SPATIAL CHANGES IN TOPOGRAPHY DETERMINES DIFFERENCES IN RADIAL GROWTH OF AN ENDANGERED TREE IN THE ATLANTIC FOREST

Vanessa Pontara – Universidade Federal de Minas Gerais, Departamento de Biologia, Belo Horizonte, MG. vanessapontara@gmail.com;
Marcelo Leandro Bueno - Universidade Federal de Minas Gerais, Departamento de Biologia, Belo Horizonte, MG. Leticia Eras Garcia - Universidade Federal de Minas Gerais, Departamento de Biologia, Belo Horizonte, MG Ary Teixeira de Oliveira Filho - Universidade Federal de Minas Gerais, Departamento de Biologia, Belo Horizonte, MG. José Pires de Lemos Filho - Universidade Federal de Minas Gerais, Departamento de Biologia, Belo Horizonte, MG.

INTRODUÇÃO

Soil water availability, sunlight, soil nutrient status and topography may all be important factors determining rates of tree growth (Oberhuber & Kofler 2000, Baker *et al*. 2003, Bagchi *et al*. 2011). On a local scale, topography has been regarded as the most important variable causing spatial variation in the structure of tropical forests since it commonly corresponds to changes in soil properties, particularly ground-water regime and natural soil fertility (Bourgeron 1983). Geomorphic factors, such as slope aspect and slope magnitude, can substantially modify the local environment of plants by altering microclimate conditions and soil development at a small-scale (Oberhuber & Kofler 2000), and these affect stand-level growth responses. Nevertheless, few studies have focused on the issue of interaction among site condition, species characteristics and radial growth response to drought. Understanding how plants respond to multiple successive or multiple combined stresses is of key significance in predicting the effects of future climate on vegetation (Niinemets 2010). Dendroecological methods were used to test the hypothesis that variation in topographic position would be related to radial growth for individuals of the endangered tropical tree *Dalbergia nigra* under uniform conditions of climate and irradiance, and to examine effects of seasonality on growth periodicity.

OBJETIVOS

Improve knowledge of the population dynamics of *D. nigra* in order to guide the conservation management practices.

MATERIAL E MÉTODOS

The study was carried out in an area of semi-deciduous forest in a fragment of the Atlantic Forest in Sumidouro State Park in the state of Minas Gerais, southeastern Brazil. Dendrometer-based measurements of stem diameter change over 26 months and local measurements of soil nutrient and water availability were compared for 24 individuals of *D. nigra* growing distributed equally between summit and valley positions. A t test for heterogeneous variance was performed to examine the relationship between radial increment differences and soil fertilities in different topographic positions. Pearson correlations analyses were performed to evaluate the relationship between monthly radial increment and climatic variables (mean monthly temperatures, total precipitation) (r, Zar 1996). To compare the growth increment of tree between topographic positions, data were subjected to a Student’s t test when assumptions of the parametric tests were met (Zar 1996). Otherwise, the

Mann–Whitney test was applied. The software R was used for these analyses.

RESULTADOS

Monthly diameter increment was seasonal and positively related to monthly rainfall. Soil water and nutrient availability, and cumulative radial growth, were greater for trees in valley than summit positions.

DISCUSSÃO

The positive relationship between radial increment and rainfall suggests that water availability limits the growth of *D. nigra*, as has been the case for other tropical trees (Borchet 1999). The reversible contraction and dilatation of cells, mainly in the secondary phloem and cambial cells, associated with changes in stem water and temperature, results in short-term diameter increment (Kozlowski *et al*., 1991). The observed radial growth can be explained by different topographic position when growing under similar climatic conditions. Some authors have described situations where the topography has a significant effect on the soil water regime (Oliveira-Filho *et al*. 1998; Baker *et al*. 2003) and where the local topography clearly is an influential factor in the soil nutrient distribution (Luizão *et al*. 2004). Thus, the trees respond quite differently to identical climatic conditions depending on the interaction of soil condition and topographic features on water availability (Oberhuber & Kofler 2000) because the slope of forest floor can affects water drainage and the leaching of nutrients.

CONCLUSÃO

We conclude that low soil nutrient and/or moisture availability causes a reduction in radial growth of *D. nigra* growing in summit positions, while trees growing in valleys exhibit faster annual growth.

REFERÊNCIAS BIBLIOGRÁFICAS

BAGCHI, R., HENRYS, P. A., BROWN, P. E., BURSLEM, D. F. R. P., DIGGLE, P. J., GUNATILLEKE, C. V. S. & GUNATILEKE, I. A. U. N. 2011. Spatial patterns reveal negative density dependence and habitat associations in tropical trees. Ecology 92: 1723-1729.

BAKER, T. R., BURSLEM, D. F. R. P. & SWAINE, M. D. 2003. Associations between tree growth, soil fertility and water availability at local and regional scales in Ghanaian tropical rain forest. Journal of Tropical Ecology 19: 109-125.

BORCHERT, R. 1999. Climatic periodicity, phenology, and cambium activity in tropical dry forest trees. Iawa J 20: 239–247.

BOURGERON, P. S. 1983. Spatial aspects of vegetation structure. In: Golley FB (ed) Ecosystems of the world 14A – tropical rain forest ecosystems, structure and function. Elsevier, Amsterdam Holland, pp 29–47

KOZLOWSKI, T. T, KRAMER, P. J. & PALLARDY, S. G. 1991. The physiological ecology of woody plants. New York, NY: Academic Press. LUIZÃO, R. C. C., LUIZÃO, F. J., PAIVA, R. Q., MONTEIRO, T. F., SOUSA, L. S. & KRUIJT, B. 2004. Variation of carbon and nitrogen cycling processes along a topographic gradient in a central Amazonian forest. Global Change Biology 10: 592-600.

NIINEMETS, U. 2010. Responses of forest trees to single and multiple environmental stresses from seedlings to mature plants: Past stress history, stress interactions, tolerance and acclimation. Forest Ecology and Management 260: 1623-1639.

OBERHUBER, W. & KOFLER, W. 2000. Topographic influences on radial growth of Scots pine (Pinus sylvestris

L.) at small spatial scales. Plant Ecology 146: 231–240.

OLIVEIRA-FILHO, A. T., CURI, N., VILELA, E. A. & CARVALHO, D. A. 1998. Effects of canopy gaps, topography and soils on the distribution of woody species in a Central Brazilian deciduous dry forest. Biotropica 30:362-375.

ZAR, J.H. 1996. Biostatistical analysis. Prentice hall, New Jersey.