Predicting the bending properties of poplar wood using non-destructive testing methods

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**Abstract.** Research and development efforts are currently underway worldwide to examine the potential use of a wide range of non-destructive technologies (NDT) for evaluating wood and wood-based materials, from the assessment of standing trees to in-place structures. As many studies have focused on measuring the stress wave of standing trees, application and extension of the results for the entire stem are not widespread. Further research is therefore needed to establish sufficient data on MOEd variation in tree trunk length.

The tests were conducted in the Vibo Valentia province (Calabria region, Italy). It extends over an area of about 3 hectares, mainly flat, and only in some points, there was a slight slope. The area under consideration was planted with *Populus canadensis*, clone I-214, having a 6 x 6 m spatial geometry.

This study aims to determine the MOEd in 55 standing trees, and trunks, of same clone (I-214), and to evaluate the relationship between the MOEd and the MOE of sawn wood. This relationship is studied at three stem heights, H1 (30 - 130 cm), H2 (130-230) H3 (230-330 cm) from base to top, to establish their effects. This survey was carried out employing two different nondestructive control approaches: the time of flight (TOF) of the acoustic stress waves and the acoustic velocity acquired on standing trees, and the measurement of the acoustic velocity in the longitudinal direction on the logs. Following the height classes chosen on the standing plan, 80 specimens measuring 2x2x40 cm were used to conduct the four-point bending tests to obtain global MOEm and F*m,k*.

Considering that the optimal transformation path of wood in the sawmill is determined by the quality of a log, and therefore also by the prediction of the elastic modulus combined with the size of the log, it follows that the inherent qualitative characteristics of the logs greatly affect the commercial value of derivative products. Another objective of this study is to evaluate the sawing yields of the finished product as a function of the dynamic elasticity module of the standing trees and the logs.

The result of this study could be introduced to the actual knowledge to expand and improve techniques of management of poplar plantation.