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Growth analysis of five Leguminosae native tree species from a seasonal semidecidual lowland forest in Brazil

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ABSTRACT

The Leguminosae family is one of the most representative families in the seasonal semidecidual lowland forest, and many of their species have economical and ecological importance, including for the recovery of degraded areas. However, there is still a lack of knowledge about the biology of native species for forest restoration. Tree growth dynamics features, such as increment rates, life expectancy and tree responses to environmental variations can be assessed through tree-ring studies. Therefore, this study aimed to investigate the growth features of *Copaifera langsdorffii*, *Dalbergia nigra*, *Pterocarpus rohrii*, *Schizolobium parahyba* and *Senna multijuga* trees in a known age experimental plantation. The study site was located in Espírito Santo State, southeastern Brazil. Stem discs were obtained for anatomical characterization of tree-rings. Wood samples were sectioned and processed following the usual plant anatomy techniques. For macroscopic analysis, samples were polished and analyzed under a stereoscopic microscope. All species showed distinct growth rings with annual periodicity formation. Growth rates, tree size measurements and growth trajectories were established for each species. These features varied even among trees of the same age and species growing under homogeneous conditions. It is noteworthy that growth variation was not related to the species' ecological group. These data are important to characterize growth behavior of native species in order to subsidize species selection for recovery of degraded areas and economical purposes.

1. Introduction

The Leguminosae family is the largest within the dicotyledons in Brazil (Giulietti et al., 2005). In the seasonal semidecidual lowland forest, trees from the Leguminosae family, together with those from the Myrtaceae and Sapotaceae families, bring together more than 30% of the species of the high plateaus and riparian areas (Rizzini and Garay, 2003). Leguminosae species have an important role for nitrogen fixation (Sprent, 2007), and they are economically important for food production, pharmaceutical use and construction (Lewis et al., 2005).

The existence of annual growth rings was reported in many Leguminosae species growing in distinct regions (e.g. Stahle et al., 1999; Fichtler et al., 2004; Lisi et al., 2008; Marcati et al., 2008; Callado and Guimarães, 2010; Brandes et al., 2011, 2015; Vasconcellos, 2012).

The presence of tree-rings is a reflection of the environment in which the tree grew (Gasson et al., 2010). For tropical species, the formation of tree-rings is mainly associated to the existence of a dry season (Worbes, 1995). In northern Espírito Santo, the climate shows an annual dry season (Egler, 1951; Peixoto et al., 2008), which may favor the formation of distinct and annual growth rings in woody species.

Thus, dendrochronology is usually applied to investigate the role of environmental factors on trees growth. It also provides information on the growth rates of trees and timber volume, which allow the construction of growth models to improve management practices, and help to determine the appropriate age for tree cutting in order to respect the cycles of population renewal (e.g., Eckstein et al., 1995; Worbes, 2002; Brienen and Zuidema, 2006; Schöngart et al., 2007; Schöngart, 2008).

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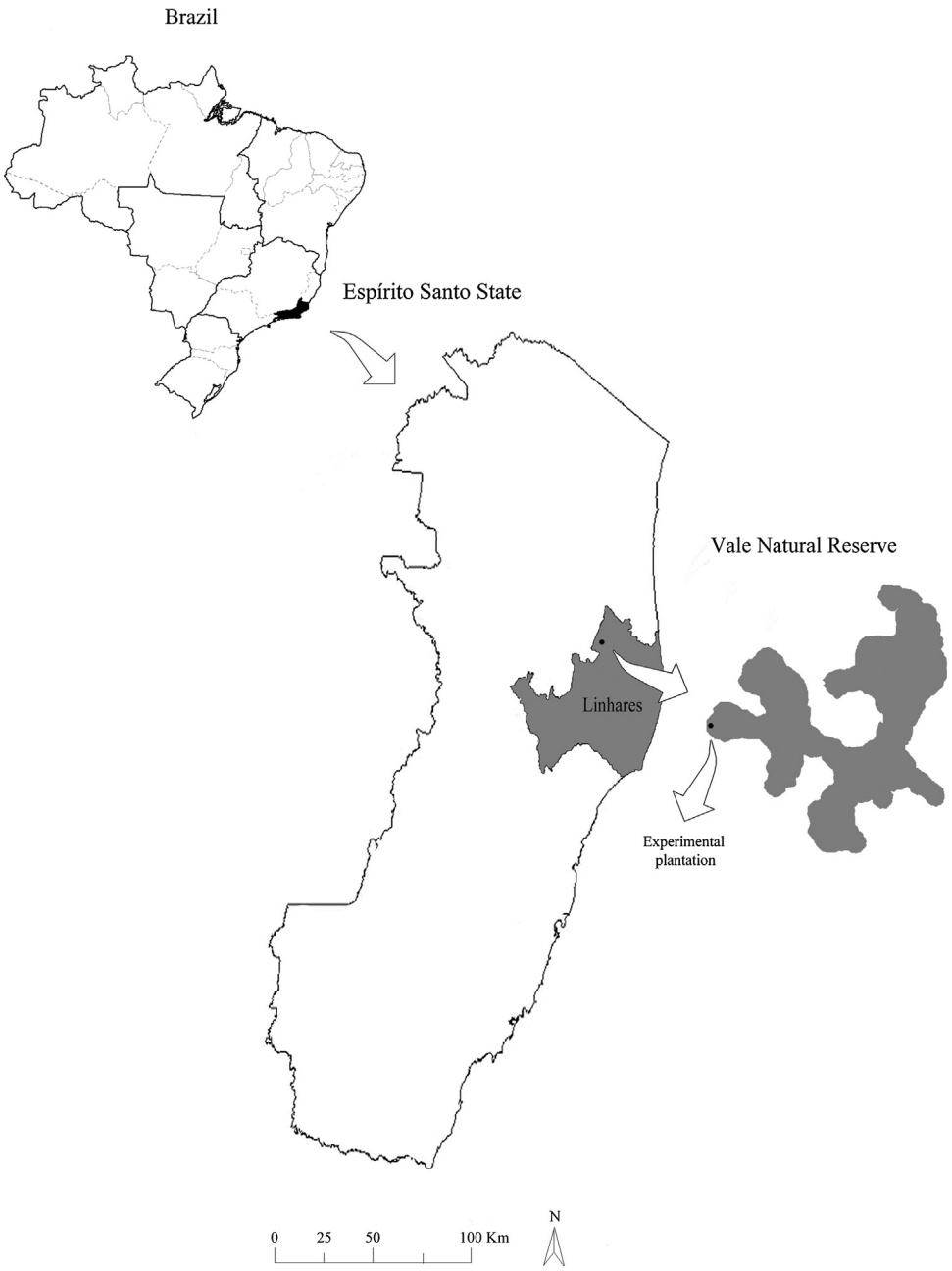

Fig. 1. Map of Espírito Santo state, in Brazil, showing the location of the study site, at Linhares city.

In tropical forests, one of the most important problems is the extraction of their woods, followed by plantation of exotic species, or by destination of the native areas for economical purposes. Historically, wood exploitation in Brazil began in the Atlantic Rain Forest, following a predatory model, which is nowadays relocated to the Amazon Forest (Cabral and Cesco, 2008). As a consequence, the Atlantic Rain Forest is one of the most threatened biomes in the world, due to a vast story of deforestation and degradation (Dean, 1995; Myers et al., 2000). Currently, only 15% of the original Atlantic Rain Forest is left (Fundação SOS Mata Atlântica/INPE, 2014). Seasonal semidecidual lowland forests of northern Espírito Santo State have undergone to exploitation of forest products and the expansion of agricultural areas, and now, they are restricted to the Sooretama Biological Reserve and the Vale Natural Reserve (Peixoto et al., 2008). These reserves are surrounded by agricultural areas; alien tree plantations (mainly *Eucalyptus* L'Her.); and to a lesser extent, pastureland (Peixoto et al., 2008).

Recently, there is an increasing effort to enable the implementation of projects to restore degraded areas next to forest remnants. Our study is inserted in Biomas Project, a Brazilian project which is concerned with the insertion of native tree species in agroforestry plantations, forest restoration and rehabilitation projects of degraded lands and forest areas. However, there is still a lack of knowledge about growth, ecology and economical use of native species.

In the Atlantic Rain Forest, native tree species growing in known age plantations are relatively scarce. Investigations about these planted trees can provide valuable information on tree-rings periodicity and species' growth rates. These data are important for implementing agroforestry plantations and degraded lands