

Ecological reconstruction of *Pinus nigra* spp. *banatica* stands from the South-Western Romania

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Abstract Current work approach the ecological reconstruction of *Pinus nigra* spp. *banatica* stands affected by forest fires in southwestern Romania, respectively across OS Baile Herculane. The amelioration perimeter in the study is located in Production Unit no VI, management unit no 108 B, with an area of 25 ha. The paper relates to the material and methods for working on ecological reconstruction of these stands, by following all steps from seeds collection and saplings production to afforestation works. Results and conclusions of the ecological reconstruction of *Pinus nigra* spp. *banatica* stands, refer to the successful of these works and also to caring works required in order to this work be a success.

Key words

ecological reconstruction, Banat black pine, *Pinus nigra* spp. *banatica*

Biodiversity conservation of ecosystems of Banat black pine on their existence was main premise on ensure the ecological stability in these extreme conditions.

The action of destabilizing factors, such as abiotic (fire, strong winds, droughts, snow abundance, etc.), biotic (fungal and insect attacks agents, etc.) and anthropogenic (abusive and uncontrolled grazing, tourism unorganized, etc.), contributing to structural disturbance of stands, worse even degradation of ecosystems, had a impact, acting in protection function of these forests.

The restoration of a degraded land is a complex process that takes place over time, depending on the conditions provided in the field by different previous actions (1).

Restore their state of biodiversity and restoring ecological balance that ensures optimal functionality of the forest from the area of *Pinus nigra* spp. *banatica* has been a concern of forest researchers in our country.

Such studies, which are based on the reintroduction of Banat black pine in areas with rocky limestone were initiated by I. Musat (1977), V. Popa - Costea et al (1980) and E. Untaru etc. (1980).

The difficulty of afforesting these areas with specific conditions leads to scientific analysis of how the installation of forest vegetation in critical biotopes.

We mention that reintroduction of forest vegetation in these areas is difficult to be done, because the excessive erosion creates a antithesis between climatic and edaphic factors and with extremely reduced possibilities to satisfy the optimum of ecological requests of plants, as a result of soil humidity deficit and in consequence to assimilate at maximum the solar heat and light.

In their evolution, these ecosystems reaches rapidly to the state of ecological balance, which are then conserved by auto protection and auto adjustment mechanisms, by realizing in consequence, the attributed functionality, at superior parameters.

After a lot of authors, the scientific and theoretical sense of ecological reconstruction consist in achievement or closing to natural structures corresponding to the natural and fundamental type of forest. But in present and not just in our country, is admitted that once produced the modifications in ecosystem and also considering the influences of climatic changes, the initial state of stand is hard or impossible to reach in many forests. Because of these, in these situations, the trend is to tends to „natural-potential” structures, optimize and adequate for new conditions in order to fight with stress and disturbed factors (5).

In the works of ecological reconstruction the accent is on the phytocoenosis rehabilitation, without neglecting the reconstruction of natural biodiversity.

Material and working method

In the Production Unit no VI – Domogled, management unit no 108 B, the ecological reconstruction and remaking of natural balance using afforestation affected by forest fires in 2000 is necessary taking into account forest ecosystem degradation after auto adjustment limit or considering an slow auto adjustment toward the necessity of rapidly and efficiently ensuring the self protective function.

The ecological reconstruction area is of 25 ha and the opportunity of interventions with afforestation works is determined by attenuation of climatic

adversities and by progressive amelioration of lands, avoiding the degradation of these areas by erosion.

Effective execution of afforestation works involves the steps shown below:

Seed collection of Banat black pine (*Pinus nigra ssp. banatica* (Borb.) Novak) is made from forest genetic resources with code RG – PINB/MJ, CR – D130 – 1 named Jelerău and it is placed in Baile Herculane Forest Department, Production Unit VI - Domogled, management unit 89A, on a surface of 6,84 ha from a totale of 22,89 ha. It is located in a stand

originated by natural seeding, with the age of 100 years, production class III, 0,7 consistency, relatively uneven age. To avoid contamination of seeds with genetically inferior foreign pollen around RGF is created a buffer of 60.4 ha, respectively management units 88B, 89B, 89C and 100B. Banat black pine cones ripen in the second year. Their harvesting is made directly from trees from October to February. The seeds of 5-8 mm long, oval-elongated brown (Fig. 1) are extracted from cone into the heated chamber at a temperature of 30-40 ° C.



Fig. 1 Banat black pine cone and seeds

Production of seedlings with protected roots must take into account the nature of the substrate and the characteristics of geomorphological conditions that impose for installation of future Banat black pine stand, the adoption of an afforestation technologies for ensuring ecological stability for substrate by efficiently capitalizing of critical stational conditions.

Afforestation technology using Banat black pine seedlings, transplanted in polyethylene bags, ensures the fulfillment of desire above.

Having into account that in Baile Herculane Forest Department are not nurseries with a surface that can ensure the production of 125000 Banat black pine saplings transplanted in polyethylene bags for integral afforestations, by care of Caras-Severin Forestry Department, the production of sapling was made in Brăduț nursery from Bozovici Forest Department (Fig. 2).



Fig. 2 Banat black pine seeds sowing in the Brăduț nursery solarium

Performing afforestation works have been made using a regeneration formula and planting scheme appropriate for rough terrain. In the stationary and cruel conditions from the management unit 108 B was the need for plantations with a minimum of 5000 sapling per hectare, corresponding for a plantation scheme of 1 X 2 m. For afforestation on the surface of 25 hectares by integral plantations they was necessary a number of 125000 sapling of Banat black pine. If we consider the necessity of completions works in the next 2 years, for an equivalent of a surface of 12 ha, the number of sapling necessary is supplemented with 60000 sapling more. Before starting the afforestation works on the surfaces for afforestation, was need the terrain cleaning in order for execution the afforestation works. The purpose of terrain cleaning for execution of

afforestation works is the removal of burned trees and shrubs resulted from forest fire and also if is possible, the removal of rocks and scree, so that a larger surface to be afforested by artificial regenerations.

Wood material resulted from burned trees and shrubs after knockdown and cutting in sters wood, have been collected with arms and stored in piles on the stumps.

Also, preparing of surface for planting consist in partially cleaning of terrain by removing the rocks and scree on 30% from the total area for afforestation, respectively on approximately 7,5 hectares.

Finally, the optimal cleaned surface (Fig. 3) for afforestation works, with Banat black pine saplings in polyethylene bags, was approximately of 25 hectares.



Fig. 3 Terrain prepared for afforestation (Production Unit IV, management unit 208 B)

A forestation works effectuated in the ecological reconstruction perimeter from management unit no 108 B, have as objective the restore of protection function of forest ecosystems.

Results

Evaluation of the success of the ecological reconstruction works of *Pinus nigra ssp. banatica* stands from amelioration perimeters was done by annually control of regeneration installed by afforestation in the amelioration perimeter from management unit no 108 B and represent a complex work whereby was determined:

- successfull of crops executed with Banat black pine;
- evolution of these plantations up to massive state;

- establishing of required works to be executed for normal development of young crops up to massive state.

Establishing the number and the surfaces of annually control plots was done by respecting the "Technical norms on execution of annually control of regenerations"(MAPP, 2000) (6). So, corresponding with 25 hectares area of afforestation site and also corresponding with the surface of 200 m² of a control plot in order for achievement the representative percentage of 2% from the crop surface, was placed 25 plots for annually control. The distance between plots is 100 m on the level curve and 50 m on the line with the highest slope.

The location of annually control plots within the perimeter of ecological reconstruction the management unit no 108B is shown in Figure 4.

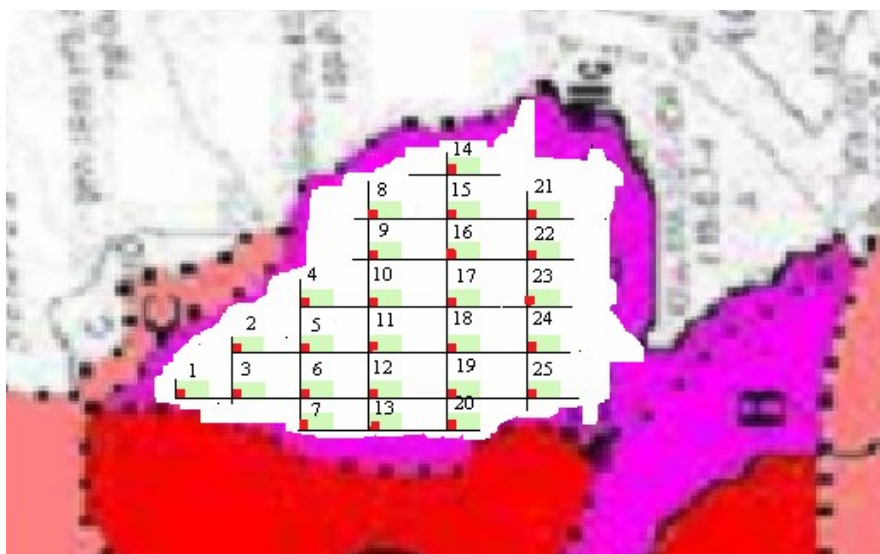


Fig. 4 Placing of annually control surfaces in the area of ecological reconstruction

According to the success on percentage of crops with Banat black pine, executed on perimeter of ecological reconstruction, were imposed completations works for artificial regenerations. In 2008, this kind of works was executed on about 7,0 hectares and in 2009 on approximately 5,0 hectares. For execution of the completations works for young crops were used saplings produced in Domogled canton nursery, obtained by transplanters without protected roots, with the age of 2 years for completations executed in 2008, and respectively 3 years for the completations executed in 2009.

Banat black pine saplings used in completations works are vigorous saplings, with a good development, with diameter at colet area of minimum 8 mm and a height up to 25 cm. This sapling are capable to endure the overwhelm tendence of planted saplings and also the same tendency of herbaceous vegetation.

Until the setting up of the massive state, the young crop of Banat black pine, showing the maximum

sensitivity to stational and climatic factors, specific for Domogled massif, lives the most difficult moments of its evolutionary cycle. Accordingly, in this period are requested, most and attentive care works, ensuring complete success and normal development of the future stand.

Reviewing of works was performed in the first 3 years after planting, after snowmelt in spring.

Mobilization of soil was executed in the first 4 years after the setting of culture, on two occasions in the first two years and one work in the next two years.

Overwhelmed removing and release works were made in the second half of works for mobilize soil and release, in the last two years and will continue for 1-2 years to achieve final success or achievement of massive state.

Summary, in table 1 is shown the succession of maintenance works of crops from ecological reconstruction perimeter from Production Unit VI Domogled, management unit 108 B.

Table 1

Maintenance works for young crops

Crt. No	Main species of basis	Cultural characteristics of new crops	Maintenance works				Year of massive achievement status
			Year of execution	Revisions	Mobilisations	Overwhelm removing	
1.	Banat black pine	Ecological reconstruction using integral afforestations	I	1	2	-	VI
			II	1	2	-	
			III	1	1	1	
			IV	-	1	1	
			V	-	-	1	

Conclusions

By afforestation works effectuated in ecological reconstruction perimeter from management unit no 108 B, was pursued the restore of protection function of forest ecosystems.

Using the method of afforestation with Banat black pine saplings with protected roots in polyethylene bags, although more expensive, is able to ensure chances of success for young crops in extreme conditions, calcareous, with a lot of skeleton rock at the surface and also on the depth of the soil.

It is important that after planting, the saplings are quickly and easily adapt to new conditions of life, without stagnant growth, specific for using at afforestation, saplings with unprotected roots.

From the analysis of existing lists for annually control, the percentage of success of afforestation work was 75% in the first growing season and respectively 80%, in the second growing season.

Exceeding the quantum of allowed losses, provided in the technical normatives, respectively more than 15% from the number of sapling planted initially, it was necessary to execute completations works in the young crops of Banat black pine.

Banat black pine saplings used in completations works are vigorous saplings, with a good development, with diameter at collet area of minimum 8 mm and a height up to 25 cm. This sapling are capable to endure the overwhelm tendence of planted saplings and also the same tendency of herbaceous vegetation.

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