TREE POPULATION DYNAMICS IN A TROPICAL FOREST FRAGMENTS IN SE BRAZIL ALONG A 19-YEARS PERIOD

Pedro Higuchi[1], Ary Teixeira de Oliveira-Filho[2], Ana Carolina da Silva[2,3], Evandro Luiz Mendonça Machado[2]

[1]Phytotechny Department/Centre of Agro-veterinary Sciences - Santa Catarina State University , [2]Forestry Department/Federal University of Lavras

INTRODUCTION

Clearing of Atlantic forests began over 500 y ago with the first Euro-African colonization of Brazil (Morellato & Haddad 2000) and by a century ago had already reduced this forest to a series of small fragments. In the state of Minas Gerais, extensive mining, agriculture and cattle ranching resulted in rapid deforestation in the second half of the 19th Century. As a result, nearly all valleys and lowlands are now croplands and pastures and existing forest fragments are restricted to steep slopes and hilltops (Valverde 1958). This landscape offers an interesting opportunity to examine population dynamics in species-rich forest fragments that have been isolated for in excess of 100 y.

One of the main questions regarding the changes in tropical tree communities after fragmentation is the different responses of particular populations and species guilds in both the short and long run, as this may help us foresee the final picture we may eventually face in the future. In this study we analysed a unique 19-y record consisting of five surveys of the tree community of a long-standing fragment of semi-deciduous Atlantic forest that was spared during a clearance that took place sometime before 1900. To assess the speed and direction of changes in the tree community through time and to investigate the underlying factors, this work addresses two main questions: (1) What are the temporal patterns of tree population dynamics? (2) Are existing temporal trends of population changes related to species regeneration guilds?

MATERIAL AND METHODS

The study area was the Forest Reserve of the Federal University of Lavras (UFLA), State of Minas Gerais, south-east Brazil, situated at 21º13'40" S, 44º57'50" W, and 925 m asl. It consists of a 5.8-ha fragment of tropical montane semi-deciduous forest. The climate is characterized by mild rainy summers and cool dry winters (Köppen's Cwb type). The mean annual rainfall and temperature between 1965 and 1990 were 1530 mm and 19.4º C, respectively, with about 83% of annual rainfall concentrated between November and March (DNMet 1992). The site is a flat hilltop, far away from any water body, and the substrate is a homogeneous rhodic ferralsol (Oliveira-Filho *et al.* 1997).

Forest surveys started in 1987, when all trees with a diameter at breast height (1.30 m) (dbh) e" 5 cm were measured, identified and tagged within a grid consisting of 126 contiguous 20 × 20-m permanent plots covering almost the entire fragment (Oliveira-Filho *et al.* 1994). The second survey took place in 1992. All tagged surviving trees were re-measured, recruits were tagged and measured, and dead trees were recorded. An analysis of the patterns arising from this first interval is given in Oliveira-Filho *et al.* (1997). Three additional surveys were carried out in 1996, 2001 and 2006 following the same procedure.

Since significant changes in population dynamics are difficult to test because most species have few trees per plot, we focused our efforts in analyzing the changes in number of individuals and basal area of the 15 most abundant species based on the first census. In order to seek for ecological meaningful dynamics patterns, the species were classified into regeneration guilds, according to Lieberman & Lieberman (1987), as: (1) understorey, (2) subcanopy, (3) canopy shade-bearer, (4) canopy light-demander, and (5) pioneers. We assigned the regeneration guild to each species based on field observation and previous studies in the same area (Nunes *et al.* 2003). Generalized additive models (GAM) were used to analyze the temporal trends of tree populations.

RESULTS AND DISCUSSION

Tree population density was near balance for most populations of the 15 common tree species analysed. The populations with the highest positive net changes were *Siparuna guianensis*, during 1987-1992 (+97 trees) and 1992-1996 (+ 96 trees); *Xylopia* *brasiliensis*, during all time intervals (+95, +138, +123 and +42 trees); and *Casearia arborea*, during 1987-1992 (+60 trees). The populations with the highest negative net changes were *Myrcia splendens*, during 1987 -1992 (-83 trees), 1992 -1996 (-103 trees) and 1996-2001 (-54 trees); *Miconia pepericarpa*, during all time intervals (-30, -164, -79 , -21 trees); *Casearia arborea*, during 1992 -1996 (-59 trees) and 2001-06 (-110 trees); and *Siparuna guianensis*, with an extremely negative net change during 2001-2006 (-369).

Tree basal area was also near balance for most populations during most time intervals. Among the few remarkable unbalanced net changes in basal area was that of *Tachigali rugosa*, a short-lived light-demander canopy tree, which showed a negative balance during the first time interval and then gradually approached balance in the following intervals. An outstanding positive balance was shown by *Xylopia brasiliensis* in all intervals although, unlike the former, there was a trend of becoming increasingly positive towards the end of the study period. In the last interval, *Siparuna guianensis*, a typical shade-bearer understorey tree, common in early successional stages, had the highest negative balance.

As observed by van den Berg (2001) studying a montane tropical semi-deciduous forest in SE Brazil, density and basal area net change for the most abundant species were close to zero. The overall population dynamics results showed that those populations with significant changes in number of tree and basal area over time had different ecological traits.

CONCLUSION

The temporal trends of population changes is related with ecological guilds, with shade-tolerant enlarging its ecological dominance at expensive of pioneers and canopy-light demanding.

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