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RENATURATION ACTIVITIES OF MOUNTAIN HABITATS WITH CREEPING MOUNTAIN PINE SEEDLINGS IN RETEZAT NATIONAL PARK

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Abstract: Focusing on the mountain pines (*Pinus mugo*), the establishing the methods of maintaining or protecting of non degraded populations, and the methods of restoration of degraded populations, within a conservative management of the alpine habitats belonging to Retezat National Park, are the aims of the present study. Between the natural and artificial regeneration methods applicable to restore the degraded mountain pines populations, the regeneration by plantation seems to be the only reasonable method, having in view that the natural regeneration is difficult and require long period of time. The renaturation with mountain pines seedlings, within the case study regarding an ecological restoration in Retezat National Park, methods, remarks and predictable results are presented. Also, the study offers details concerning the ecological principles of the destroyed habitat's artificial regeneration, such as: the planted area, seedlings, seedling production and their transportation to the planting area and effective plantation.
Keywords: Retezat Mountains, alpine habitats, mountain pines (*Pinus mugo*), habitat restoration, artificial regeneration, afforestation

1. INTRODUCTION

The Retezat National Park, located in Meridional Carpathians (Romanian Southern Carpathians), encompasses Romania's highest mountain ranges and one of Europe's last remaining pristine forests. Established since 1935, the Retezat National Park Reservation protects an exceptional floral diversity for high mountainous area with steep slopes, raised from ancient forests. The existence of more than a third of the Romanian flora in this area, sheltering around 1190 superior plants species of the 3450 species known in Romania, is one of the reasons for which it was declared a National Park. The Retezat National Park has a great diversity of forms, which makes the landscape peculiarly spectacular. The protected area occupies the centre of the mountain. The first area with full protection has a scientific character (11466 ha), being prohibited any exploitation (mining, grazing, hunting, fishing, gathering fruit, hiking, and camping). In this area, the access is allowed only with authorization from the Natural Monuments Preservation Commission, on certain routes and territories. The second area has a less rigorous protection, grazing being allowed two months per year. With a wide variety of endangered and endemic plants and spectacular wildlife, the Retezat National Park is included in the UNESCO network of biosphere reserves.

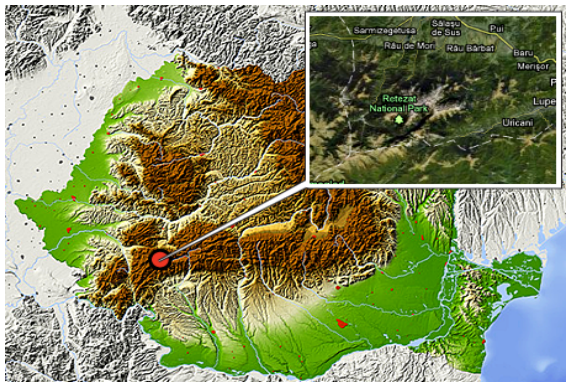


Figure 1. The Retezat National Park Reservation (Hunedoara County, Romania)

Since the 90's, the grazing activity has increased considerably, and damages brought to nature in Retezat National Park have increased worryingly. Every summer, sheep were climbing to alpine

meadows, endangering the flora and fauna of the area (as a result, the chamois number is decreasing every year). Because of this, in the last decade of the past century, the pasture area in Retezat decreased considerably, and for years, at the end of each summer remained eroded lands and much stevia, as a result of sheep grazing. Due to overgrazing, the characteristic species of natural grasslands have been completely degraded or gradually replaced by species that eliminate the other cohabiting plants.

Following a study on grasslands in Retezat Mountains, the Retezat National Park Administration concluded that their area has decreased drastically due to overgrazing. The alpine habitats in Retezat National Park are abused by overgrazing, an example in this respect being Drăgşanului Ridge, where the biodiversity is very low, being correlated with the abandonment of former grazing areas, which requires careful management measures.

Figure 2. The Retezat Mountains view on the Drăgşanului Ridge

The preservation of the unique natural landscape, undisturbed, is a priority activity which brings benefits both in terms of biodiversity and tourism attractiveness. During 2008, it has been developed a monitoring protocol for the priority habitat of the creeping mountain pine and juniper shrubs in Retezat Mountains, aimed at the maintenance of natural processes deployment and elimination, or at least reduction of the factors hindering the deployment of these processes. So, certain direct actions have been supported for stopping the destructive processes, within a conservative management of the alpine habitats belonging to Retezat National Park.

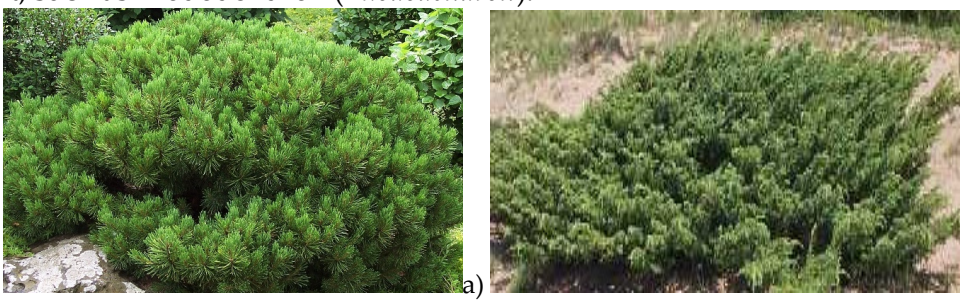
Two ecological restoration actions have been proposed – the ecological reconstruction of eroded slopes and reforestation of some degraded ecosystems – destroyed areas located within the creeping mountain pine and juniper habitat. The reforestation action has been cancelled, because it was seen the natural regeneration of juniper in the affected areas, while the ecological restoration was made in Drăgşanului Ridge area, on a highly eroded torrent found in the juniper habitat, where a total of 1600 creeping mountain pine seedlings were planted, obtained from seeds collected from the Park, thus stopping the severe soil erosion phenomena over an area of approx. 1.5 ha.

In the summer of 2007, it was started the destruction of stevia, and in the subsequent have been started the ecological restoration projects. In the years that followed, direct actions have been taken to restore the valuable alpine habitats belonging to the Park, resulting in the development of pilot projects for ecological restoration of some mountain pine tree habitats. In this regard, for the rehabilitation of some degraded areas in the mountain habitat, a series of actions have been conducted to review the perimeter planted, in soil beds, with 2–3 years old seedlings of creeping mountain pine shrubs originated from natural populations.

2. THE CREEPING MOUNTAIN PINE AND JUNIPER HABITAT IN RETEZAT MOUNTAINS

The mountain pines (*Pinus mugo*) are dominant in the Retezat Mountains, spread over the entire subalpine floor, from the upper limit of the spruce forest (*Picea abies*), found at about 1500 – 1600 meters, up to an altitude of 2300 meters. The large hedges covering the subalpine slopes, the mountain pine habitat, are mostly composed of creeping mountain pine (*Pinus mugo*), which grows either alone or associated with other arborescent woody plant species (especially spruce – *Picea abies*) or shrubs (especially common juniper – *Juniperus communis*). The mountain pines are found from the upper limit of the spruce forest, up to the contact with the alpine meadows,

physiognomically characterizing the subalpine floor. The mountain pines scrubs are becoming compact with increasing altitude, the boundary spruce forests thinning gradually. The clumps of stunted mountain pines and juniper bushes can be found at altitudes far beyond the limit of the compact mountain pines trees, on alpine meadows and rocks. With increasing altitude, the mountain pines compact thickets are crumbling, making way increasingly for undergrowths of 30–50 cm height, such as rhododendron (*Rhododendron*).



a) b)

Figure 3. Mountain habitats in the Retezat Mountains: a) the creeping mountain pine habitat; b) the common juniper habitat in the Retezat Mountains

The mountain pines tree subfloor (1700 – 2300 m) is, undoubtedly, interesting in terms of vegetation and landscape in Retezat National Park, consisting of juniper and creeping mountain pine trees, found in clumps or spreading carpets. Clumps can be seen on the northern slopes below 1700 m, as modest shrubs can withstand the climate at altitudes over 2300 m. The largest carpets of mountain pine are spreading between 1700 and 2100 m, as is the case of Drăgşanu Valley's forests and thickets.

3. RENATURATION IN RETEZAT NATIONAL PARK – CASE STUDY

3.1. Brief overview & Motivation

A shorter erosion stage is observed on the northern slope of the mountain, on Drăgşanu Ridge (approx. 1600 – 1800 m altitude). A land in Retezat Mountains, degraded by overgrazing, located at 1600 m altitude, was strengthened by planting creeping mountain pine and junipers supplied by Retezat National Park Administration. Thus, a severely damaged forest area in Retezat National Park will be ecologically reconstructed (REPORT, 2008; REPORT, 2013).

Figure 4. Degraded land by overgrazing in Retezat Mountains (Drăgşanu Valley)

Within the ecological restoration, five tons of creeping mountain pine and juniper seedlings (1600 seedlings) were transported in Retezat National Park by Retezat National Park Administration, for the renaturation of a degraded area. The objective of such ecological restoration is to restore the mountain pine natural habitat in Drăgşanu Ridge area, part of Retezatul Mic, belonging to Retezat National Park, located between 1600 m and 1950 m altitude, on the northern slope of Retezatul Mic. In this area, the priority habitat has been destroyed, and the habitat area reduction occurred in the past due to deforestation activities in favour of extending the grasslands, using mountain pine and juniper as firewood by shepherds and tourists, and the intense adjacent grazing.

Why was mountain pine and juniper required in Drăgşanu area? There, because of gullies dug by the sheep hooves, strong soil erosion occurred, phenomenon that favoured the formation of a torrent. This has resulted in landslides and degradation of the area, and the slope was severely affected. The mountain pine remained only in proportion of about 30% of the area. Because of the

tree vegetation disappearance and the steep slope, which in some sections even reached 45º, an avalanche corridor has been formed.
All these led to the need to restore the former natural habitats, recovery consisting of strengthening by planting creeping mountain pine and juniper (seedlings). In these conditions, some ecological terraces have been made, on which creeping mountain pine was planted, for strengthening the soil. The planting of creeping mountain pine seedlings was organized by camps at altitude, with volunteers, with the support of Retezat National Park Administration and the assistance of Deva Forestry Directorate. To be noted that this is only one of the actions conducted within the conservative management activities aiming the alpine habitats of Retezat Național Park. Restoration works would target around 130 ha of valuable alpine habitats, mountain pine (*Pinus mugo*) habitats and alpine wetlands, and soil erosion would be prevented on several locations.
In the last few years, similar actions for the degraded grassland restoration have been started, through the implementation of pilot projects for ecological restoration of some mountain pine habitats. In Retezat National Park, the reconstruction actions will continue in the coming years, by planting mountain pine and juniper seedlings. Just like before, the planting will be made in compost pits, with 2–3 years old seedlings, supplied by Deva Forestry Directorate, a branch of National Forest Administration, from the nurseries of the Forest Research and Management Institute (ICAS).

3.2. Materials

The plant material consisted of creeping mountain pine seedlings. The habitat restoration was designed based on the principles of genetics, according to which the planting should be made using seedlings with local provenance. This principle could not be strictly observed in case of creeping mountain pine, as this species, although it's well represented in Retezat Mountains area, is very poor in the affected area. Therefore, the seedlings were grown in a nursery of the Forest Research and Management Institute, in Sinaia. The mountain pine seedlings of Pinus mugo were transported by truck from Sinaia, from the nursery of the Forest Research and Management Institute (ICAS), taken over by a helicopter, and brought in the affected area to be planted on Drăgşanu Ridge, in Retezat National Park.

3.3. Method of action / Remarks

The plantation at the end of summer in subalpine zones was preferable to the spring one, because the nursery, where the seedlings were produced, is located at about 680–700 m altitude, where the vegetation period usually starts in March. Depending on soil thaw, in Retezat Mountains area the planting process can not take place until the second decade of June. Until this time, the seedlings have already achieved a significant growth in nursery, and can be broken during transportation and handling. This is why we opted for planting them in late August.
We must note that the slope, associated with the felt formed by the perennial grass carpet roots and the limestone rock fragments, located at the surface or incorporated into the soil, created particularly difficult working conditions.
The habitat restoration with creeping mountain pine, within Drăgşanu Ridge area, depends on the success of this plantation, located in the subalpine zone on the northern slope of Retezatul Mic. Although the mountain pine seedlings may suffer transmutation stress, it is hoped, however, that at least 75–80% of the seedlings will adapt to the new conditions. In this regard, the creeping mountain pine seedlings are brought from the nursery with a sleeve of ground weighing more than 3 kilograms. Also, to prevent the drying during transmutation due to differences in humidity and temperature, the transportation had to last a period as short as possible. According to the inventory made taking into account the sample areas planted with creeping mountain pine, the median survival of the seedlings was even 90% in the previous years, but the survival rate varied from one area to another.

4. PREDICTABLE RESULTS – CONCLUDING REMARKS

The research and studies carried out in this area are numerous; they have continuity and tradition, and concern fundamental aspects regarding the biodiversity. For this reason, the maintenance and proper management of this unique national park is a priority. The main objective was to improve the conservation management activities to halt the alpine habitats destruction in the Retezat Mountains would be implemented along with a campaign promoting conservation, especially the long-term preservation of the alpine habitats.

The long–term predictable results of the ecological restoration with creeping mountain pine, performed for supporting some actions aiming the stoppage of the destructive processes, are:

- ✓ prevention of avalanches, floods and soil erosion as a result of solid and liquid precipitation retention by the woody vegetation;
- ✓ creating the required conditions for natural regeneration and/or restoration of the creeping mountain pine population;
- ✓ provision of food, by means of mountain pine seeds, of some mammals (bear and certain species of small rodents), as well as some birds living in the mountain area;
- ✓ organising a campaign to promote the green conservative concepts, with a special focus on long–term preservation.

In the medium term, the expected outcomes are to create better conditions for the development of woody and herbaceous plants, along with the wild animals, followed by a normal development in the future. This goal is achieved by establishing a control over the factors that previously contributed to the degradation of the ecosystems consisting of plants and wild animals.

In the short term, the predictable results of this ecological restoration are:

- ✓ protection and preservation of flora and fauna;
- ✓ ecological restoration of creeping mountain pine and juniper habitats by planting in affected and degraded areas;
- ✓ creating normal conditions for natural regeneration of the mountain pine, which is going to spread bit by bit in the surrounding areas, so that the creeping mountain pine population will recover.

By ecological restoration of these mountain habitats, it is expected that the surface erosion of the degraded woodlands, previously used for grazing, to be fully stopped in 5–15 years after the execution of afforestation works, in accordance with the afforestation species and the nature and intensity of degradation.

Through the direct effect of the protective afforestations with creeping mountain pines, applied for the ecological reconstruction of these mountain habitats, it is expected a regeneration in 5–10 years time of the moderately/highly eroded slopes, and in 8–15 years time of the very strong/excessively eroded slopes.

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