



# DIVERSITY, STRUCTURE AND INDICATOR SPECIES IN SEASONAL FORESTS AT THE HYDROGRAPHICAL BASIN OF THE SOUTHERN TOCANTINS (TO) STATE, BRAZIL.

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## INTRODUCTION

Tropical seasonally dry forests present a worldwide distribution, occurring in África, Oceania, Asia and the Americas, under climates with well defined rainy and dry seasons and average precipitation under 1600 mm per yer (Prado & Gibbs 1993). The largest concentration of these forests is in the Neotropics (South and Central America) where their trees reach up to 25 m high with diameters up to 120 cm. Their biomass production is intermediate between the savannas and the rain forests.

Seasonal forests stand out in the landscape due to their leaf loss. Deciduous forests are those losing from 50% to 90% while semideciduous lose from 20% to 50% (Scariot & Sevilha 2005). They grow on hilly terrain, limestone outcrops and also in plain more fertile soils than the surrounding savanna soils. In Tocantins State at the Southern portion, seasonal forests occur forming a mosaic of vegetation where savanna (cerrado) is the main vegetation and those forests occur in patches linked to edaphic conditions.

This study of diversity and soil - plant relationship was conducted to obtain information for a phytoecological mapping of Tocantins state aiming to support government decisions on sustainable management within a project named "Mapeamento e Inventário Florestal das regiões Fitoecológicas do Estado do Tocantins".

## OBJECTIVES

The objective was to analyse patterns of species richness, diversity and similarity among four sub - hydrological basins of the Tocantins River and to detect indicator species of environmental conditions.

## MATERIAL AND METHODS

Study site

The Southern part of Tocantins State with 100,818.12 km<sup>2</sup> is at 11 - 13° 30' S and 45° 0' - 51° W. It includes 45 municipalities and 14 sub - hydrographical basins, four belong to the Araguaia river basin and ten at the Tocantins river basin. This study was conducted within this last basin.

The geology is complex and the soils belong to the following subordens according to the Brazilian soil classification: PLINTOSSOLOS, NEOSSOLOS, LATOSSOLOS, ARGISSOLOS, CAMBISSOLOS, PLANOSSOLOS, GLEISSOLOS and NITOSSOLOS. Four climatic types according to Thornthwaite's classification (SEPLAN, 2008) occur in the area: a) C1dA'a' b) C2wA'a'; c) B1wA'a'; d) B2rA'a'.

Selection of the study - sites and the sampling methodology The sample sites and the physiognomies were selected Based on the Tocantins land use and coverage maps (year 2007). Physiognomies in sites over 5.000 ha in good state of conservation were chosen.

The sampling methodology followed Felfili *et al.*, (2005) where all individuals from 5 cm diameter at 30 cm from the ground level were identified and measured. The plots were 20 x 50 m. Vouchers were deposited at the herbarium of Palmas - TO, the UB (UnB) and IBGE.

The sample sizes varied according to the extension of the physiognomy in Rios Palma it was 2.84 ha, Tocantins (1.16 ha), Manoel Alves da Natividade (1 ha) e Santo Antônio (0.52 ha).

## RESULTS AND DISCUSSION

Rio Palma sub - basin (Vão do Paranã) was the richest site with 110 species where the seasonal forests dominate the landscape associated to limestone outcrops and also to neighbouring plain fertile soils. In the other sites, richness varied from 52 species at the Rio Santo Antônio sub - basin, 88 species in Rio Tocantins sub - basin till 91 species in Rio Manuel Alves da Natividade. subbasin. These values

are higher than those found at the Paranã Valley in Goiás State. In Goiás, richness varied from 32 to 52 species (Scariot & Sevilha 2005, Nascimento *et al.*, 2004, Felfili *et al.*, 2007). The richness in Tocantins resembled to those found in seasonal forests in Mato Grosso de Goiás deciduous and semideciduous forests, in Fercal at the Federal District and at the Parque Nacional de Sete Cidades in Piauí State (Haidar *et al.*, 2008).

Average densities varying from 719 to 960 ind.ha<sup>-1</sup> are similar to those found in those forests at the Paranã Valley in Goiás State and other sites in Central Brazil although, lower than the range found in South and Southeast Brazil (Souza *et al.*, 2003). Basal area ranging from 18.92 to 27.23 m<sup>2</sup>.ha<sup>-1</sup> is closer to the values obtained in undisturbed seasonal forests on plain soils at the Paranã valley (Scariot & Sevilha 2005).

Diversity was high varying from 2.94 a 3.67 nats.ind<sup>-1</sup>, at the higher end of the range already found for the Paranã valley in Goiás, 2.81 to 3.18 nats.ind<sup>-1</sup>. these values are close to those found for semideciduous forests in the Southeast with 3.56 nats.ind<sup>-1</sup> (Souza *et al.*, 2003) and in the Northeast 3.57 nats.ind<sup>-1</sup> (Haidar *et al.*, 2008).

The first TWINSPLAN division suggested a low similarity (eigen - value 0.73) between plots of seasonal forests of the Rio Santo Antônio. Rio Santo Antonio is at the Western portion of the state.

The second division, with eigenvalues significant of 0.38, grouped all plots of the Rio Manuel Alves da Natividade sub - basin with those from the Rio Tocantins sub - basin on soil with low rocky cover and also with the plots of plain semideciduous forests of the Rio Palma. the other grouping of this division put together the plots on high rocky cover both in Rio Tocantins and Rio Palma sampled sites.

Indicator species of the Rio Santo Antônio was *Tetragastris altissima*, common in forest formations of Tocantins State, especially in the drier portions of the gallery forests, in cerrado (forested savanna) and in the semideciduous forests. *Diospyros poeppigiana*, *Hirtella gracilipes*, *Inga thibaudiana*, *Michropholis venulosa*, *Protium unifoliolatum*, *Copaifera lagsdorffii*, *Terminalia glabrescens* and *Physocalymma scaberrimum*, are common to riverine forests, suggesting a relationship with moister sites.

*Anadenanthera colubrina*, *Aspidosperma pyriforme*, *Myracrodruon urundeuva* and *Tabebuia impetiginosa* characterized, on the other side of the division, the plots at the Rio Palma, Tocantins and Manuel Alves da Natividade. Those species grow well in dry conditions such as the Caatinga in Northeast Brazil (Andrade - Lima 1982) but also in deciduous seasonal forests of central Brazil (Nascimento *et al.*, 2004, Scariot & Sevilha 2005; Haidar *et al.*, 2008).

The classification indicates a strong humidity gradient that determines the floristic composition and structure. Only *Casearia rupestris* was non - preferential with high density in the first division. This species showed a generalist feature being recommended for recuperation of degraded land in Southern Tocantins.

TWINSPLAN suggests floristic and structural differences within and between the sub - basins of the Southern Tocantins, probably linked to variation in humidity, rockness

and soil fertility. These results give support to the creation of protected areas to conserve the distinct species associations leading to the need to creating more conservation units.

## CONCLUSION

TWINSPLAN classification showed differences within and between sub - basins and permitted to detect associations related to environmental condition. The association "Tetragastris - Physocalymma" was detected for seasonal forests on plain soils with absence of rocks. This association included the plots in Rio Santo Antônio sub - basin, with a higher degree of humidity. The association "Aspidosperma - Callisthene - Casearia - Talisia" was related to the semideciduous group while the association "Combretum - Pseudobombax - Sterculia - Commiphora" was related to deciduous vegetation on rocky and hilly terrain.

## REFERENCES

- Andrade - Lima, D. 1982. The caatingas dominium. *Revista Brasileira de Botânica* 4:149 - 163.
- Brasil. 2003. Áreas prioritárias para a conservação, uso sustentável e repartição dos benefícios da biodiversidade brasileira. MMA/PROBIO/SBF.
- Felfili, J.M.; Rezende R.P. 2003. *Conceitos e Métodos em Fitossociologia*. Brasília: Universidade de Brasília, Departamento de Engenharia Florestal. 68 p
- Felfili, J. M.; Carvalho, F. A.; Haidar, R. F. 2005. Manual para o monitoramento de parcelas permanentes nos biomas Cerrado e Pantanal. Brasília: Universidade de Brasília, Departamento de Engenharia Florestal. 55p.
- Jeanine M. Felfili, J.M., Nascimento. A.R.T., Fagg, C.W., Meirelles, E.M. 2007. Floristic composition and community structure of a seasonally deciduous forest on limestone outcrops in Central Brazil. *Revista Brasileira de Botânica* 30(4):611 - 621.
- Haidar, R.F.; Felfili, J.M. & Castro A. A. J. F. 2008. Diversidade beta entre florestas estacionais do bioma cerrado e sua correlação com variáveis ambientais. Trabalho científico apresentado no 59<sup>o</sup> Congresso Nacional de Botânica, Natal, RN, Brasil.
- Kent, M. & Coker, P. 1992. *Vegetation description analyses*. Behaven Press. London. 363p.
- Nascimento, A.R.T., Felfili, J.M. & Meirelles, E.M. 2004. Florística e estrutura da comunidade arbórea de um remanescente de floresta estacional decidual de encosta, Monte Alegre, GO, Brasil. *Acta Botanica Brasílica* 18(3): 659 - 669.
- Prado, D.E. & Gibbs, P.E. 1993. Patterns of species distributions in the dry seasonal forests of South America. *Annals of Missouri Botanic Gardens* 80: 902 - 927
- Ratter, J.A., Bridgewater, S. & Ribeiro, J.F. 2003. Analysis of the floristic composition of the Brazilian Cerrado vegetation III: comparison of the woody vegetation of 376 areas. *Edinburg Journal of Botany* 60(1):57 - 109.

Scariot, A & Sevilha, A.C. 2005. Biodiversidade, estrutura e conservação de florestas estacionais decíduais no Cerrado. In Cerrado: Ecologia, biodiversidade e conservação (A. Scariot, J.C. Souza - Silva & J.M. Felfili, orgs). Brasília: Ministério do Meio Ambiente. p. 121 - 139.

Seplan. 2008. Secretaria de Planejamento e Meio Ambiente: Diretoria de Zoneamento Ecológico. Atlas do Tocantins:

subsídios ao planejamento da gestão territorial. Palmas.

Souza, J.S, Espírito - Santo, F.D.B, Fontes, M.A.L, Oliveira - Filho, A.T & Botezelli, L. 2003. Análise das variações estruturais da comunidade arbórea de um fragmento de floresta semidecídua às margens do rio Capivari, Lavras - MG. Revista Árvore 27(2): 185 - 206.