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FROM PLANTING TO STABILITY: 20 YEARS OF EVOLUTION OF PINUS CEMBRA L. IN THE RODNA MOUNTAINS BIOSPHERE RESERVE

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ABSTRACT

This study assessed the status of Swiss stone pine (Pinus cembra L.) approximately 20 years after ecological restoration planting in the Pietrosul Rodnei Reserve. Field surveys conducted in 2025 used ten circular 500 m² sample plots and supplementary transect observations. The estimated surviving population was 2,987 trees (approximately 58% of the initial planting). Mean tree diameter, height and individual volume were 9.33 cm, 3.10 m and 0.0395 m³, respectively. The findings support continued monitoring and long-term conservation of this relict subalpine species.

INTRODUCTION

Swiss stone pine (Pinus cembra L.) is a glacial relict of considerable ecological and conservation importance in the Romanian Carpathians. In 2004, ecological restoration began across approximately 50 ha in the Pietrosul Rodnei Reserve under the LIFE NATURA programme. This study evaluates plantation development after roughly two decades.



Fig. 1. Swiss stone pine in its subalpine habitat.



Fig. 2 Current plantation development

MATERIALS AND METHODS

The 2025 field assessment combined project documentation (LIFE 2003 NAT/RO/000027 REV), ten circular sample plots (500 m² each) and observations along survey routes. Recorded variables included tree position, vitality, foliage condition, diameter, circumference and total height. Data were used to estimate survival, tree volume and radial growth.



Fig. 3. Spatial distribution of the ten sample plots.



Fig. 4. Field measurement of tree diameter.

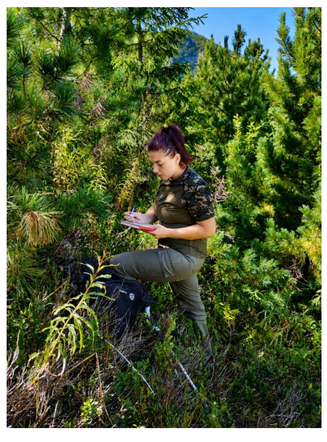


Fig. 5. Recording field observations.



Fig. 6. Historical restoration planting activities.

RESULTS AND DISCUSSION

Approximately 2,987 trees were estimated to remain, equivalent to 58% of the original planting. Mean diameter was 9.33 cm, mean height 3.10 m and mean individual stem volume 0.0395 m³. Mean radial growth was 1.40 mm, with interannual variation and reported extremes in 2016 and 2018.

Estimated plantation survival after ~20 years

58% surviving	42% not remaining

Percentages are estimated from the original planting stock.

9.33 cm	3.10 m	0.0395 m³
Mean diameter	Mean height	Mean tree volume

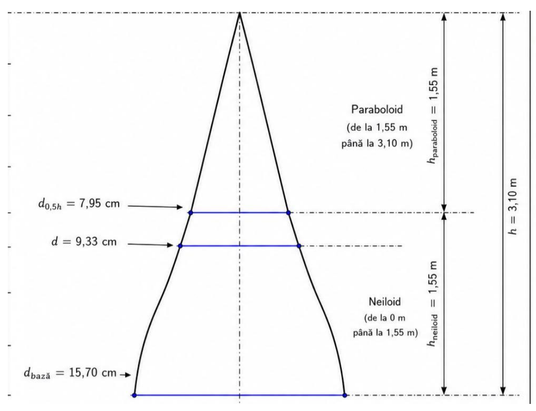


Fig. 7. Stem-form model used for volume estimation.



Fig. 8.. Restored planting area.

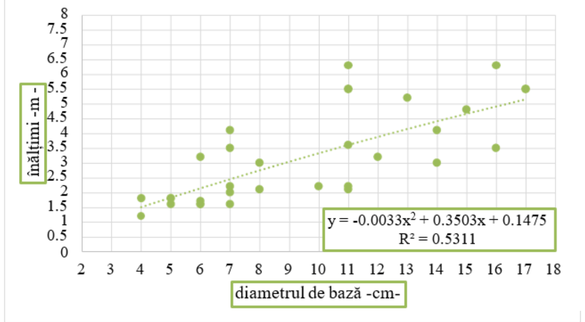


Fig. 9 Compensated curve of heights for the species Pinus cembra L.

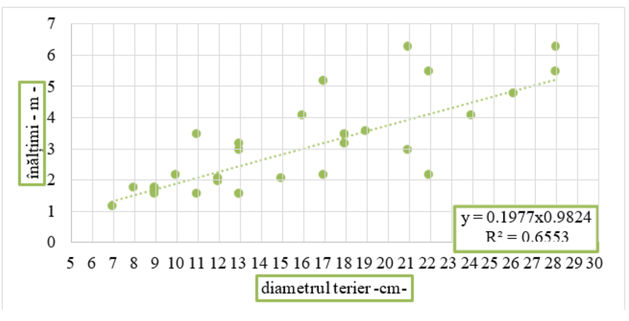


Fig. 10. Compensated curve of heights relative to the diameter of the terrier

CONCLUSIONS

The surviving population and measured dendrometric characteristics indicate substantial establishment after two decades. The restoration programme has contributed to the conservation of Pinus cembra in the Rodna Mountains. Continued monitoring is essential to assess future stability, growth and population persistence.



Fig. 11. Field team in the study area.

“This ancient glacial relict, known as Swiss stone pine, much like the Romanian people, descendants of the Dacians and Romans, has endured the hardships of millennia that have affected, and still affect, both the species and this people and their land.”

— I. Blada (translated from Romanian)

ACKNOWLEDGEMENT | Ecological restoration project LIFE 2003 NAT/RO/000027 REV

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