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Reconciling rural development and ecological restoration: Strategies and policy recommendations for the Brazilian Atlantic Forest

Helena N. Alves-Pinto[a,b,g,*], Agnieszka E. Latawiec[a,c,g,h], Bernardo B.N. Strassburg[a,b,g], Felipe S.M. Barros[a,g], Jerônimo B.B. Sansevero[a,e], Alvaro Iribarrem[a,f,g], Renato Crouzeilles[a,g], Luisa Lemgruber[a,g], Marcio C. Rangel[a], Augusto C.P. Silva[d]

[a] *International Institute for Sustainability, Estrada Dona Castorina 124, 22460-320 Rio de Janeiro, Brazil*
[b] *Programa de Pós Graduação em Ecologia, Universidade Federal do Rio de Janeiro, 21941-590 Rio de Janeiro, Brazil*
[c] *University of East Anglia, School of Environmental Sciences, Norwich, NR4 7TJ, UK*
[d] *Department of Geography and the Environment, Pontifícia Universidade Católica, 22453-900 Rio de Janeiro, Brazil*
[e] *Universidade Federal Rural do Rio de Janeiro (UFRRJ), Instituto de Florestas (IF), Departamento de Ciências Ambientais (DCA). BR 465, Km 07, 23890-000, Seropédica, Rio de Janeiro, Brazil*
[f] *International Institute for Applied Systems Analysis (IIASA), Ecossystem Services and Management Program, Schlossplatz 1, A-2361 Laxenburg, Austria*
[g] *Rio Conservation and Sustainability Science Centre, Department of Geography and the Environment, Pontifícia Universidade Católica. 22453-900 Rio de Janeiro, Brazil*
[h] *Institute of Agricultural Engineering and Informatics, Faculty of Production and Power Engineering, University of Agriculture in Krakow, Balicka 116B, 30-149, Krakow, Poland*

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ABSTRACT

Increased demand for both agricultural production and forest restoration may lead to increased competition for land in the next decades. Sustainably increasing cattle ranching productivity is a potential solution to reconcile different land uses, while also improving biodiversity conservation and the provision of ecosystem services. If not strategically implemented in integration with complementary policies, sustainable intensification can however result in negative environmental, economic and social effects. We analyzed the potential for sustainable intensification as a solution for a conflict between agricultural expansion and forest restoration in the Paraitinga Watershed at the Brazilian Atlantic Forest, a global biodiversity hotspot. In addition, we provide policy recommendations for sustainable development in the region, based on interviews with producers and local actors. We found that the Paraitinga Watershed has the potential to increase its cattle-ranching productivity and, as a result, relinquish spared land for other uses. This was true even in the most conservative intensification scenario considered (50% of the maximum potential productivity reached), in which 76,702 ha of pastures can be spared for other uses (46% of total pasture area). We found that restoration, apiculture and rural tourism are promising activities to promote sustainable development in the region, thus potentially increasing food production and mitigating competition for land. Our study shows that results from socioeconomic interviews and biophysical modelling of potential productivity increases offer robust insights into practical solutions on how to pursue sustainable development in one of the world's most threatened biodiversity hotspots.

1. Introduction

Between 2000 and 2012, tropical rainforests experienced the greatest forest loss, representing 32% of global forest cover loss (Hansen et al., 2013). Pressures on forests and other natural ecosystems are likely to continue due to increasing demand for agricultural products to support population growth and changing consumer demands (Smith et al., 2010; Wirsenius et al., 2010; Alexandratos and Bruinsma, 2012). There is also increasing interest in large-scale forest restoration initiatives to mitigate the loss

* Corresponding author at: International Institute for Sustainability, Estrada Dona Castorina 124, 22460-320 Rio de Janeiro, Brazil.
E-mail addresses: h.alves-pinto@iis-rio.org (H.N. Alves-Pinto), a.latawiec@iis-rio.org (A.E. Latawiec), b.strassburg@iis-rio.org (B.B.N. Strassburg), f.barros@iis-rio.org (F.S.M. Barros), j.boelsums@iis-rio.org (J.B.B. Sansevero), a.iribarrem@iis-rio.org (A. Iribarrem), r.crouzeilles@iis-rio.org (R. Crouzeilles), l.lemgruber@iis-rio.org (L. Lemgruber), m.rangel@iis-rio.org (M. C. Rangel), augustoc@puc-rio.br (A.C.P. Silva).

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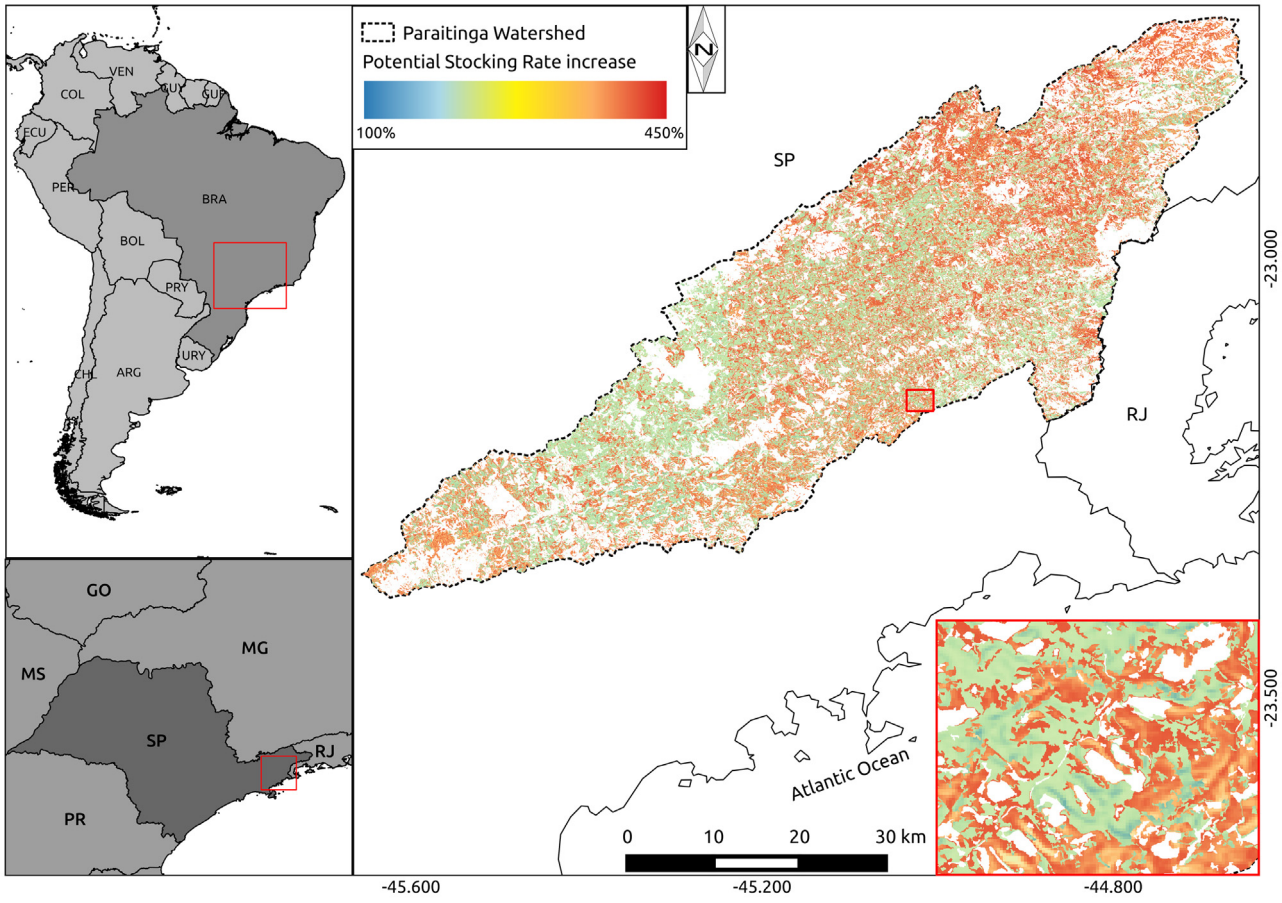

Fig. 1. Map showing the location of the Paraitinga Watershed in Brazil and São Paulo State. The colored areas are pastures with different potential stocking rates (%), and white areas represent other land uses.

of biodiversity and ecosystem services (Nazareno and Laurance, 2015). It is therefore likely that in upcoming years, an increased demand for both agricultural production and large-scale forest restoration will result in further competition for land (Smith et al., 2010), and debates will continue on how to diminish this competition (Latawiec et al., 2015).

Increasing cattle ranching productivity in a sustainable manner has been proposed as a potential solution to reconcile increasing demand for different land-uses, reduce competition for land, improve provision of ecosystem services and increase biodiversity conservation (Smith et al., 2010; Lambin and Meyfroid, 2011; Bustamante et al., 2012; Cohn et al., 2014; Latawiec et al., 2014a). Sustainable intensification was considered as moderate increases in agricultural productivity (increase in number of animals per hectare) in a system that maintains grass-feeding (most of the cattle-ranching systems in Brazil are extensive pasture-based grazing systems; Latawiec et al., 2014b). If not implemented correctly, sustainable intensification can however have negative environmental and socioeconomic effects. For example, rebound effect may follow where further deforestation occurs as more productive systems become more profitable (Lambin and Meyfroid, 2011). Indirect deforestation (Arima et al., 2011; Lambin and Meyfroid, 2011; Cohn et al., 2014), leakage (Strassburg et al., 2014a) and displacement of less capital-intensive smallholders (Bustamante et al., 2012) are other examples of unintended adverse effects. Delivering sustainable intensification without causing environmental and social adverse effects is a great challenge. Therefore, sustainable intensification should be developed and implemented concomitantly with complementary public policies and strategies.

In Brazil, agriculture and cattle ranching are among the main drivers of land-use change, with cattle ranching being the most important driver of deforestation (Nepstad et al., 2006; Gibbs et al., 2010; Cohn et al., 2011; Arima et al., 2011). Although the country is among the biggest beef producers worldwide (FAOSTAT, 2015), cattle ranching is based on an extensive system with low pasture efficiency (stocking rate is approximately 33% of the sustainable potential; Strassburg et al., 2014b). Furthermore, Brazilian landowners need to collectively restore approximately 21 million ha of native vegetation (Soares-Filho et al., 2014) in order to comply with the new Forest Code (National Law No. 12.651/2012). Approximately half of this restoration (12.5 million ha; Soares-Filho et al., 2014), will need to happen within the Atlantic Forest hotspot, the most affected by deforestation in Brazil (Lapola et al., 2014). Currently, only 12–16% of its original 150 million ha forest cover remains standing, with more than 80% of forest remnants now smaller than 50 ha (Ribeiro et al., 2009). It is a great challenge to integrate both large-scale restoration and increased agricultural production in the Brazilian Atlantic Forest (Latawiec et al., 2015).

The aim of this study is to propose strategies for land sparing based on modelling and interviews with local actors in the Paraitinga Watershed in the Brazilian Atlantic Forest. We first estimated the potential for sustainable intensification of cattle ranching, and estimated the amount of spared land that would be generated in three different sustainable intensification scenarios. We also performed interviews with producers and local actors in order to understand their perception of ecosystem services, and the potential of the region for diversification of agricultural activities. Our central hypothesis is that by increasing stocking rates within

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