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REGENERATION DYNAMICS OF THE BEECH FOREST IN THE UPPER BASIN OF THE NAIBA VALLEY, GODEANU MOUNTAINS

Mariana NICULESCU

University of Craiova, Faculty of Agriculture, 19 Libertăţii Street, Craiova, Dolj, Romania

Corresponding author email: mniculescum@yahoo.com

Abstract

The imbalances produced by climate change, wind blows, excessive drought, increasingly high temperatures, excessive drought, the lack of precipitation or their decreasing amount can greatly affect the synchrony of regeneration and, therefore, the stability of beech forests in Romania and around the world. Studies on the dynamics of regeneration of beech stands are based research regarding: the structure of the stand, the dynamics of the tree population, the characteristics of gap formation, the distribution and characteristics of the shrub layer the vitality of the individuals within the analyzed beech populations, the distribution and characteristics of the seed. In order for natural regeneration to take place in the seedbed, it is necessary to have enough mature trees, able to bear fruit abundantly and seed the entire surface. Following the research carried out in Naiba Valley, it was found that there are favorable conditions for the natural regeneration of the beech groves and the dynamics of the regeneration is good in relation to the current eco-pedo-climatic conditions due to appropriate and adapted conservation measures in this area.

Key words*: beech forest, Naiba Valley, regeneration, dynamics, plant community.*

INTRODUCTION

Carpathian beech forests are of particular importance from an ecological point of view and have considerable economic value.

The problem of the natural regeneration of the edifying species of these types of forests European beech (*Fagus sylvatica* L.) is very topical and an important concern of specialists in the field in recent years.

A regeneration with good results involves studies on the main factors that directly or indirectly influence this process. The value of the genetic resources, the morpho-anatomical characters of the naturally regenerated saplings, the ecological factors such as tolerance to shade and increased temperatures, drought, are of particular importance to the degree of beech regeneration.

The beech forest can beconsidered a complex phytocenotic structure whose dynamics, physiognomy, composition, state of health, vitality, conservation and regeneration are in close correlation with the current eco-pedo-climatic conditions and at the same time with the degree of anthropogenic impact exerted.

The natural regeneration of beech forests in Romania is a very important step to ensure their long-term sustainability.

Regeneration of forests in accordance with climate change and the anthropogenic impact resulting from socio-economic activities, represent challenges and opportunities regardingas good as possible forest management.

Seed germination is closely correlated with soil conditions, climate factors, and at the same time subsequent seedling growth will become more and more dependent on soil characteristics and prevailing microclimatic conditions. The growth rate of seedlings at early stages is an important factor affecting their survival (Doniță et al., 2007; Chiriță et al., 1977).

The objectives of this article are based on the analysis of the current state of regeneration of the beech forests in the Naiba Valley in order to determine the correct regeneration mechanisms and the proposal of research strategies to improve regeneration in these beech forests.

MATERIALS AND METHODS

Study area:

The research area is located in the south-western part of Romania, in the upper basin of Naiba Valley, an integral part of the "Domogled-Valea Cernei" National Park

(Figure 1).From a physical-geographical point of view, the researched territory belongs to the Godeanu Mountains, the group of mountains that is part of the Romanian Southern Carpathians. The Godeanu Mountains, whose main peak forms the basin between the Cerna and Râului Mare rivers, have a maximum altitude of 2.291m at the Gugu Peak.

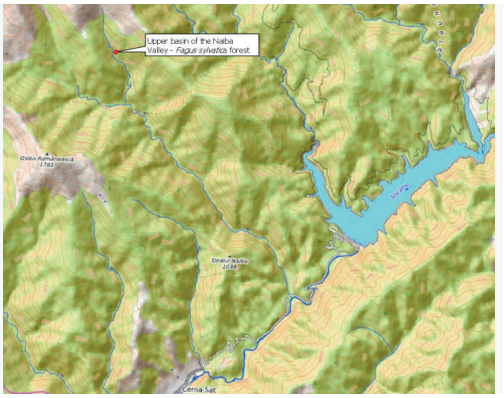

Figure 1. Map of the studied territory

Data Collection:

The data were collected from 20 experimental areas with a size of 400 m^2 (40 x 10 m), installed in comparable stands in terms of vegetation conditions, structural and physiognomic features.

Phytosociological studies were based on the methods of research characteristic of Central European phyto-sociological School and on the principles of Braun-Blanquet (1932).

To identify the taxa and infrataxa it was analyzed Romanian Flora, vol. I (Săvulescu coord., 1966), Flora Europaea (Tutin et al., 1968-1993). The plant communities were identified according to the characteristic, edifying, dominant and differential species.

Their identification and coenotaxonomic classification were made using synthesis works of Coldea (1975, 1991, 1997), Sanda et al. (1997), as well as Oberdorfer (1992), Mucina et al. (1993, 2016) and Rodwell (2002).

To determine the dynamics of beech regeneration within the identified plant community, 20 sample areas smaller than 100 m^2 (10 x 10 m), in forest of the upper basin of the Naiba Valley, were also selected, located in each described phytocoenosis, where analyses were made regarding the dynamics of the seedling, the germination rate, as well as the morphological state, viability, vitality and abundance-dominance of beech seedlings.

The vitality, viability and germination power of the analyzed beech species were determined through direct observations of the morphology of vegetative and reproductive organs as well as the analysis of the population size of individuals in the established sample areas.

In order to determine the level of regeneration of a beech tree, we must pay special attention to the following aspects: the degree of fruiting, the distribution and characteristics of the seed, the survival and seedling population dynamics and gap formation (Doniță et al., 2007; Chiriță et al., 1977).

RESULTS AND DISCUSSIONS

Ecological and cenological characterization of the species *Fagus sylvatica* L. in the investigated territory

Following field research in the beech forests in the upper basin of the Naiba Valley, an integral part of the "Domogled-Valea Cernei" National Park, it was found that they belong to the following plant community:*Hieracio rotundati-Fagetum* (Vida 1963) Tauber 1987 (Syn.: *Deschampsio flexuosae-Fagetum* Sóo 1962) (Boșcaiu, 1971; Niculescu, 2020) (Figure 2). From a conservation point of view, this plant community has a special importance in the edification of the following types of natural habitats: 9110 - *Luzulo-Fagetum* beech forests (RO habitat type code: R4102, R4105, R4106, R4107, R4110; CLAS. PAL.: 41.11) this being interwoven at the lower limit with the habitats 91V0 - Dacian Beech forest (Symphyto-*Fagion*) (RO habitat type code: R4101, R4103, R4104, R4108, R4109, R4116) and 91K0 - Illyrian *Fagus sylvatica* forests (*Aremonio-Fagion*) (RO habitat type code: R4112-4115, R4121; CLAS. PAL.: 41.1C) (Gafta and Mountford, coord. 2008).

The edifying species for the plant community that builds this habitat are *Fagus sylvatica* L. and *Hieracium transylvanicum* Heuff., alongside which there is a nucleus of well-defined species belonging in particular to the order FAGETALIA SYLVATICAE Pawl. 1928 and the alliance SYMPHYTO-FAGION Vida 1959.

The research we conducted in this forest habitat has highlighted the presence of well-structured phytocoenoses from a floristic, physiognomic and coenotic point of view, thus we can mention the following species in the grassy layer that have constancy and high abundance-dominance: *Luzula luzuloides* (Lam) Dandy & Wilmott, *Calamagrostis arundinacea* (L.) Roth, *Vaccinium myrtillus* L., *Galium odoratum* (L.) Scop., *G. schultesii* Vest, *Oxalis acetosella* L., *Dentaria glandulosa* W. et K., *D. bulbifera* L., *Deschampsia flexuosa* (L.) Trin., *Veronica officinalis* L., *Pteridium aquilinum* (L.) Kuhn., *Carex pilosa* Scop., *Mycelis muralis* (L.) Dumort, *Poa nemoralis* L., *Athyrium filix-femina* (L.) Roth., *Dryopteris filix-mas* (L.) Schott., *Viola reichenbachiana* Jord., *Rubus idaeus* L., *Glechoma hederacea* L., *Leucanthemum waldsteinii* (Schultz Bip.) Pouzar, *Actaea spicata* L., *Asarum europaeum* L., *Helleborus purpurascens* Waldst. et Kit., *Euphorbia amygdaloides* L., *Melica uniflora* L., *Stachys sylvatica* L., *Geranium robertianum* L., *Mercurialis perennis* L., *Polytrichum formosum* (Hedw.) G.L. Smith. In the grassy layer of the studied phytocoenoses within these forests, a series of orchid species are also found, including: *Neottia nidus-avis* (L.) L. C. M. Rich., *Cephalanthera rubra* (L.) Rich. *Platanthera bifolia* (L.) L. C. M. Rich., *P. chloranta* (Custer) Rchb., *Neottia cordata* (L.) Rich., *Cephalanthera damasonium* (Mill.) Druce (1906), *Epipactis helleborine* (L.) Crantz.

The forest floor is also covered with a layer of grasses with a maximum coverage of 35%.

The shrub layer is extremely rare. The main species in this layer is *Rubus idaeus* which is found in relatively high abundance-dominance AD=2-3, and which has highly developed populations in some phytocoenoses where they can reach abundance-dominance of up to 2-3 according to field studies.

Regeneration dynamics of the beech forest in the study area

At the basis of a very good regeneration, with a high dynamic in the beech forests of the researched territory, the treatment of successive cuttings (preparatory cutting,seeding cutting, development cutting, final cutting) which was applied for a longer time before carrying out these studies, was of particular importance

Figure 2. The plant community of *Fagus sylvatica* on Naiba Valley

The seed from a tree is of particular importance in its natural regeneration, by forming new individuals. In order for natural regeneration to take place from the seedbed, it is necessary to have enough mature trees, able to bear fruit abundantly and seed the entire surface.

In the studied area located in the Naiba Valley basin, the soil is valuable according to field observations and data from the Baia de Arama Forest District Management and presents favorable conditions for growth and development.of the study species.

Following studies conducted through direct morphological observations of the vegetative organs of individuals from each sample area, it was found that the beech trees in the Naiba Valley have an active (vigorous) state of vegetation. Following the biomonitoring of this forest ecosystem built by *Fagus sylvatica*, it was found that the health and vitality of the trees that make up the stand is good.

Through the morphological and physiological analyzes carried out in the 20 sample areas established for the edification of the plant community in the *Fagus sylvatica* stands on Naiba Valley, it was found that the phenomena of damage, drying and breakage of the beech trees have a minimal value. Physiological and morpho-anatomical state of the leaf sheath is good. Thus, the phytocoenoses of *Fagus sylvatica*, *Hieracio rotundati-Fagetum*(Vida

1963) Tauber 1987 (Syn.: *Deschampsio flexuosae-Fagetum*Sóo 1962), were found to be characterized by: poor drying, isolated breaks, isolated fellings, weak game damage. Regarding *Fagus sylvatica*, the edifying species of the arboretum on Naiba Valley, it was observed after the studies carried out that fruits and seeds are formed throughout the crown of the tree, which also loves moonlight.

Fruiting of *Fagus sylvatica* trees depends on: trees maturity, differentiation and formation of flower buds, flowering and pollination, seed formation, seed maturation and ripening.

The *Fagus sylvatica* seed is abundant, the species fructifies very well under natural conditions, in several subplots, this may have a special role in the phenomenon of natural regeneration of these valuable trees. The seed inventoried in 20 sample areas within each phytocenosis that builds the plant community and including the natural habitat has a high density, a high germination power and increased viability. The density of seedlings was between 25-35/100 individuals m^2 (Figure 2, Figure 3).

Figure 3. Seeds development in the beech forests on the Naiba Valley

Figure 4. Beech seedlings within the analyzed phytocenoses on the Naiba Valley

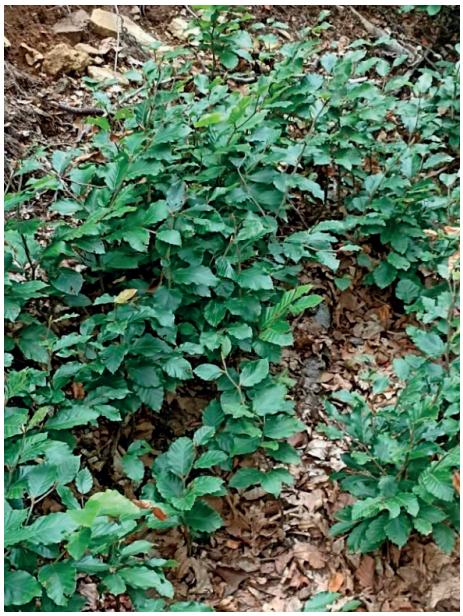

Figure 5. Evolution of beech seedlings in the Naiba Valley (at the upper forest limit of the beech forest, altitude 1450 m)

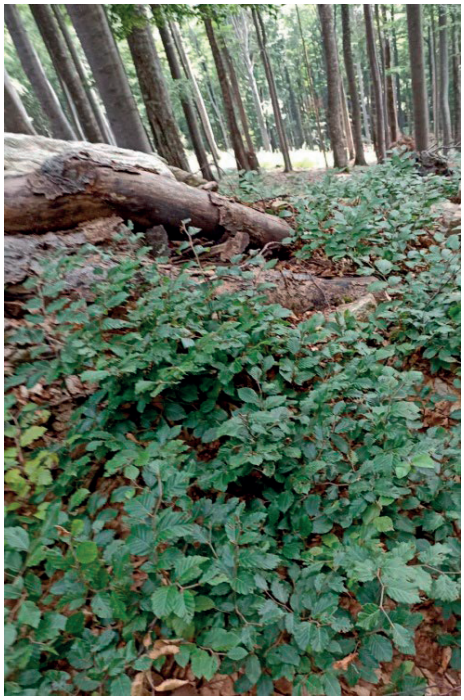

Figure 6. Natural regeneration of beech in a phytocoenosis in which dead wood was also preserved on the Naiba Valley

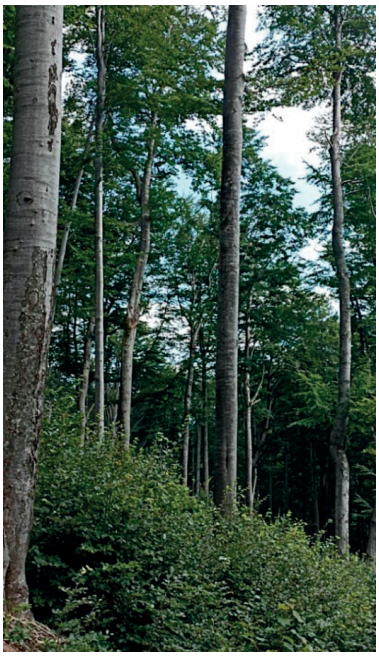

Figure 7. Natural regeneration of beech in the Habitat 9110 - *Luzulo-Fagetum* beech forests on the Naiba Valley

CONCLUSIONS

In conclusions, in the perspective of climate changes that greatly influence the quality and structure, the physiognomy, the conservation value but also the syndynamic global biodiversity, the degree of natural regeneration of virgin beech forests is of great importance for the research of forest ecosystems both from the perspective of protection and management, in order to ensure a sustainable natural capital.

Following the research carried out, it was found that the forest in which studies were conducted is prepared for abundant fruiting of the valuable species, and the eco-pedo-climatic conditions are favorable for the germination of seeds fallen on the forest floor.

In order to favor the development of the seedling in the first years after installation, it is recommended in the studied area to extract broken, dried trees within the limits of the accepted norms regarding the maintenance of dead wood in a protected area.

Throughout the Carpathian Chain in Romania and beyond, the conservation of beech forests is of particular importance from a biological, silvicultural, pedological, conservation, economic and social point of view.

In order for them to have a very good state of conservation, a harmonious and favorable evolution, silvicultural actions and works must be planned and implemented in such a way as to respect ecological criteria and conservation measures through the implementation of adequate management systems in the phenomenon of natural forest regeneration must have priority.

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