

Decline in Giant Tree Numbers: Status Report for Santa Catarina State and Perspectives for Brazil

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ABSTRACT

Loss of large trees due to indiscriminate timber cutting and opening of new areas for human use is a global problem. Brazil is well known for tree species richness within its extensive forested areas composed of various biomes. Giant trees are “key” to recognize the original forest structure. Decline of their populations in Brazil may be estimated by comparing data of the National Forest Inventory (NFI) with those of regional data and other surveys. In fact, Santa Catarina is the first state in Brazil to have currently completed its forest inventory. However, only few large trees were sampled systematically. Recognition of the maximum tree growth is important for their ecological management and tourism potential. Public policies for cataloging and management of these resources must be developed before it is too late.

Keywords: ancient trees, large old trees, tree protection, forest inventory, conservation.

Populations of large trees, an important element in forests, agricultural areas, and urban environments, are declining throughout the world (Lindenmayer & Laurance, 2017). Only 50 out of ca. 100,000 estimated tree species worldwide exceed 70 m in height (Tng et al., 2012). Although only one such tree has been recently recorded for Brazil (Gorgens et al., 2019), it seems that many other trees are likely to exist. They are vulnerable to intentional or accidental destruction and are in danger of extinction. Recognition of their loss has been acknowledged worldwide in the last decade (Crowther et al., 2015; Lindenmayer et al., 2012; Lindenmayer & Laurance, 2017). Few studies highlight loss of large trees and their density in landscapes dominated by humans (Liu et al., 2019). Despite the recognized ecological significance of large trees within different forest typologies, relatively little is known about their distribution and abundance on the global scale (Lutz et al., 2018).

Gutiérrez (2016) denominates large trees an unrecognized natural heritage of Chile, citing two examples, one of 4.2 m diameter at breast height (dbh), *Nothofagus dombeyi* (Mirb.) Oerst., and another one of 3,622-year-old, *Fitzroya cupressoides* (Molina) I.M. Johnst. The Big Tree Program in the United States of America (USA), begun in 1940, has been recording measurements of largest trees, covering all of its states and listing both native and naturalized species (Van Pelt, 2001). Regrettably, there are only a few records of the size of large individual trees in Brazil, lacking knowledge of their population dynamics and threat of extinction (Scipioni et al., 2019).

Among largest trees in the Brazilian rainforests are imbuia (*Ocotea porosa* (Nees & Mart.) Barroso), cedro (*Cedrela fissilis* Vell.), canafistula (*Peltophorum dubium* (Spreng.) Taub.), ficus (*Ficus* spp.), jequitibá (*Cariniana legalis* (Mart.) Kuntze), kapok (*Ceiba pentandra* (L.) Gaertn.), among others (Figure 1). Their



Figure 1. Giant trees in Brazil: (A) jequitibá – *Cariniana legalis* (Mart.) Kuntze; (B) ficus – *Ficus* spp., Parque Estadual Vassununga, SP (A-B); (C) pinheiro do Paraná (Paraná pine) – *Araucaria angustifolia* (Bertol.) Kuntze., São Joaquim, SC; (D) sumaúma (kapok) – *Ceiba pentandra* L., Ilha de Santana, AP (photo: Gustavo Garcia); (E) cajueiro (Cashew nut tree) – *Anacardium occidentale* L., Praia de Pirangi, RN; (F) cedro – *Cedrela fissilis* Vell., Caçador, SC; (G) imbuia – *Ocotea porosa* (Nees & Mart.) Barroso, Vargem Bonita, SC; (H) canafistula – *Peltophorum dubium* (Spreng.) Taub., Parque Estadual Fritz Plaumann, SC (photo: Karine L. dos Santos).

trunks may exceed 2.5 m dbh. One Brazilian nut tree (*Bertholletia excelsa* Bonpl.) has been recorded with 5.25 m in dbh (Salomão, 1991) and one jequitibá of 4.01 m dbh (Figure 1A). Large trees in the rainforest may live longer than 1,400 years (Chambers et al., 1998). There is a lack of records for giant trees in the country, concerning the height parameters of largest trees remaining, and these parameters could be estimated from references found in the studies in the 1970s (Reitz et al., 1978), probably not yet re-assessed using modern techniques and likely no longer exist. On the other hand, a recent discovery of an 88.5 m tree in the Amazon basin, measured using Light Detection and Ranging (LIDAR) technology (Gorgens et al., 2019), is an exception.

The concept of giant trees is not dependent on their age or size. The definition of a large old tree must be based on its relative size (diameter at breast height and height) and be species-specific. There are fast-growing species reaching large size that are not long-lived. With strong evidence of tree height deterioration and crown failure, the oldest living trees are not necessarily the tallest (Lindenmayer et al., 2012). Other forms of arboreal life, represented by plant colonies, may perpetuate themselves over centuries and millennia. The cashew nut (*Anacardium occidentale* L.) of the Brazilian Northeast is an example of a giant tree of anomalous growth, with pendent branches rooting in the ground and forming large individuals occupying ca. 7,300 m² (Figure 1). Having records of such trees and their conservation status is of high importance, both ecologically and economically.

Ocotea porosa is the state symbol tree of Santa Catarina. However, informations on the age and location of its largest trees are missing. On the other hand, it is known for Paraná pine (*Araucaria angustifolia*) the locations of these giant trees in Brazil, with the largest individual found in Santa Catarina (Scipioni et al., 2019). Both of them represent the most important state species. The Santa Catarina Forest Inventory (in Portuguese – Inventário Florístico Florestal de Santa Catarina (IFFSC)) survey recorded only a few large individuals of them from the secondary forests formed by young trees with thin trunks and low canopy. As reported by Scipioni et al. (2019) for the Araucaria Forest and by Gorgens et al. (2019) for the Amazon Forest, in these areas exist a populational imbalance

and also loss of large trees due to the absence of a historical record for the original forests.

Current forest policies in Brazil call for cataloging the remaining forests using standardized methodology. The IFFSC was firstly in the country to complete its sampling (Vibrans et al., 2010), revealing intensively exploited forests. The IFFSC data of 114,836 trees yielded only five giant trees of dbh > 1.5 m, commonly reported from 1950s and 1970s (Reitz et al., 1978; Scipioni et al., 2019). Data of the principal species of giant trees of South and Southeast Brazil, sampled by Scipioni et al. (2019) and Reitz et al. (1978), and of North Brazil by Salomão (1991, 2009), are cited in this paper. They could notice the devastating effect of disorderly exploitation of forest resources, poor forest management techniques, and also lack of awareness of the importance of their conservation in Brazil, and the data are presented here in a dbh/height scatter plot (Figure 2). Due to their scarceness, one of the most important Brazilian gymnosperms, *Araucaria angustifolia*, with few trees of > 2 m dbh (Scipioni et al., 2019), had no records in state inventories. The biotic, ecological, and economic functions associated with large trees are in danger of being lost in the scenario of an increasing environmental degradation, highlighting the need for undertaking forest inventorization of large trees and of old-growth forests.

New policies and management action to conserve existing large trees are urgently needed. In order to sustain their ecological and economic functional properties, recognition and cataloging of large individual trees and old-growth forests as the first step is called for, apart from management of their populations to ensure their perpetuation as the second step (Gutiérrez, 2016; Lindenmayer et al., 2013; Lutz et al., 2018; Scipioni et al., 2019). Lindenmayer et al. (2013) argue that conservation of existing large trees by restoring their ecologically effective and viable populations requires creation of protected areas on much longer temporal and spatial scales than those currently practiced in the Amazon. Recognition of old-growth forests in fragmented areas, such as the Atlantic Forest (Scipioni et al., 2019) and the Amazon Forest (Gorgens et al. 2019), in official records, including regular information on the forest health and vitality, tree size, tree life cycles, structure, composition, biomass and carbon stock, are important for the forest management in these distinct developmental stages (Feldmann et al., 2018; Keren & Diaci, 2018; Merschel et al., 2019).

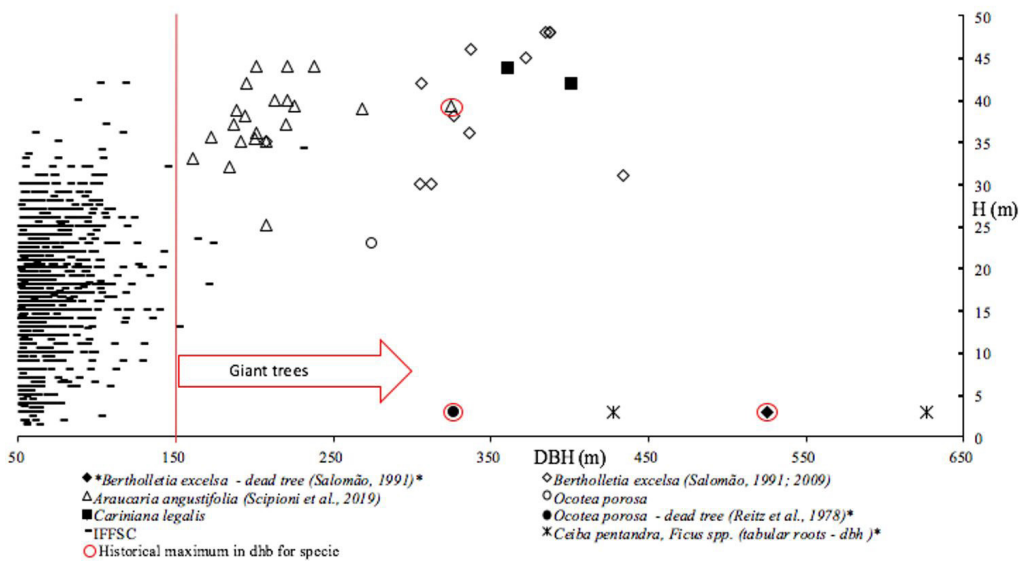


Figure 2. Scatter plot of tree height vs. diameter at breast height (DBH) of the principal giant trees in Brazil. *In order to visualize the graph, the height of 3 m was used for trees with no height records.

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