REDE SISBIOTA: A RESEARCH NETWORK ON ECOLOGY OF ANTHROPOGENIC LANDSCAPES.

REDE SISBIOTA is a research network designed to investigate how landscape-scale forest loss affects regional biodiversity patterns of and processes in anthropogenic landscapes. The network is officially coordinated by Dr. Deborah Faria from Universidade Estadual de Santa Cruz (UESC) in close collaboration with other reserachers from Brazil (Universidade Federal de Pernambuco-UFPE, Universidade Federal da Bahia-UFBa, Universidade de Brasília-UnB, Universidade Federal da Paraiba, Universidade do Estado de São Paulo-UNESP, Universidade de São Paulo-USP) and Mexico (Universidade Autonoma de Mexico-UNAM). The research network included multi taxonomic surveys (trees, invertebrates, small mammals, birds and bats) and also assessed patterns of ecological processes such as fruit removal rates, seed dispersal, plant herbivory and recruitment, nutrient cycling and carbon stocks in forest sites within anthropogenic landscapes.

Study area

This study was conducted in southern Bahia State, northeastern Brazil (Figure 1). This region is a mosaic of forested habitats that includes remnants of mature forests, secondary forests at different successional stages, shade plantations of cacao (*Theobroma cacao*), rubber trees (*Hevea brasiliensis*) and *Eucalyptus* sp. (Pardini et al. 2009). The dominant

vegetation is classified as Lowland Wet Forest and is characterized by a clear vertical stratification into lower, canopy (25-30 m) and emergent layers (up to 40 m); an abundance of epiphytes, ferns, bromeliads and lianas; and high levels of endemism of different groups (Thomas et al 1998; Haffer 1974). The average annual temperature is 24°C, and the mean annual rainfall is 1500 mm. There is no defined seasonality, although a rainless period may occur from December to March (Mori et al. 1983).

Sampling design

We had previously identified landscapes between the Jequitinhonha and Contas Rivers that still harbor large, representative forest tracts, and these forests have similar soil, topography and floristic composition (Thomas et al. 1998).

We mapped this region by analyzing satellite images that were specifically acquired for our work (QuickBird and WorldView, from 2011) or were already available (RapidEye, from 2009-2010). Mapping was done at scale of 1:10000, which is adequate for identifying patches based on the visual inspection of differences in color, texture, shape, location and context. Patches were delimited as polygons, and a digital map was created using ArcGIS software. Polygons were classified according to different forest types following the typologies provided by IBGE (IBGE, 2006). After intensive ground-truthing, we developed a map of the land use of a 3500 km^2 area that encompasses the municipalities of Belmonte, Una, Santa Luzia and Mascote. The coordinates of the center of the sampled area are 15° 28'S and 39° 15'W. At a regional scale, there was a north-to-south gradient in forest cover within the mapped region (Figure 1). Although there are open areas within the mapped region, most of the large and continuous forests in the northern area are concentrated around the Una Biological Reserve and the Una Wildlife Refugee, two federally protected conservation units that have a total area of 34804 ha, which includes the municipality of Una. In contrast, the southern part of the mapped area is clearly more deforested than the northern part, but there are still some large forest tracts in the southern part.

Based on this map, we identified 58 sampling sites that were located in forest remnants. To characterize the landscape, we delimited sampling sites that each had a radius

of 2 km from its center (which yields a surface area of each site of approximately 13 km^2) and quantified the percentage of forest cover using ArcGIS software. Please note that we considered only native forests in our estimations of the amount of forest cover within the landscape. Therefore, forest cover included all of the native forest types, including the mature and successional forests types described above but excluding shade plantations of cacao and rubber trees. This classification may be a simplification of the ecological requirements of bird species, but we believe that this broad definition is the most appropriate because many recommendations for the conservation and management of landscapes are based on fragmentation or habitat loss in general (Smith et al 2011).

We excluded those sites that were located at a distance of less than 1 km from the closest site to avoid recounting individuals that have high dispersal ability and large home ranges (e.g., falcons and parrots). We randomly selected 40 sites that had forest cover at the landscape scale that ranged from 6% to 85%. The distance between the sites ranged from 1 to 105 km. We did not sample in either of the protected areas, and no specific permission was required for the selected locations. However, we secured the owner's permission to conduct fieldwork in all sampling sites that were located on private land.

Survey Methodology

Woody trees

We sampled trees in 20 sites within the SISBIOTA NETWORK. In each site we placed five 25x4m plots, located at 50 m distance from each other and at least 50 m from forest edge, and measured all individuals with diameter at breast height ≥ 5cm (DBH). All individuals were collected from branches to taxonomic identification, according to AGP III, and the botanical material was included in the reference collection at the Herbarium of the Universidade Estadual de Santa Cruz (HUESC).

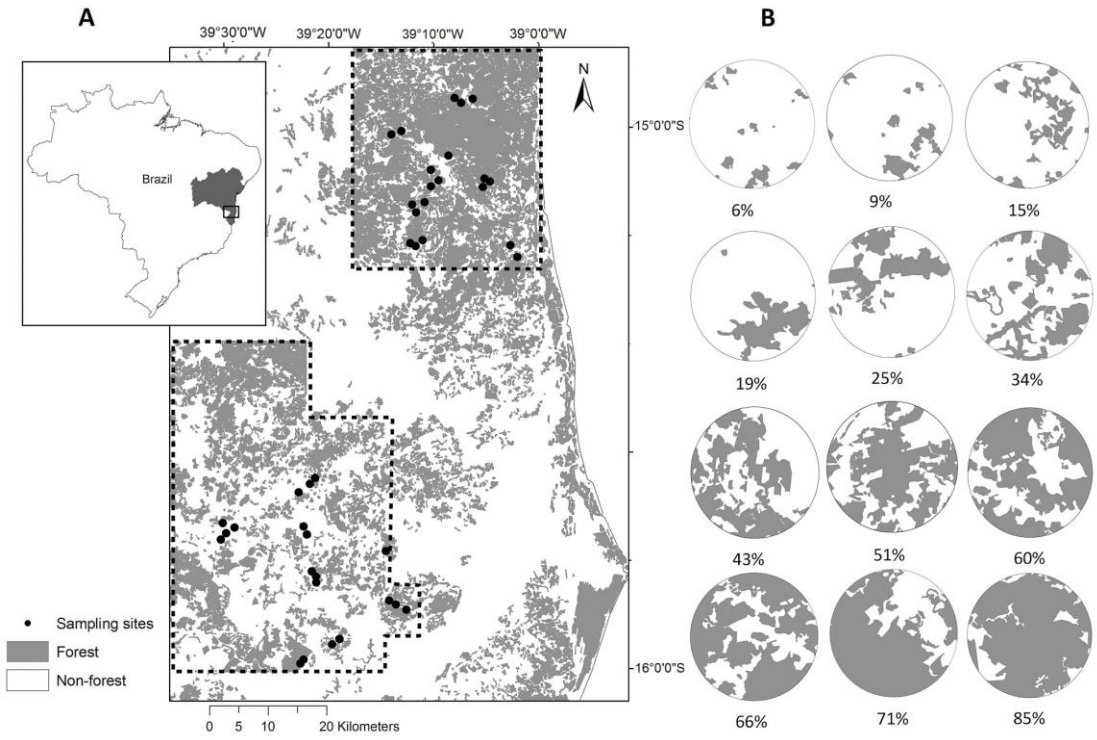

Figure 1. Map of the study area in southern Bahia, northeastern Brazil.

A: Atlantic Forest remnants (gray areas) and the 40 sampling sites (black circles). Dashed lines show the areas that were mapped for this study. Maps of areas that are outside of the dashed lines were obtained from SOS Mata Atlântica and Instituto Nacional de Pesquisas Espaciais (2012). B: Detail of some sampled landscapes (2 km radius), highlighting the percentage of forest cover (gray areas).

Rubiaceae sampling

Among the understory plants in the Neotropics, Rubiaceae is an outstanding family, having the fourth highest number of individuals among all angiosperms, particularly in Brazil, one of the numerous hotspots of Rubiaceae diversity in the tropics, harboring about 1396 species in 120 genera. Within the REDE SISBIOTA we sampled Rubiaceae in 9 sites comprising areas of mature or late secondary forests, from January and December 2012. In

each site we placed a 50x100m plot, in each plot all understory individuals of Rubiaceae (0.5 to 4m tall) were marked and collected to posterior identification. The botanical material was included in the reference collection at the Herbarium of the Universidade Estadual de Santa Cruz (HUESC).

Regenerating component of trees and shrubs

We selected 20 sites within the SISBIOTA NETWORK, and in each site we placed five plots of 25 x 2 m, systematically distributed at a minimum distance of 50 m from each other, and sampled all individuals from the regenerating component of trees and shrubs with height ≥ 1.3 and DBH ≤ 5 cm were collected. All individuals were collected, processed, herbalized and stored in Herbarium Alexandre Leal Costa, Universidade Federal da Bahia (ALCB / IBio / UFBa) to be screened, sorted by morph type, hereafter species, and identified with the aid of specific literature and with our knowledge of plant species in southern Bahia, consultation with experts and comparison with the collection of Herbarium André Maurício V. de Carvalho, Centro de Pesquisas do Cacau (CEPEC / CEPLAC) and ALCB.

Bird survey

We sampled bird communities during three periods between January 2013 and April 2014. We used the point-count method (Bibby et al 1992), and at each sampling site we established four sampling points that each had a radius of 50 m and that were separated by a minimum distance of 150 m. We assigned sampling points inside each forest area that were at least 100 m from the edge to avoid effects of adjacent habitats and to ensure that the documented bird community was representative of the site.

All sites were covered in each sampling period, and sampling at each point was conducted for 15 min at sunrise (between 0600 and 0900 hr) and at sunset (between 1500 and 1700 hr), which are the periods of greatest bird activity. We did not capture birds but instead recorded each bird that was seen or heard within the sampling point. We avoided sampling on rainy and windy days because such conditions reduce bird detectability. We excluded birds that were flying over the forest and birds that could not be located precisely.

We used 8x42 binoculars to identify the birds and a digital recorder to record their vocalizations. We confirmed vocalization-based bird identifications by playback or by comparing the recordings with an existing database. Field guides (Ridgely & Tudor 2009; Remsen et al. 2014) were used for identification. The scientific nomenclature used conforms to that of the South American Classification Committee (Remsen et al. 2014).

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