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Richness and distribution of useful woody plants in the semi-arid region of northeastern Brazil

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Abstract

The species richness and distribution of useful plants in the semi-arid *caatinga* vegetation of northeastern Brazil was evaluated based on 20 phytosociological surveys conducted over a period of 36 years. Precipitation and altitude were analyzed as possible predictors of species richness. A total of 43 families, 130 genera, and 225 species were cataloged. The family Euphorbiaceae had the highest richness (34 species), with the genus *Croton* comprising 11 species. In terms of the distribution of species, four species were found to be widely distributed, 33 demonstrated intermediate distribution, and 188 were of restricted distribution. Of all the species recorded, 122 were considered useful. The main use-categories were: wood for construction (86 species) and medicinal plants (80). The plant with the greatest number of recorded uses was *Schinopsis brasiliensis* Engl. There was no significant correlation observed between precipitation and the species richness of useful or non-useful plants; however, a correlation was observed in terms of total richness, despite the existence of a nonlinear increment in species richness along the precipitation gradient. Similarly, there was no significant correlation between altitude and either total plant or useful plant richness but, interestingly, there was a significant relationship of this nature observed with non-useful plants. As such, the richness of useful plants in the *caatinga* seems to be a function of general biodiversity and it is not directly linked to the ecological factors examined (precipitation and altitude).

Keywords: Biodiversity; *Caatinga*; Dry forests; Economic botany; Environmental gradients

1. Introduction

Studies of the flora, wood reserves, and the forest products of northeastern Brazil arose from initiatives of governmental organizations such as the ''Superintendence of Development of the Northeast'' (SUDENE) and the initiation of forest inventories (Feitoza, 2004). One of the first inventories was directed towards evaluating the wood production potential of *caatinga* (tropical deciduous forest) species in the states of Ceará and Pernambuco (Tavares et al., 1969a,b, 1974a,b). Later studies focused on physiognomic patterns (Lira, 1979), floristics, phytosociological analyses (Fonseca, 1991; Araújo et al., 1995; Gomes, 1999; Pereira et al., 2002;

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Alcoforado et al., 2003; Costa, 2003; Nascimento et al., 2003), variations in abundance of plant populations (Andrade, 2000; Figueiredo, 2000), as well as the relationships of human communities with the regional vegetation (Albuquerque and Andrade, 2002a,b; Almeida and Albuquerque, 2002; Albuquerque et al., 2005a,b; Almeida et al., 2005, 2006; Ferraz et al., 2005; Monteiro et al., 2006a,b; Lucena et al., 2007). In their review of 38 previous publications concerning the *caatinga* vegetation, Rodal et al. (1988) noted that a total of 48 different families, 161 genera, and 339 species had been cited, while Giulietti (2000) reported that a total of 932 vascular plants have been recorded for all of the *caatinga* biome to date. Most studies have analyzed woody plants, as they constitute most of the forest biomass and to a very large extent determine its structure and function (Berry, 2002).

Despite advances in our knowledge of the biodiversity of the *caatinga*, there are gaps that are only slowly being filled concerning the variables that might explain the differences in floristic composition, species richness, and species distribution observed at different sites (see Araújo et al., 2007). Many *caatinga* areas demonstrate strong variations in floristic composition that is reflected in a high physiognomic diversity (Andrade-Lima, 1966; Rodal and Sampaio, 2002). Such variations are usually associated with physiographic, climatic, and anthropogenic gradients (Andrade-Lima, 1981; Sampaio et al., 1994; Sampaio, 1995).

Predictable variations in species richness along environmental gradients (such as soil type, precipitation, altitude, and latitude) have been documented in neotropical plant communities (Gentry, 1982, 1988). Precipitation, for instance, is positively correlated with species richness—although Asquith et al. (2002) observed that this correlation might be driven more by the duration and intensity of the dry season in these neotropical regions than simply by the total amount of rainfall. Likewise, diversity decreases with altitude (Gentry, 1988). Such gradients do not have the same influence on all organisms, however, as life forms living within their optimal environment range respond differently to environmental factors than do organisms facing adverse conditions or pronounced natural perturbations (Scatena, 2002). In terms of the *caatinga*, the available information suggests that species richness responds to soil type and precipitation (Sampaio, 1995; Rodal and Sampaio, 2002; Tabarelli and Vicente, 2002). However, much available information is anecdotal, and little is really known about how these gradients affect ecological processes or individual species (such as useful plants).

Numerous studies have been conducted in the *caatinga* of northeastern Brazil, often focusing on woody species (Rodal and Andrade, 1998; Lemos and Rodal, 2002; Alcoforado et al., 2003; Costa, 2003; Silva et al., 2003), but very few have analyzed the factors that might influence their occurrence, richness, and economic potential. Predictable variations in community dynamics, such as the prevalence of species dispersed by mammalian vectors, for example, can be detected along precipitation gradients (Tabarelli et al., 2003). Another factor determining species distribution in the *caatinga* is related to anthropogenic influences. Humans are responsible for harvesting on approximately half a million hectares of *caatinga* lands every year (Campello et al., 1999), and many other species are commercialized and threatened with extinction (IBAMA, 2004). About 30% of all the forest products extracted are used as fuel—either as charcoal or firewood (Campello et al., 1999).

The present study intends to increase our knowledge of the richness and distribution of useful plants in northeastern Brazil based on information contained in 20 phytosociological surveys carried out during the past 36 years. We intend to address the following questions: (1) does the species richness of useful plants vary along precipitation or altitude gradients? As useful species are essentially biological entities that have been found to be directly useful to humans, we would expect a closer relationship; (2) is the species richness of useful plants a function of general biodiversity? Although this relationship has not been closely examined, that a greater local biodiversity would increase the probability of encountering species that are useful to humans; (3) can the local availability of a plant (as measured in terms of its density and frequency) explain its utilitarian importance (potential)? A number of local-scale studies have indicated a relationship between these variables (Albuquerque and Lucena, 2005). Although larger scale studies in this sense have been rare (e.g. Silva and Albuquerque, 2005), we would expect to encounter a positive relationship between the availability of a plant in a given region and its use-potential there. Various techniques have been described in the ethnobotanical literature to determine the importance of a plant species, and we have opted in the present work to use a simplification of the relative importance technique proposed by Bennett and Prance (2000) that permits us to