

# Conservation of valuable remaining populations of Norway spruce in interest areas of the Czech Republic



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## Introduction

The Norway spruce (*Picea abies* (L.) H. Karst) is the main domestic tree in the Czech Republic, but in recent years due to calamitous influences (HLÁSNÝ et al. 2011, RAMSFIELD et al. 2016) its representation is rapidly decreasing and thus disappear its valuable population. In the stand there are also individuals which withstand the high pressure of abiotic and biotic factors, however those trees may not withstand the intense onslaught forever. The reasons, a project was created, is to preserve valuable populations and to find surviving spruce trees that have gained and kept the resistant abilities to negative effects.



Figure 2 a, b. Selected and certified spruce individuals as a source of reproductive material



Figure 1. Calamity situation on a site with a valuable spruce population in Kácov

## Aim

The main goal of the project is to protect the diversity of forest communities: maintaining the genetic variability of valuable residual spruce populations, increasing resistance to incidental natural phenomena. Its essence is to connect the research process with conservation practice in the use of resistance potential to adverse environmental effects in part of the gene pool of Norway spruce preserved in lower and middle positions, and thus preserving this species as a natural part of forest ecosystems.

## Project description

The ongoing four-year project (06/2020 - 05/2024) is divided into two activities A1: "Design and implementation of an innovative technological procedure for the establishment of seed orchards of valuable subpopulations of Norway spruce (NP Podyjí, NP České Švýcarsko and Orlická nad Vltavou)" and A2: "Genetic characterization of drought and bark beetle-resistant populations in the localities Leděčko (Kácov), Dolní Břežany (ARCIBISKUPSTVÍ PRAŽSKÉ) and Klokočná (Konopiště)". At all localities, from selected and comparative individuals using DNA analyzes is determined their genetic characteristics. Suitable SSR markers are used for analyzes, resp. optimized PCR and fragment analysis procedures to obtain multilocus spruce genotyping. The output after statistical processing will be knowledge of the genetic diversity of subpopulations and their structuralization, which are essential for maintaining the potential for their conservation in a changing environment. After identified diversity of spruce individuals, the most suitable graft donors will be selected from three areas, a seed orchards *in situ* will be established to obtain reproductive material for repatriation to suitable habitats.

In Dolní Břežany the expression level of selected genes in tree species will be determined by RNA analyzes. The expression levels of genes related to drought stress response (e.g. transcription factors, genes related to phytohormone metabolism or water regime) will be determined by quantitative PCR (qRT-PCR) in spruce trees that have survived in good condition in order to determine the mechanism of resistance from a molecular biology perspective.

## Literature

HLÁSNÝ T., HOLUŠA J., ŠTĚPÁNEK P., TURČÁNI M., POLČÁK N. 2011. Expected impacts of climate change on forests: Czech Republic as a case study. *Journal of Forest Science*, 57 (10): 422–431.

RAMSFIELD T.D., BENTZ B.J., FACCOLI M., JACTEL H., BROCKENHOFF E.G. 2016. Forest health in a changing world: effects of globalization and climate change on forest insect and pathogen impacts. *Forestry*, 89: 245–252.

## Acknowledgments

This work was supported by the project of the Technology Agency of the Czech Republic with reference number SS01020260 and the project of the Ministry of Agriculture of the Czech Republic – Resolution RO0118.



Figure 3. Grafted seedlings for establishing seed orchards

## Conclusions

By using an innovative method that combined classical breeding procedures with molecular genetic methods, it is possible to achieve the selection of a quality source of reproductive material and thus preserve valuable populations of Norway spruce, which have over the long term evolved. Once the method is completed, forest owners, forest managers, and the professional public will be able to use this technology if they prefer to maintain the source of reproductive material and keep Norway spruce still as a domestic tree on their holdings, where it occurs naturally.