

TREE AND UNDERSTOREY FINE ROOT GROWTH AND LONGEVITY IN A NORWAY SPRUCE STAND IN NORTHERN FINLAND

Sah, S.P.¹, Børja, I.², Truus L.³, Helmisaari, H-S.¹

¹Finnish Forest Research Institute, Vantaa Research Center, Box 18, FI-01301 Vantaa, Finland, shambhu.sah@metla.fi

²Norwegian Forest and Landscape Institute, P. O. Box 115, NO-1431 Ås, Norway

³Institute of Ecology at TPU, Kevade 2, EE-Tallinn 10137, Estonia

ABSTRACT

Tree and understorey fine root growth and longevity were determined by minirhizotron (MR) research in northern Finland. The study was made in a 70-year-old Norway spruce stand, growing on a mesic mineral soil site in the Kivalo experimental forest. Three replicate plots were established, and three vertical and two horizontal MR tubes installed in June 2003 in soil of each of the three plots. The images were taken at monthly intervals (altogether 11 sessions) during the growing seasons 2004, 2005 and 2006. The lengths, diameters and status (new, living, dead, disappeared) of Norway spruce fine roots and understorey (mainly shrub) fine roots and rhizomes were recorded.

For both trees and understorey, the frequency of new born roots was comparatively higher in the first two growing seasons (2004 and 2005) after the tube inserting, and then considerably decreased in 2006. The primary reason may be root growth stimulation by cutting them by soil coring for tube inserting. Another contributing factor may be that roots growing into the limited space between the MR tube wall and soil the first years left little space for new roots in the following years.

Root elongation rate was highest during late summer and early autumn. The reason for reduced root growth during shoot elongation is possibly attributed to greater carbon demand by the canopy, and reduced carbohydrate translocation to the roots. Both for horizontal and vertical tubes, the overall means of root elongation rate in all plots was slightly higher for understorey roots/rhizomes than for tree roots.

Tree and understorey roots did not differ much in their longevity, disappearance and decomposition duration, and are not affected by either soil depths or the tube placement (horizontal and vertical tubes). The mean root longevity, time from emergence to death, was 14-16 months. Roots of both trees and understorey born in 2004, one year after installing the tubes, died and disappeared proportionally more within a year than roots born in 2005. Also, root longevity was lower for those roots which were born in early summer (June 2004) than roots born later (July and August 2004).

We observed a large number of living roots disappearing without being dead, sometimes only after a few months after they were born. Root decomposition (duration from death to disappearance) ranged from 4.6 to 7.4 months for trees and from 3.2 to 6.1 months for understorey, the longer durations involving one winter period.

Key words: fine root, longevity, death, disappearance, minirhizotron, Norway spruce, understorey