



Research article

Protected areas and agricultural expansion: Biodiversity conservation versus economic growth in the Southeast of Brazil

Mayra Cristina Prado de Moraes ^a, Kaline de Mello ^b, Rogério Hartung Toppa ^{c,*}^a Federal University of São Carlos, Brazil^b Luiz de Queiroz College of Agriculture, University of São Paulo - (ESALQ-USP), Brazil^c Department of Environmental Science, Federal University of São Carlos, Sorocaba (UFSCar-Sorocaba), Brazil

ARTICLE INFO

Article history:

Received 5 May 2016

Received in revised form

1 November 2016

Accepted 28 November 2016

Keywords:

Buffer zone

Sugar cane

Land use and land cover

Landscape pattern

ABSTRACT

The conversion of natural ecosystems to agricultural land and urban areas plays a threat to the protected areas and the natural ecosystems conservation. The aim of this paper is to provide an analysis of the agricultural expansion and its impact on the landscape spatial and temporal patterns in a buffer zone of a protected area located in the transition zone between the Atlantic Forest and Cerrado, in the State of São Paulo, Brazil. The land use and land cover were mapped between 1971 and 2008 and landscape metrics were calculated to provide a spatiotemporal analysis of the forest structure and the expansion of the croplands. The results showed that the landscape patterns were affected by the economic cycles. The predominant crop surrounding the protected area is sugar cane, which increased by 39% during this period, followed by citrus. This landscape change is connected to the Brazilian oil crisis in 1973. The rapid expansion of sugar cane was largely driven by Brazil's biofuel program, the "Proálcool" (pro-alcohol), a project in 1975 that mixed ethanol with gas for automotive fuel. The forest loss occurred mainly between 1971 and 1988, decreasing the forest cover from 17% in 1971 to 12.7% in 2008. Most of the forest patches are smaller than 50 ha and has low connectivity. Throughout the years, the fragments in the buffer zone have become smaller and with an elongated shape, and the park has become isolated. This forest fragmentation process and the predominance of monoculture lands in the buffer zone threaten the protected areas, and can represent a barrier for these areas to provide the effective biodiversity conservation. The measures proposed are necessary to ensure the capability of this ecosystem to sustain its original biodiversity.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Due to the massive environmental changes from the conversion of natural ecosystems to agricultural land and urban areas, the protected areas (PA) are a cornerstone of efforts to sustain biodiversity and natural ecosystem processes (Laurance et al., 2014). However, the designation of PA is not enough to ensure the role in biodiversity conservation (Mehring and Stoll-Kleemann, 2011). The PA must be well managed to provide the habitat quality for the species and to decrease neighborhood effects such as deforestation, habitat fragmentation, urban growth, pollution, contamination by pesticides, propagation of invasive species and hunting (Dudley,

2008; Payés et al., 2013).

Tropical forests are under severe threat from logging and clearing for agriculture (FAO, 2010). Over the last two decades, global rates of tropical deforestation increased from 5.6 to 9.1 Mha per year (FAO and JRC, 2012). Atlantic Forest and Cerrado, in particular, are two biodiversity hotspots (Mittermeier et al., 2011) that are threatened in Brazil due to the agricultural and urban areas expansion. Forty-eight percent of the original cover of the Cerrado was destroyed, and only 3% of the remnants is protected (IBAMA, 2010). The original Atlantic Forest cover has been reduced to 89% approximately (Ribeiro et al., 2009) and about 9% of its remnants is protected, which corresponds to 1.62% of the original cover. Moreover, many PA are small and/or impacted due to neighborhood effects (Galindo-Leal and Câmara, 2003).

To maintain viable populations, PA need a minimum amount of habitat area and a network with other habitat patches, where potential connectivity is possible (Alexandre et al., 2010). Therefore,

* Corresponding author.

E-mail addresses: mayracpmoraes@gmail.com (M.C.P. Moraes), kaline.mello@gmail.com (K. Mello), toppa@ufscar.br (R.H. Toppa).

the Buffer Zone (BZ) plays an important function as a transition area that could minimize negative impacts on PA (Metzger, 2008). However, the success of the BZ depends on plans and strategies based on data that allow the interaction between biological and socio-economic perspectives (Metzger, 2008; Alexandre et al., 2010). In Brazil, there has been a growing number of environmental conservation initiatives involving public policies, projects, and legal regulations, but the process of implementing them has resulted in conflicts with surrounding population and landowners, primarily about possible land uses (Payés et al., 2013).

In the last decades, the sugar cane, annual crops, citrus, pasture, and eucalyptus have been the most important factors of deforestation in the State of São Paulo, Southeast of Brazil (Kronka, 2005; IBGE, 2012). Land use surrounding PA, in most situations, is developed without environmental planning. It is necessary to identify those crops that have expanded most rapidly in recent years and to assess the spatial pattern of these changes to be able to understand the current and future threats they pose for the PA (Phalan et al., 2013).

The understanding of land use and land cover patterns in the BZ generates valuable information for the development of public policies, management plans, rules for land use criteria, type and intensity of land use allowed, and environmental and social programs for the surrounding population aimed at the maintenance of biodiversity (Hamilton et al., 2013). Previously, Moraes et al. (2015) analyzed the current landscape pattern in the BZ of Porto Ferreira Park (State of São Paulo) and simulated a legal scenario by the riparian forest restoration. The land use change analysis will provide new information about drivers of change, as well as threats and opportunities that those changes may pose to the PA conservation (Hamilton et al., 2013).

The aim of this paper is to provide an analysis of the agricultural expansion in the BZ of a PA located in the transition zone between the Atlantic Forest and Cerrado, in the State of São Paulo, and to answer the following questions: (1) How have economic aspects influenced the land use and land cover changes in the BZ? (2) How was the landscape pattern due to land use and land cover change? (3) How can the agricultural expansion induce the habitat

fragmentation in the BZ?

2. Material and methods

2.1. Study area

This study was carried out in the BZ of Porto Ferreira State Park (PFSP), it is a PA located in Porto Ferreira city, northwest of São Paulo State, Brazil, between UTM coordinates 245.000 m E to 251.000 m E 7.579.500 m S to 7.583.500 m S (Fig. 1).

PFSP has 612 ha and its forest formation is composed of two biodiversity hotspots: the Atlantic Rainforest and the Cerrado, with the predominance of Seasonal Semideciduous Forest (Rossi et al., 2005) (see Fig. 2). PFSP's BZ has 6004 ha and it was delimited from the buffer of 10 km, thus respecting the criteria for inclusion and exclusion of areas provided in Methodological Guide of Brazilian Institute for the Environment and Natural Resources - IBAMA (Galante et al., 2002).

A major highway in the State of São Paulo (SP 215) borders the north of PFSP, which is responsible for the cargo traffic of the region. The south of PFSP is also bound by the Mogi Guaçu river that is an important source for State of São Paulo because it provides public, industrial and, agricultural sources.

Near the PA about 2 km is the urban center of Porto Ferreira, which has a population of 51,400 (45,568 in the urban area and 5832 in rural areas). The main economic activity is linked to the primary sector, with technical agriculture associated with industrial complexes (pottery industry), highlighting the cultivation of sugar cane and citrus, and pastures (IBGE, 2010).

2.2. Database

The historical landscape series were composed by the use of images referring to three years: 1971, 1988 and 2008. For the year 1971, orthophotos were used with a scale of 1: 25,000 and spatial resolution of 0.4 m. The orthophotos of 1988 have a scale of 1: 40,000 and spatial resolution of 0.4 m. All images for both, 1971 and 1988, were georeferenced and merged in ArcGIS software (ESRI,

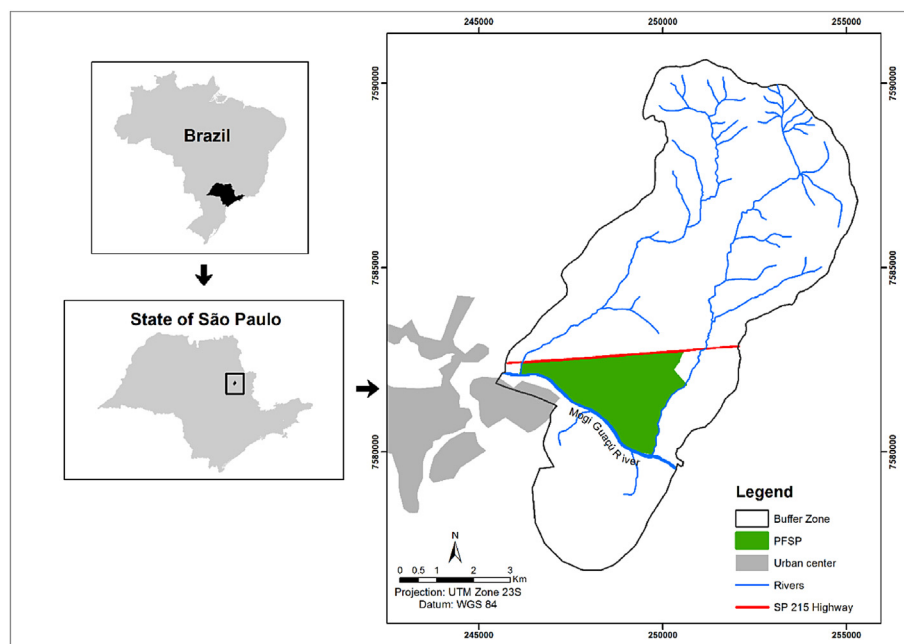


Fig. 1. Porto Ferreira State Park's (PFSP) buffer zone, county of Porto Ferreira, State of São Paulo, Brazil.

Download English Version:

<https://daneshyari.com/en/article/5117126>

Download Persian Version:

<https://daneshyari.com/article/5117126>

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