

ROOT SYSTEM MODIFICATION OF *PINUS BRUTIA* TEN. SPECIES UNDER ADVERSE ECOLOGICAL CONDITIONS

P. P. GANATSAS and M. N. TSAKALDIMI

Aristotle University of Thessaloniki, Department of Forestry and Natural Environment
Laboratory of Silviculture
P.O.Box 262, 54 124, Thessaloniki, Greece
E-mail: pgana@for.auth.gr

EXTENDED ABSTRACT

Tree root system plays an important role in forest stands establishment and growth. *In situ* studies on root development of mature trees have a long history despite the fact that these are difficult to be carried out due to many practical problems and the high labor cost. The aim of this study was to examine the root distribution and root type of mature trees of a Mediterranean coniferous species *Pinus brutia* Ten., under adverse ecological conditions named shallow soil, high mechanical resistance of the underground bedrock and low water availability.

A soil transect of 2 km was studied in the peri-urban artificial forest of Thessaloniki, following the excavation performed during the works of ring-road extension. The forest stands were approximately 65 years old, dominated by the species *Pinus brutia*. In order to assess root spatial distribution, twenty seven soil vertical profile walls were taken from nine tree stumps and at three different spaces from each representative tree: i) at the point that the stump ends (0 m distance from the stump), ii) 0.75 m from the stump, and iii) 1.50 m from the stump, distance that corresponds to the half of the tree spacing in the planting row. Each vertical soil profile wall was divided into square grid cells of 25 cm² for the upper soil layers (0-30 cm) and 100 cm² for the deeper soil layers (>30 cm) and the number of roots belonging to three diameter classes (between 0.1 and 1 mm, 1 and 10 mm, and over 10 mm) were counted in each grid cell. Root system architecture was estimated from observations on twelve selected stumps. In order to describe above-ground stand growth, the tree characteristics (tree height and diameter at breast height) were estimated before the road works.

The findings of the study showed a change in root distribution of 65-year old *Pinus brutia* trees and confirmed that the root system is highly affected by the stress factors of soil (absence of sufficient soil depth, mechanical resistance of underground bedrock). The highest root density of fine, medium and coarse roots was observed in the upper soil layers (0-30 cm). Mean fine root density (FRD) values decreased sharply with soil depth, regardless of the distance from the tree stump. The density of coarse roots (CRD) showed a clear negative relationship with the distance out from the tree contrary to the fine root density which found lower under the stump. The stress factors of soil caused a deflection of the typical pine root system, restricted the root penetration in the deeper soil layers and obliged the root to elongate towards the surface soil layers with more available water. This root restriction and deformation strongly affected the stand growth which was found extremely limited.

Key words: fine root density, mechanical impedance, root architecture, root distribution.