



## Planning by the rules: A fair chance for the environment in a land-use conflict area



Guilherme Augusto Carminato Bircol<sup>a,\*</sup>, Marcelo Pereira de Souza<sup>a,b</sup>, Aurélio Teodoro Fontes<sup>c</sup>, Adriano Garcia Chiarello<sup>b</sup>, Victor Eduardo Lima Ranieri<sup>c</sup>

<sup>a</sup> School of Arts, Science and Humanities, University of São Paulo (USP), Brazil

<sup>b</sup> Faculty of Philosophy, Sciences and Literature of Ribeirão Preto, University of São Paulo (USP), Brazil

<sup>c</sup> School of Engineering of São Carlos, University of São Paulo (USP), Brazil

### ARTICLE INFO

#### Keywords:

Landscape ecology  
Policy-Making  
Environmental planning  
Land-Use change  
Ecological threshold  
Urbanizing environment

### ABSTRACT

The establishment of protected areas is one of the most common environmental policy tools which can effectively contribute to landscape protection, biodiversity conservation, and ecosystem services provision. In this sense, the Brazilian Law on Native Vegetation Protection establishes the legal reserves, mandatory protected spaces within private rural lands, which seek to maintain and restore ecological functions and promote biodiversity conservation. This paper aims to present an approach that attempted to locate potential protected spaces, in the form of legal reserves, in the East Zone of Ribeirão Preto – a recharge zone of the Guarani Aquifer System. We made use of seven criteria to create five possible scenarios with varying priorities for native vegetation protection or restoration. Then, we used eight landscape metrics, as well as the level of compliance with the law, to discuss the viability of each scenario in terms of ecological thresholds and landscape indicators. We found only one scenario (the broader perspective on recovering the natural vegetation corridors) capable of meeting the ecological and legal requirements. We conclude that using less data-demanding methods, such as the one applied in this research, could be useful in assisting decision-making regarding the selection of areas for conservation or restoration.

### 1. Introduction

Among the environmental problems being recently targeted by public policies, landscape transformation is considered of crucial importance since it alters the functioning of ecosystems and is directly linked to other environmental issues, such as habitat and biodiversity loss, and climate change (Smith and Zeder, 2013; Vitousek et al., 1997). For instance, the clearing of tropical forests for agricultural expansion is much responsible for greenhouse gases (GHG) emissions (Foley et al., 2011). Other problems related to landscape transformation are urban sprawl, in which large areas are converted into urban use in an unsustainable manner, and habitat loss and fragmentation (Marshall and Shortle, 2005, p. 62). Therefore, in an ever-urbanizing world, with a fast-growing population, there needs to be compatibilization between human activities and well-preserved ecological processes (Cumming, 2016; Watson et al., 2014).

One strategy regarded as capable of balancing these driving forces is the creation of protected areas (PAs) by attempting to safeguard the

landscape's attributes and, thus, allowing the ecological process to be sustained – at least to some extent (Watson et al., 2014). In fact, even before biodiversity and ecosystem services became popular mottos in public policy, different countries had already adopted protection measures targeting natural areas, with the intent of avoiding or at least slowing down the transformation of physical and culturally significant landscapes (Worboys et al., 2015).

The need for new protected spaces in Brazil is directly linked to the country's historical agricultural practices. Since its foundation, Brazil established itself as a commodity producer, with the acting governments always stimulating agricultural activities (Baer et al., 1973). The resulting economic outcomes came along with landscape transformation and the consequent impacts on the natural environment (Dean, 1997; Grecchi et al., 2014; Oliveira et al., 2016; Rada, 2013; Verburg et al., 2014).

In urbanizing environments<sup>1</sup> of developing countries – such as Brazil – the availability of native ecosystems is linked to the expansion of economic activities: the more expansion in agriculture and livestock

\* Corresponding author.

E-mail addresses: [guilhermebircol@usp.br](mailto:guilhermebircol@usp.br) (G.A.C. Bircol), [meps@usp.br](mailto:meps@usp.br) (M.P.d. Souza), [afontes@alumni.usp.br](mailto:afontes@alumni.usp.br) (A.T. Fontes), [bradypus@ffclrp.usp.br](mailto:bradypus@ffclrp.usp.br) (A.G. Chiarello), [vranieri@sc.usp.br](mailto:vranieri@sc.usp.br) (V.E.L. Ranieri).

<sup>1</sup> Rural land and ex-urban areas; these last ones are defined as semi-rural areas located between rural areas and already urbanized areas.

production the less available patches of natural environment (Alexandratos and Bruinsma, 2012). Landscape in such situations tends to present small and isolated patches of native vegetation spread through the human-modified matrix (Breuste et al., 2008), making it a difficult task to overcome political and economic interests and propose new PAs.

In this context, the Brazilian Native Vegetation Protection Law (Law, 2012) established the legal reserves (LR), mandatory protected spaces within private rural lands that seek to maintain and restore ecological functions and promote biodiversity conservation. In spite of being relatively small if compared to IUCN categories such PAs may help to slow down land-use change (Geldmann et al., 2013), given the critical role that small patches play on highly fragmented regions (Ribeiro et al., 2009). There is concern, though, regarding their effectiveness in ensuring biodiversity conservation due to external pressures and patch isolation (Fischer and Lindenmayer, 2007; Geldmann et al., 2013; Gray et al., 2016). Suspensions aside, LRs are legal instruments that will continue to be used in the foreseeable future. It is fair to believe that depending on how LRs are planned and allocated in the landscape benefits for protection can be achieved, even if limited ones.

A considerable challenge to land-use planning, however, is trying to conciliate different demands on the same and often-limited environment. Economic demands usually overtake decision-making when weighing its outcomes against those related to social and environmental demands (De Groot, 2006). When facing these political stalemates, planners need to get hold of useful and insightful information for supporting their decision-making (Bina et al., 2011; Papathanasiou and Kenward, 2014). Not only data itself but it must be timely provided since public authorities have institutional procedures and requirements to be followed (González et al., 2011). Proposed methods for allocating PAs on a landscape scale usually demand significant amount of data (Cullen, 2013; Rodrigues and Gaston, 2002). These data may not always be available or easily obtained, at least from the management point of view.

Based on these considerations, this paper aims to present a study carried out in 2012, which sought to locate potential protected spaces, in the form of LRs, in the East Zone (EZ) of Ribeirão Preto, Brazil. To achieve this result, we used a set of seven landscape ecology-based criteria, focusing on the usage of non-biological criteria for being more practical in terms of timely assisting decision-making regarding small private PAs such as LRs – while also recognizing the importance of biological information for guiding decision. With the assistance of GIS technology, we created five possible scenarios of LR occupation with a varying degree of protection priority. Then, we used landscape indicators, as well as the level of compliance with the Brazilian Law, to analyze each scenario and provide insights for conservation.

### 1.1. Brazilian legislation

Understanding, herein, protected spaces as any space being protected by the force of law, Brazilian legislation institutes two main kinds of protected spaces regarding environmental conservation:

- a) The PAs established by the National System of Conservation Units (Law, 2000), which constitute areas of native environments, with varying objectives depending on the specific category<sup>2</sup> and usually managed by the public power<sup>3</sup>;

<sup>2</sup> Based on the categories proposed by the International Union for Conservation of Nature (IUCN).

<sup>3</sup> There are certain unusual PA categories in the Brazilian legislation. For example, the environmental protected area (EPA), equivalent to the IUCN category V, allows for the presence of private properties within its borders, despite the ownership being of the public power. Another unusual category is the private reserve of the natural patrimony (RPPN), created by private initiative, but with very similar objectives to those from the most restrictive IUCN categories.

- b) The statutorily protected spaces defined by the Native Vegetation Protection Law (NVPL) (Law, 2012), namely the legal reserves (LR) and the areas of permanent protection (APP), being both subtypes managed by private landowners. The APPs are located in high erosion-risk areas, as well as in riparian forests and river springs, with the purpose of protecting superficial water resources, whereas the LRs seek to maintain and restore ecological functions, and promote biodiversity conservation (Law, 2012).

Despite the different protected spaces established by Brazilian legislation, the NVPL states that the allocation of LRs should take into consideration the APPs, as well as the already existing PAs, as to form ecological corridors (Law, 2012), thus, evidencing the strategic role that some landscape ecology principles could play, especially in the context of urbanizing environments.

Concerning LRs, private land areas are demanded to protect a specific percentage of native vegetation, depending on the biome in which they are located. Aside from the Amazon Forest and the Brazilian Savannas close to the Amazon region, the protection required in all other biomes is of 20% of the total rural property area. Landowners of properties that have already been deforested above this limit have three options: to recompose the field to the natural state using native vegetation; to conduct the natural regeneration of the environment, or to compensate for the damage in another property. Public authorities are responsible for inspecting and enforcing the due implementation of LRs.

As explained further, the EZ of Ribeirão Preto is located on an aquifer recharge zone. With the intention of increasing the land permeability to guarantee water recharge, as well as protecting the land from potentially polluting agricultural activities, the protection rises to 35% of natural vegetation, according to the municipal law (Law, 2004).

### 1.2. Landscape ecology as a planning tool

Landscapes found in urbanizing environments, which are subject to an ongoing urbanization pressure, tend to present a fragmentation of its natural vegetation features. Thus, using fundamental concepts of the landscape ecology as a framework plays an essential role in planning for location and distribution of protected spaces (Zipperer et al., 2000). In this sense, the proposed criteria made use of some landscape-ecology key principles, though not all seven criteria are based on this theory (e.g., the protection of areas with high erosion risk or even the protection of river springs).

Despite focusing on non-biological data, protecting high-biodiversity areas against human action has been considered strategic by many countries and organizations (Cullen, 2013; Dudley, 2008; Secretariat of the Convention on Biological Diversity, 2014; Shafer, 1999). Dealing with landscape ecology as tool implies in focusing on the importance of spatial configuration to a given ecological process (Turner et al., 2001, p. 4); and where there is ecology, there is, to some extent, biodiversity. Given the purpose of LRs – maintaining and restoring ecological functions, and promote biodiversity conservation – the framework proposed by this work tries to allocate these small PAs in way that, at the same time, complies with the law and takes into account landscape principles in a given focal level (Turner et al., 2001, p. 35). In the case of EZ, the focal level was related to some target species, discussed in the next section. Even so, only the criteria regarding the decrease of patch isolation level – addressed further on – specifically demanded biological information, since isolation level can only be assessed in relation to a certain biological organism or group of ecologically related species.

Aside from the proposition of criteria, the assessment of the resulting scenarios also made use of landscape ecology theory; namely, landscape metrics. The use of such parameters allows for the quantitative comparison of different landscapes, the identification of structural changes through time, as well as the possibility of relating structural patterns and ecological processes (Gustafson, 1998; Li and Wu,

Download English Version:

<https://daneshyari.com/en/article/6546243>

Download Persian Version:

<https://daneshyari.com/article/6546243>

[Daneshyari.com](https://daneshyari.com)