was very low (Hartig,1791, Cotta, 1813).

In order to restore forests, early silviculturists conceived a management system by which they pursued to obtain a continuous , high and valuable wood production, by a special spatial organization of forests and a long term management of natural ecological processes within tree populations. The way trees grow – by annual accumulation of a thin layer of wood – and the fact that it takes at least one century for large-sized trees with valuable wood (which can have numerous utilizations) – were taken into account. Meantime, in order to ensure permanent economic resources for the management of forest administrations, forests must consist in tree populations of all ages and sizes, suitable for exploitation.

This was the principle of continuity in wood production, which is at the basis of european forestry for two hundred years, and is now called – not quite

correctly – durableness. This principle can only be implemented if the permanence of a forest is ensured, as well as that of its management (Leahu 2002).

Since its beginnings, European silviculture also laid stress on the promotion of technologies meant to hasten and direct natural ecological processes in forest ecosystems: the regeneration process – i. e., the formation of new generations after old trees have been cut down, as well as the process concerning the attendance and long term supervision of these generations, until the age of exploitation.

French silviculturists have illustrated this by a dictum: "imiter la nature, hâter son oeuvre" (imitate nature, quicken its work) (Lorenz 1837).

It is obvious that European forestry has worked and still works with technologies which take into account the specificity of ecological processes within forests – and are hence genuine ecotechnologies.

But human society was – and still is, more and more so – interested not only in wood production, but also in the special role played by forests in generating and preserving environment, through the many services they bring: regarding atmosphere (diminution of CO<sub>2</sub> concentration and increase of oxygen one); regarding climate (moderation of termic, hydric and wind extremes); regarding hydrology (decrease of surface drainage and redirection of meteoric water towards the phreatic zone) as well as flood prevention, regarding edaphic services (soil formation and its protection against erosion), and – last but not least – regarding medical and leisure services, more and more requested by society.

In order to ensure these benefits, tree populations and forests as a whole must have a certain spatial structure, which can be generated, too, by utilizing ecotechnologies (Donita et al, 2006).

The present system of forest management – characterized by continuity and the implementation of ecotechnologies – which is also utilized in Romania, has two components (Doniță et al, 2006):

- the territorial organisation of forests and planning of the necessary works by means of adequate ecotechnologies; it is what is known as forest planning;
- actual implementation of ecotechnologies, implying the regeneration of tree populations in places where old trees have been removed from, the attendance of ensuing seedlings, the management of tree populations of different ages, protection of trees against pests; it is what is called forest cultivation and protection.

Territorial organisation of forests is done at geographic and forest cover levels, on rather large areas (500-2.000 ha), so that tree populations of all ages can be included and the continuity of wood production can be ensured, as well as environment services and financial support (Leahu, 2001).

This area is divided by plots (subplots), in consistence with the ecological specificity of forests, i.e. the types of ecosystems that make up the forest cover (Leahu, 2001).

An ecological description of these plots is then done: the type of station, the type of the forest, the type of soil and the characteristics of the stand (the constitutive populations, their percentage, their capacity of production are established).

These elements are the basis on which management procedures are established, as well as ecotechnologies which must be applied, considering the actual state of the forest, taking into account stands' productivity, the quantity of wood which can be turned to profit each year and which must not exceed the production of stands within the whole forest district.

All these data are listed in the management study which, after a thorough examination and the approval of the Forest Central Department, is sent to forest administration to be carried out. The study contains the planning of works on 10 years and is periodically renewed for updating, according to the current ecological state of the forest.

The apposition of management forecasts in forest administrations is done at ecological level, that is, by types of ecosystems, using the ecotechnologies established on the basis of long term research and experimentation.

The utilization of these technologies for natural regeneration, which starts with seeds of trees having reached exploitation age, seedlings issued from regeneration are attended to and, along several decades, the composition and the density of tree populations are selected, as well as the valuable tree specimens.

If necessary, special ecotechnologies of pest control are applied, especially by biological and integrated methods.

Regarding game cultivation, ecotechnologies aim at selection, feeding and pest control.

Natural regeneration ecotechnologies are carried out by a certain way of cutting down old trees and are differentiated according to the autecologic peculiarity of tree species; special attention is paid to the demands of saplings for light and the necessity to protect them against frost.

The main ecotechnologies used for natural regeneration are (Florescu 1991, Doniță et al., 2006):

- the ecotechnology of continuous regeneration in forests comprising trees of all ages on the same area, when trees having reached a certain thickness are removed each year – or once in several years – and in the resulting small clearings groups of seeds are strouting; this is the „unevenaged forest” regeneration and is applied in the case of trees which, as seeds, are shadow-tolerant (beech trees, fir trees).

- the periodical regeneration ecotechnology, (applied, as a rule, once in 100 years); it is suitable for forests with trees of the same age, and consists in a gradual, uniform clearing of the old population followed by the development of seedlings on the entire area; this is the „regular forest with succeeding cutting” regeneration, applied in the case of species with shadow-tolerant seeds (beech trees, fir trees).

- the periodic regeneration ecotechnology, applied once in 100 years, too, but by an irregular (in patches) clearing of old populations; the patches are then gradually expanding; it is the “regular forest with in-patch (progressive) cuttings” and is suitable for trees which, as seeds, do not tolerate shadow (species of *Quercus*, *Pinus*, *Larix*).

Ecotechnologies used for seedlings’ attending consist in eliminating shrubs and grasses which compete the newly emerged plantlets.

Ecotechnologies used for thinning tree populations during their secular development consist in directing the composition and density of seedlings in order to stimulate the growth of the best specimens (valuable trees) belonging to the desired species. Other species, as well as specimens with deficient trunks or treetops, as well as sick specimens and those which compete valuable trees are eliminated by clearing .

Ecotechnologies driving tree populations are differentiated by their developmental stages.

Ecotechnologies used for handling tree populations are differentiated by development stages of trees. By using these ecotechnologies, rather large quantities of exploitable wood are obtained; in unattended forests, this wood would be lost due to natural clearing or decomposition.

In the self-regulation of the trees, it is taken into account that their structure can also provide the environmental services for which they are intended, according to the functional zoning of forests (Doniță et al., 2006).

In regulation of stands density, the fact that their structure is a guarantee for the environment services they are meant for, in consistence with the functional zoning of forests, must be considered.

Technologies of wood cutting and its delivering to transport roads are important for the conservation of the forests’ capacity of production, mainly for soil, seedlings and old trees which have not been yet cut down.

Many of these technologies are not yet ecological ones, but some of them do not harm forests (e.g., the use of cable installations or helicopters for trees removal).

An essential requirement for applying in due time all these technologies – without disturbing the forest – is the presence of a dense enough (at least 20-25 meters per one ha of forest) transportation network (Doniță et al. 2006).

In conclusion, we can assert that, since its beginnings, european silviculture has been conceived and implemented with the purpose of ensuring the continuity of wood production and afterwards of environment services by means of ecotechnologies, which are hastening and controlling natural ecological processes within ecosystems which form the forest cover.

Silviculturists payed special attention to the promotion of autochtonous, naturally regenerated and cultivated in an ecosystemic environment, as little contaminated as possible, tree species, for a peak utilization of productivity and of self-regulation within forest ecosystems, as well as to the forests' capacity of generating and protecting environment.

### References

- [1] Cotta H., 1813 – Grundriss der Forstwissenschaft.
- [2] Doniță N., Borlea F., Turcu D., 2006 – Cultura pădurilor. Eurovit, Timișoara, 367 p.
- [3] Florescu I., 1991 – Tratamentele silviculturale. Ceres, București, 256 p.
- [4] Hartig G., 1791 – Anweisungen zur Holzzucht für Förster.
- [5] Leahu I., 2001 – Amenajarea pădurilor. Ed. Didactică și Pedagogică, 420 p.
- [6] Lorenz H., Palade A., 1837 – Cours élémentaire du culture des bois.