“PANDA”forest stands
planted in April 2023
in the Eastern Carpathians

TRANSYLMAGICA

Panda

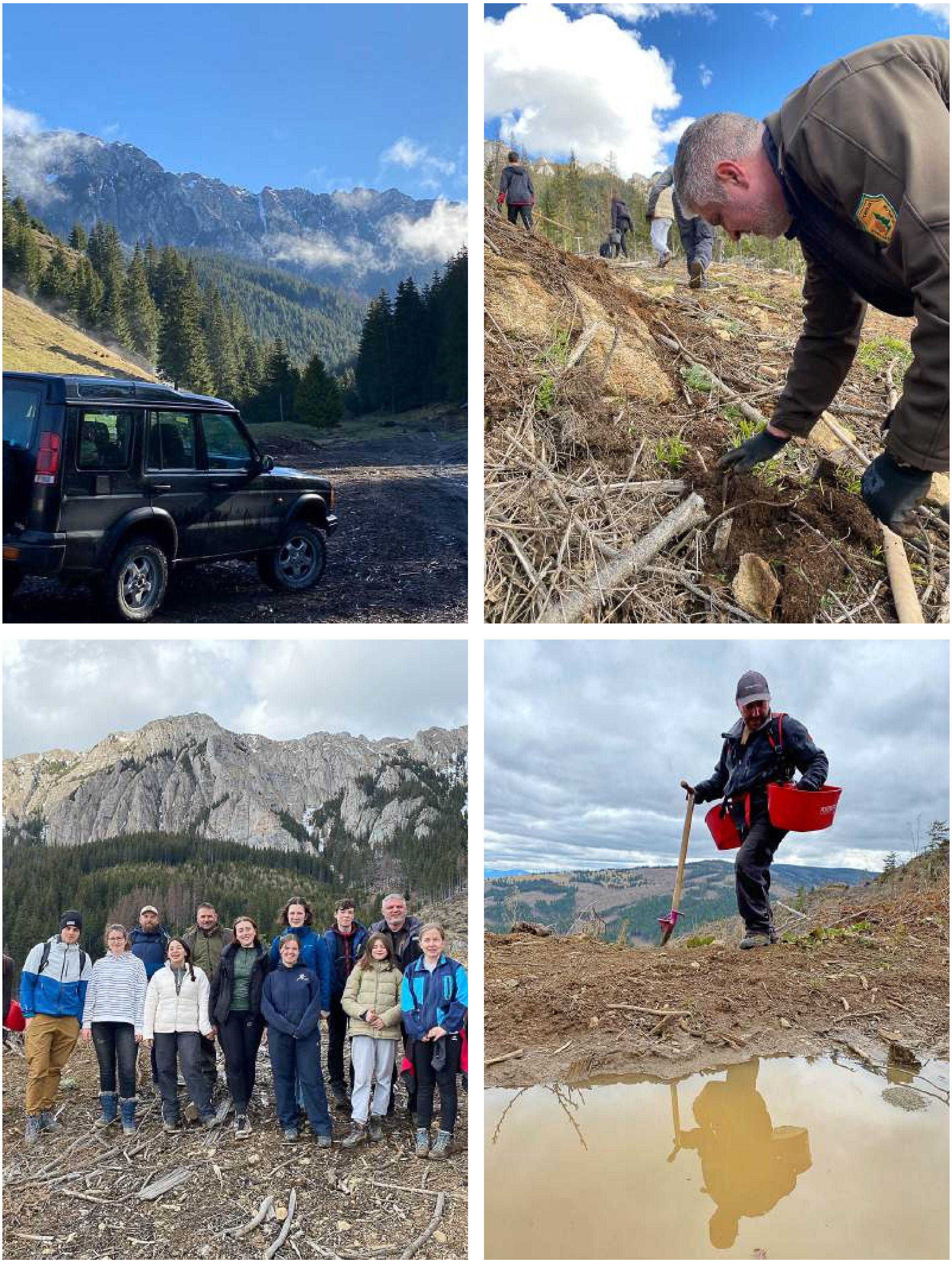
Spruce (Picea abies) seedlings

The existence of the PANDA forest stands begin with the planting of young tree seedlings in april 2023.

3500 sessile oak seedlings (Quercus petraea) tree seedlings were planted on hillside previously covered by a pine (Pinus sylvestris) forest - felled by wind in 2021.
https://goo.gl/maps/u8ehaZ3vRxa44uBBA

3500 seedlings - 55% Norway spruce (Picea abies), 45% Beech (Fagus sylvatica) + sycamore maple (Acer pseudoplatanus) + rowan (Sorbus aucuparia) in the Hasmas Mountains - Cheile Bicazul-Muntii Hasmas National Park on the place of a previous Norway Spruce forest.
https://goo.gl/maps/nfjmXmcC8AEdtRnZ9

These seedlings were raised in nurseries and then transplanted into the plantation site.



Planting in the Cheile Bicazului - Hasmas National Park / April 2023

During this first and the next few years, the primary focus will be on their survival and establishment, as the seedlings adapt to their new environment. They develop root systems, establish symbiotic relationships with soil microorganisms, and undergo an initial shoot growth.maple and rowan in our case) will be slower. They will need constant monitoring and care (removal of competing vegetation.

The trees are not densely planted so competition among individual trees for resources such as light, water, and nutrients is not going to be significant.

The place is dominated by dwarf shrubs, herbs and grasses. The disappearance of the previous forest created an opportunity for herbaceous plants to invade the site.
Several factors contribute to the invasion of herbs on wind-damaged areas:
- open space was created with increased sunlight, moisture availability, and nutrient resources. These favorable conditions provide an ideal environment for fast-growing and opportunistic herbaceous plants to establish and thrive.
- the soil contained a seed bank—a reservoir of seeds from various plant species present in the surrounding environment. The fall of the trees exposed the dormant seeds to light and suitable germination conditions. As a result, many secies such as annual and perennial grasses and ruderal species, beginned to germinate and grow rapidly.

The herbaceous plants are characterized by rapid growth and the ability to compete for sunlight with much slower-growing woody plants. Herbaceous plants, which have faster nutrient uptake rates and high nutrient requirements, can utilize these available nutrients to establish and flourish.

Epilobium angustifolium

Viola sp.

Digitalis grandiflora

Campanula sp.

Silene dioica

Verbascum sp.

Aquilegia vulgaris

Fragaria vesca

We need to manage herbaceous plants in order to reduce their competitive pressure ont he planted seedlings. The only viable solution is removing them manually (using sickles) at the end of the vegetation period (end of August, September).

In this period, the primary goal of the small seedlings is to establish a strong root system and develop a sturdy stem.

In their early years, saplings focus on vertical growth, elongating their stems to reach for sunlight. Height growth is influenced by genetic factors, site conditions, and resource availability.

Seedlings allocate a significant portion of their biomass to root development. This investment enables efficient nutrient and water uptake from the soil, essential for seedling establishment and growth. Thus, seedlings typically allocate a relatively higher proportion of biomass to roots compared to mature trees. The root system of small trees undergoes significant development during their early years. While the majority of the root system remains concentrated near the surface, some roots start to grow deeper into the soil. The establishment of a well-developed root system is crucial for anchorage, nutrient uptake, and water absorption.

Small trees typically have smaller and more delicate leaves compared to mature trees. These leaves are often adapted to maximize photosynthesis and resource acquisition in the limited space available. And they produce relatively large amount of leaves - compared to their stem size - in order to maximise their photosynthetic capacity. In their first years they allocate at least as much biomass in their leaves as in their stem. When these leaves fall they slowly decompose and become part of the soil carbon pool.

In the future, as the forest plantation matures, the growth dynamics change. Over time, natural processes of succession and self-thinning occur, leading to the development of a more diverse and complex forest structure.

Oak seedlings. - https://goo.gl/maps/u8ehaZ3vRxa44uBBA

Spruce seedling

Rowan seedling

Sycamore maple seedling

Beech seedling

*References

Carbon content of wood

Castaño-Santamaría, J., Bravo, F. Variation in carbon concentration and basic density along stems of sessile oak (Quercus petraea (Matt.) Liebl.) and Pyrenean oak (Quercus pyrenaica Willd.) in the Cantabrian Range (NW Spain). Annals of Forest Science 69, 663–672 (2012). https://doi.org/10.1007/s13595-012-0183-6

Doraisami, M., Kish, R., Paroshy, N.J. et al. A global database of woody tissue carbon concentrations. Sci Data 9, 284 (2022). https://doi.org/10.1038/s41597-022-01396-1

Genet, H., N. Breda, and E. Dufrene. "Age-Related Variation in Carbon Allocation at Tree and Stand Scales in Beech (Fagus Sylvatica L.) and Sessile Oak (Quercus Petraea (Matt.) Liebl.) Using a Chronosequence Approach." Tree Physiology 30.2 (2009): 177–192. Web.

Giberti, G.S.;Wellstein, C.;Giovannelli, A.; Bielak, K.; Uhl, E.; Aguirre-Ráquira,W.; Giammarchi, F.; Tonon, G. Annual Carbon Sequestration Patterns in Trees: A Case Study from Scots Pine Monospecific Stands and Mixed Stands with Sessile Oak in Central Poland. Forests 2022, 13, 582. https://doi.org/10.3390/f13040582

Thomas, S.C.; Martin, A.R. Carbon Content of Tree Tissues: A Synthesis. Forests 2012, 3, 332-352. https://doi.org/10.3390/f3020332

Thomas, Sean C. and Adam R. Martin. "Carbon Content of Tree Tissues: A Synthesis." Forests 3 (2012): 332-352.

Biomass allometric equations

Cienciala, Emil & Apltauer, J. & Exnerová, Zuzana & Tatarinov, Fyodor. (2008). Biomass functions applicable to oak trees grown in Central-European forestry. Journal of Forest Science. 54. 109-120. 10.17221/2906-JFS.

Cienciala, Emil & Černý, M. & Apltauer, J. & Exnerová, Zuzana. (2005). Biomass functions applicable to European beech. Journal of Forest Science. 51. 147-154. 10.17221/4553-JFS.

Dutcă, I.; Zianis, D.; Petrițan, I.C.; Bragă, C.I.; Ștefan, G.; Yuste, J.C.; Petrițan, A.M. Allometric Biomass Models for European Beech and Silver Fir: Testing Approaches to Minimize the Demand for Site-Specific Biomass Observations. Forests 2020, 11, 1136. https://doi.org/10.3390/f11111136

Dutca, Ioan & Abrudan, Ioan & Stancioiu, Petru & Viorel, Blujdea. (2010). Biomass conversion and expansion factors for young Norway spruce (Picea abies (L.) Karst.) trees planted on non-forest lands in Eastern Carpathians. Notulae Botanicae Horti Agrobotanici Cluj-Napoca. 38. 10.15835/nbha3835450.

Dutcă, Ioan, Mather, Richard, Blujdea, Viorel N.B., Ioraş, Florin, Olari, Mănăilă and Abrudan, Ioan Vasile (2018) Site-effects on biomass allometric models for early growth plantations of Norway spruce (Picea abies (L.) Karst.), Biomass Bioener

Dutca, Ioan. (2018). Biomass data for young, planted Norway spruce (Picea abies (L.) Karst.) trees in Eastern Carpathians of Romania. Data in Brief. 19. 2384–2392. 10.1016/j.dib.2018.07.033.

Forrester, David & Tachauer, I & Annighöfer, Peter & Barbeito, Ignacio & Pretzsch, Hans & Ruiz-Peinado, Ricardo & Stark, Hendrik & Vacchiano, Giorgio & Zlatanov, Tzvetan & Chakraborty, Tamalika & Saha, Somidh & Sileshi, Gudeta. (2017). Generalized biomass and leaf area allometric equations for European tree species incorporating stand structure, tree age and climate. Forest Ecology and Management. 396. 160 - 175. 10.1016/j.foreco.2017.04.011.

Ioan Dutcă, Richard Mather, and Florin Ioraş. 2017. Tree biomass allometry during the early growth of Norway spruce (Picea abies) varies between pure stands and mixtures with European beech (Fagus sylvatica). Canadian Journal of Forest Research. 48(1): 77-84. https://doi.org/10.1139/cjfr-2017-0177

Jalkanen, Anneli & Mäkipää, Raisa & Ståhl, Göran & Lehtonen, Aleksi & Petersson, Hans. (2005). Estimation of the biomass stock of trees in Sweden: Comparison of biomass equations and age-dependent biomass expansion factors. http://dx.doi.org/10.1051/forest:2005075. 62. 10.1051/forest:2005075.

Konopka, B., Pajtik, J., Moravcik, M. and Lukac, M. (2010) Biomass partitioning and growth efficiency in four naturally regenerated forest tree species. Basic and Applied Ecology, 11 (3). pp. 234-243. ISSN 1439-1791

Konôpka, Bohdan & Pajtík, Jozef & Moravčík, Martin & Lukac, Martin. (2011). Biomass partitioning and growth efficiency in four naturally regenerated forest tree species. Basic and Applied Ecology. 11. 10.1016/j.baae.2010.02.004.

Konôpka, Bohdan & Pajtík, Jozef & Moravčík, Martin & Lukac, Martin. (2011). Biomass partitioning and growth efficiency in four naturally regenerated forest tree species. Basic and Applied Ecology. 11. 10.1016/j.baae.2010.02.004.

Lehtonen, Aleksi & Mäkipää, Raisa & Heikkinen, Juha & Sievänen, Risto & Liski, Jari. (2004). Biomass expansion factors (BEFs) for Scots pine, Norway spruce and birch according to stand age for boreal forests. Forest Ecology and Management. 188. 211-224. 10.1016/j.foreco.2003.07.008.

Wirth C, Schumacher J, Schulze ED. Generic biomass functions for Norway spruce in Central Europe--a meta-analysis approach toward prediction and uncertainty estimation. Tree Physiol. 2004 Feb;24(2):121-39. doi: 10.1093/treephys/24.2.121. PMID: 14676030.

Zianis, Dimitris & Mencuccini, Maurizio. (2003). Aboveground biomass relationships for beech (Fagus moesiaca Cz.) trees in Vermio Mountain, Northern Greece, and generalised equations for Fagus sp. Ann. For. Sci. 60 (5) 439-448 (2003) DOI: 10.1051/forest:2003036

Zianis, Dimitris & Muukkonen, Petteri & Mäkipää, Raisa & Mencuccini, Maurizio. (2005). Biomass and stem volume equations of tree species in Europe.. Silva Fennica. 4. 10.14214/sf.sfm4.

Stem volume increment

Giurgiu, V., Drăghiciu, D., 2004. Modele matematico-auxologice şi tabele de producţie pentru arborete, Editura Ceres, Bucureşti, 607 p.

Wood density

Flores, Olivier & Coomes, David. (2011). Estimating the wood density of species for carbon stock assessments. Methods in Ecology and Evolution. 2. 10.1111/j.2041-210X.2010.00068.x.

Zanne AE, Lopez-Gonzalez G, Coomes DA, Ilic J, Jansen S, Lewis SL, Miller RB, Swenson NG, Wiemann MC, Chave J (2009) Data from: Towards a worldwide wood economics spectrum. Global wood density database. Dryad Digital Repository. doi:10.5061/dryad.234