

ABSTRACT

Wind damage in *Eucalyptus* plantations is one of the main factors affecting fiber productivity losses in RAPP plantations. High levels of damage start from 1.5 to 3.5 years old, with the total wind damage area between approximately 7% to 15%. In this study, the ForestGALES model was parameterized for *Eucalyptus* clones grown under the environmental conditions of Riau, Indonesia. Measurements of tree characteristics, wood mechanical properties (modulus of elasticity and rupture), and uprooting resistance were conducted to parameterize the ForestGALES model for use in Indonesia.

This study was conducted in the *Eucalyptus* plantations in Teso East and Nagodang in the Kampar regency, Riau province, Indonesia, a concession area of PT. Riau Andalan Pulp and Paper. Two clones with three replications were evaluated in this study, for which nine trees for each clone were selected. The analysis in this thesis consisted of identifying the tree characteristics affecting the maximum resistive moment, ForestGALES model parameterization and validation, the calculation of Critical Wind Speed (CWS), sensitivity analysis, and the use of the ForestGALES CWS calculations for tree improvement selection.

The results showed that uprooting resistance was linearly correlated to stem weight. Damage levels were set within *Eucalyptus* stands at 20%, 27%, and 30% for ages of 1.5, 2.5 and 3.5 years, respectively. The model was able to successfully discriminate between damaged and undamaged stands using the Receiver Operator Characteristic (ROC) with Area Under the Curve (AUC) values of between 0.77 to 0.95. The sensitivity results showed that tree characteristics such as diameter at 1.3 m above the ground (dbh) and tree height were critical factors in the prediction of CWS for stem breakage and uprooting. A significant difference in calculated CWS between two different clones was observed, indicating that ForestGALES can be used as a tool for tree breeders to classify clones that are resistant to wind damage and those that are susceptible to wind damage.

Keywords: *Eucalyptus*, *Tree characteristics*, *Tree-pulling experiments*, *ForestGALES*, *Critical wind speed*, *Wind damage*