ABECO
ASSOCIAÇÃO BRASILEIRA DE CIÊNCIA ECOLÓGICA E CONSERVAÇÃO

Natureza & Conservação
Brazilian Journal of Nature Conservation
Supported by Boticário Group Foundation for Nature Protection
http://www.naturezaeconservacao.com.br

Research Letters

Prioritizing rare tree species of the Cerrado-Amazon ecotone: warnings and insights emerging from a comprehensive transitional zone of South America

Everton A. Maciel[a,b], *Ary T. Oliveira-Filho*[c], *Pedro V. Eisenlohr*[b,*]

[a] *Postgraduate Program in Ecology and Conservation, Universidade do Estado de Mato Grosso, Nova Xavantina, MT, Brazil*
[b] *Laboratory of Ecology, Universidade do Estado de Mato Grosso, Alta Floresta, MT, Brazil*
[c] *Department of Botany, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil*

ARTICLE INFO

Article history:
Received 28 May 2016
Accepted 13 October 2016

Keywords:
IUCN
Red list
conservation gaps
Regional responsibility
Local rarity
Vulnerable habitat

ABSTRACT

Many locally and regionally rare species are not covered by red lists, thus compromising conservation strategies. This is the case with ecotones. After applying three rarity criteria based on both geographic range and on local occurrences to 1755 species of a large transitional zone in South America, we discuss how the priority hierarchy found in the study region can be combined with red books in decision-making to reduce the gaps left by the classification systems adopted by these lists. We point out clear directions about how these species can be used to guide decision making in ecotones, including identifying species of interest for conservation that have not yet been included in red lists, structuring a species group of narrow distribution occurring in areas adjacent to ecological transitions into a hierarchy of priorities for conservation, and using species of the highest hierarchy position in decision making. We believe that the combination of regional lists with national and international red lists is an interesting strategy in the management of species for conservation.

Introduction

Uncertainties embedded in international classification systems of species, such as the system adopted by IUCN (Akçakaya et al., 2000), can compromise the selection of species of local and regional importance (Lõhmus, 2015). Therefore, alternative systems can be used to select regional priorities (e.g., Gauthier et al., 2010). Among them, the method proposed by Gauthier et al. (2010) is very simple and practical for the evaluation of different types of plant rarities. Basically, this method consists in drawing up a list of priority species for regional conservation from three priority criteria, named, Regional Responsibility, Local Rarity and Habitat Vulnerable. To operate these criteria, the authors propose a scale with five priority classes, in which the scores range from 1 to 5,

* *Corresponding author.*
E-mail address: pedrov.eisenlohr@gmail.com (P.V. Eisenlohr).
http://dx.doi.org/10.1016/j.ncon.2016.10.002

where 1 means species of lowest priority and 5, species of highest priority. The resulting product is a list of species hierarchically organized according to the degree of priority for conservation. This system has the advantages of (1) flexibility of spatial scale, (2) selecting different forms of species rarity, and (3) being of easy application (Gauthier et al., 2010). This third point is particularly important in reducing the gap that exists between the studies developed in the area of conservation and its practical application, commonly known as the "Knowing-doing gap" (Habel et al., 2013). Furthermore, the classification systems based on regional and local priorities select species that are not covered by international initiatives and combine the results of different systems to cover the largest number of species for conservation management (Mehlman et al., 2004), thereby constituting a powerful strategy. This possibility becomes even more attractive to be used in regions that do not have studies of endangered flora, for example, regions of ecotones and ecological transitions.

Although transitional regions are sources of diversity and evolutionary novelties, they are neglected by conservation policies (Smith et al., 2001). Our focus here is the transition that occurs between the two largest phytogeographic areas of South America, the Amazon and the Cerrado, which stands out due to its diverse flora (Marimon et al., 2006), low floristic similarity with its adjacent areas (Kunz et al., 2009), and an advancing pattern of the Amazon rainforest into the Cerrado (Marimon et al., 2006). Such issues highlight the importance of this transition in maintaining the biota of both phytogeographic domains (Françoso et al., 2016). However, this transition is the scene of an intense consolidated settlement process (Becker, 2005) and a policy focused on the exploitation of natural resources (Théry, 2005), factors that drive the extinction of rare species. Indeed, rare species with low population, small geographic range and that are restricted to specific habitats deserve special attention in conservation policies (Caiafa and Martins, 2010).

We assume that tree species of a community tend to differ in abundance, geographic range and habitat requirements (e.g., Caiafa and Martins, 2010); in such case, some species would present greater priority for conservation, while others would have lower priority. Otherwise, all tree species would simultaneously occur in their optimal distribution, an unrealistic scenario. Thus, our aim was to investigate how the tree species of the Cerrado-Amazon transition show a hierarchical priority structure for conservation when different forms of rarity are considered in the evaluation of these species. As this list of tree species of hierarchy priority is identified, efforts can be directed into areas that focus on tree species of highest priority for conservation.

Material and methods

Study area

We used the definitions of Ab'Sáber (2003), thus considering the Cerrado-Amazon transition (hereafter, Transition) as part of the states of Pará, Maranhão, Tocantins, Rondonia and Mato Grosso. Records from the SNUC ('*Sistema Nacional de Unidades de Conservação*', the Brazilian system of protected areas) database indicate that the conservation units are unevenly distributed in the Transition - one can find 13 strictly protected areas and 19 areas of sustainable use (http://mapas.mma.gov.br/i3geo/datadownload.htm). Note that these conservation areas are concentrated in extreme portions of this region, specifically in the northern coast of Maranhão state and Rondonia state (Fig. 1).

Database

We used the *NeoTropTree* database (Oliveira-Filho, 2014) for compiling the species occurring in the Transition (Table S1). The *NeoTropTree* contains records of native tree species for the entire Neotropical region, providing information for each species by sampling lists organized by sites with a 5-km radius. Each site corresponds to a vegetation type (savanna or forest). We considered the ecoregions that occur in the Cerrado and Amazon areas to verify the extent of the tree species in the Transition. We created a matrix for each site including: (a) occurrence points (geographical coordinates); (b) list of tree species; (c) type of vegetation; and (d) ecoregion.

Weighting method for prioritizing species

To punctuate the tree species, we used a weighting method based on three priority criteria (Gauthier et al., 2010): Regional Responsibility (RR), Local Rarity (LR) and Habitat Vulnerability (HV). Each criterion was divided into five classes, and each class was assigned with a point value ranging hierarchically from isolated scores of 1 (lowest priority) to 5 (highest priority) for the three criteria assessed (Table 1).

RR is characterized as a biogeographic criteria (Schmeller et al., 2008), and the relevance of each species is considered by comparing its geographic range in the region of interest to its occurrence in an area assumed as a reference. We used ecoregions (sensu Olson et al., 2001) that overlap the areas of the Cerrado and Amazon domains outside the Transition. Ecoregions comprise a set of natural communities and species that occur in a land portion which, when nested within a domain, provide a comparison structure between different units of habitats (see Olson et al., 2001 for more details on 'ecoregion' issues). We consider the tree species that occurred in a larger number of ecoregions as a species with broad distribution, thereby having lower priority because they tend to be less vulnerable to stochastic processes. On the other hand, tree species with distribution restricted to one ecoregion tend to be more vulnerable, and are generally considered as priority for conservation (Table 1).

LR is related to the frequency of a species within the region of interest, based on both the number of locations where the occurrence of the species is known and the local tree species abundance (Gauthier et al., 2010). We took the number of sites where the occurrence of the tree species was verified to score their frequency in the Transition. For Gauthier et al. (2010), the fewer the number of sites within a given region where the tree species of interest occur, the rarer this tree species is considered and, therefore, more points this species receives. In contrast, species that present many sites of occurrence