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Articles

Diametric distribution of forestry species in riparian forest in the southern part of the Amazon

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Abstract - The expansion and changes in land use and land cover in the Southwest Amazon are mainly related to the activities of logging without management rules, agriculture and cattle production, which resulted in the conversion of natural forests, especially along water courses. This study aimed to verify the diametric distribution of forestry species with higher importance value index in the riparian forest of the Acre River (Acre, Brazil). The forestry inventory was performed at eight municipalities crossed by the Acre River, using two stage sample units (conglomerates) and applying stratified random sampling techniques at the river bank. Twenty-seven primary plots were installed, within which another four secondary plots were implanted. It was fitted Weibull's probability density functions with 2 and 3 parameters to species diametric distribution, provided by the maximum likelihood method. Graphic analysis verified that 86% of the species analyzed presented a distribution trend with positive asymmetry. The distribution of the Weibull function with two parameters presented better the best estimative of the frequency of species by diameter class of the natural forest evaluated. Considering the heterogeneity of the species, further studies to verify whether the distribution behavior follows the same trend is recommended.

Distribuição diamétrica de espécies florestais da mata ciliar na parte sul da Amazônia ocidental

Resumo - A expansão e as mudanças no uso e cobertura da terra na parte sul da Amazônia ocidental estão vinculadas principalmente às atividades do extrativismo madeireiro sem regras de manejo e à produção agropecuária, que resultaram na conversão de florestas nativas, especialmente ao longo de cursos d'água. Esse estudo teve como objetivo verificar a distribuição diamétrica de espécies florestais com maior índice de valor de importância da mata ciliar do Rio Acre, AC. O inventário florestal foi realizado em oito municípios cortados pelo Rio Acre, utilizando unidades amostrais com dois estágios (conglomerados) e técnicas de amostragem aleatória estratificada pela faixa marginal do Rio Acre. Foram instaladas 27 parcelas primárias, dentro das quais foram distribuídas quatro parcelas secundárias. Para estudo da classificação diamétrica, foram avaliadas as funções de densidade probabilística de Weibull 2 e 3 parâmetros pelo método da máxima verossimilhança. Pela análise gráfica, verificou-se que 86% das espécies analisadas apresentaram tendência de distribuição com assimetria positiva. A distribuição da função Weibull com dois parâmetros estimou melhor a frequência de espécies por classe de diâmetros. Diante da heterogeneidade das espécies, recomendam-se novas pesquisas para verificar se o comportamento da distribuição segue a mesma tendência.

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Introduction

The area by the Acre River is important for agricultural purposes, consequently the watershed has the higher rates of anthropic changes, including colonization projects in which forest coverage has been converted to homogeneous plantations. Many of those areas exceed the 20% allowed by legal limit, according to the Brazilian Forest Code (Law 12.727, of 2012) for forest areas located in the Legal Amazon (Brasil, 2012).

This intense occupation has damaged the watershed, with visible impacts (Aragão, 2012), such as the river overflowing during the Amazon winter (December to March) or intense drought during summer (April to November), leaving urban areas without water supply (Chambers & Artaxo, 2017).

Despite riparian forests being legally protected by Brazilian Federal Law (12.727/12), which classifies riparian forests as areas of permanent protection (Brasil, 2012), they are subjected and susceptible to various types of degradation (Rodrigues et al., 2013, 2017). To counteract this situation, some projects have been highlighting the importance of preserving and/or restoring the riparian forests, especially in areas containing native species, as stated in Resolution 429/11 of the Brazilian Council for Environment (CONAMA, 2011).

The analysis of vegetation is important to obtain a value that indicates the overall structure of the system being studied or that characterizes the importance of each species in the total conglomerate of the forest. Further, it is possible to integrate the 3 partial indexes (i.e., abundance, dominance and frequency), to obtain a unique expression capable of representing the forestry structure, named as importance value index (Chaves et al., 2013).

The diametric distribution of forests is important as basis to obtain information on growth dynamics and to infer the ecological relationship among tree species. As a result, the management strategy best fitted to the diametric structure at the forest area or tree level may be selected based on this information during the decision-making process (Campos & Leite, 2013; Santos et al., 2016).

There is a good correlation between tree diameter and certain variables, such as tree height, wood volume, timber value, conversion cost and product stratification (Binoti et al., 2013). The diametric distribution and its relationship with the site, forest area composition, tree age, and species density are important for biological and economical purposes (Binoti et al., 2013). Therefore, the diametric distribution is an indicator of the forest structure, helping to distinguish forest typologies and to identify natural regeneration at species level (Machado et al., 2010).

The diametric structure description of forests has been verified through probability density functions (pdf), as they allow the specimen probability to be obtained for determined diameter intervals, presenting the structural behavior of the forest clearly (Machado et al., 2010; Nascimento et al., 2012).

According to Nascimento et al. (2012), the first work performed in an Amazon area that implemented diametric classification using pdf was in 1979, which was largely diffused in the region. The same authors affirm that models based on the pdf have mathematical characteristics, making them flexible, allowing the use of several forms and asymmetries for the dendometric descriptions and forests typologies, precise and presenting good correlations between the coefficients and forests attributes.

The adjustment of the Weibull function by the maximum likelihood method provides reliable estimates, with lower tendentiousness than other methods, such as moments or percentages. This function is also considered superior to other probability density functions and is also easy to apply (Araújo Júnior et al., 2010; Binoti et al., 2012; Campos & Leite 2013).

Due to the characteristics of forest species, it is necessary to establish bases for sustainable management in natural forests. Diametric distribution and fitting models are good alternatives to understand the structure of the forest at diameter class level. Thus, this study aimed to analyze the diametric distribution of 30 forestry species identified with a higher importance value index in a riparian forest of the Acre River, using the 2 and 3 parameters Weilbull probability density functions.

Material and methods

The Acre River hydrographic basin is located in the South-Western Amazon, on the triple border between Brazil, Bolivia and Peru and has an approximate area of 35,967.5 km^2, of which 87.5% belong to the Brazilian territory (87.6% belong to the state of Acre and 12.4% to the state of Amazonas). This study was conducted in the remaining fragments of a riparian forest of the Acre River (Figure 1). The critical areas that were studied in this research are the result of the urbanization process,