Improving land management in Brazil: A perspective from producers

Agnieszka E. Latawiec[a,b,c,d,*], Bernardo B.N. Strassburg[a,b,e], Daniel Silva[b],
Helena Nery Alves-Pinto[a,b,e], Rafael Feltran-Barbieri[b,f], Ana Castro[a,b], Alvaro Iribarrem[a,b],
Márcio Cordeiro Rangel[b], Kemel Amin B. Kalif[b], Toby Gardner[b,g], Francisco Beduschi[h]

[a] Rio Conservation and Sustainability Science Centre, Department of Geography and the Environment, Pontifícia Universidade Católica, 22453900 Rio de Janeiro, Brazil
[b] International Institute for Sustainability, Estrada Dona Castorina 124, 22460-320 Rio de Janeiro, Brazil
[c] Institute of Agricultural Engineering and Informatics, Faculty of Production and Power Engineering, University of Agriculture in Kraków, Balicka 116B, 30-149 Kraków, Poland
[d] School of Environmental Sciences, University of East Anglia, Norwich NR4 7TJ, United Kingdom
[e] Programa de Pós Graduacão em Ecologia, Universidade Federal do Rio de Janeiro, 21941-590 Rio de Janeiro, Brazil
[f] World Resources Institute-Brazil, Claudio Soares 72, 05422-30 São Paulo, Brazil
[g] Stockholm Environment Institute, Linnégatan 87D, 115 23 Stockholm, Sweden
[h] Instituto Centro de Vida, Rua Américo Salgado, 1890, Santa Helena, 78045-055 Cuiabá, Mato Grosso, Brazil

ARTICLE INFO

ABSTRACT

The low productivity of many tropical pasturelands is a major driver of deforestation and other negative environmental and socio-economic impacts. In Brazil, the second biggest meat producer in the world, 85% of cattle farms remain within extensive pasture systems, and cattle farming is by far the most important proximate driver of deforestation. It is possible to expand Brazilian agriculture with zero deforestation through improvements to rangeland productivity yet understanding of the challenges and motivations of the actual cattle farmers in the face of such a transition remains sparse. To better understand the importance of the underlying factors that lead to or inhibit improvements to land management, we used focus groups and semi-structured interviews (N = 250) with farmers from the state of Mato Grosso in the Brazilian Amazon. We found that the majority of the respondents (60%) claimed that the principal benefit of adopting good agricultural practices was increased productivity, followed by increased income (43%) and better farm administrative management (34%). The adoption of improved pasture management techniques was positively correlated with stocking rates ($p < 0.005$, $r = 0.48$). Farms that adopted improved pasture management, most often through rotational grazing had, on average, lower levels of forest cover ($p < 0.05$, $r = 0.22$). We found that scarcity of labour was the major issue affecting the adoption of improved techniques (36%), followed by financial constraints (18%). We also identified a shortfall in access to technical extension services to be a significant problem because 40% of the technical assistance is currently provided by vendors of fertilizers and other chemicals. To our knowledge, this is the first study to systematically assess the barriers to and the conditions surrounding the adoption of good agricultural practices in Brazilian pasturelands from the perspective of the farmers from the Amazon involved in the implementation of these practices. It is critical that decision-makers involved in the design of technical assistance schemes, education and credit programmes consider these factors if sustainable land management is to be realised at scale. In particular, the lack of skilled and available labour contrasts with the widespread assumption that new credit lines for sustainable agriculture will automatically result in better land management. A failure to consider factors discussed in this paper may contribute to the continued clearance of native vegetation and the environmental degradation of existing pasturelands, in addition to the persistence of widespread poverty among cattle-farmers. These results can assist the large scale implementation of sustainable land use policies in Brazil and elsewhere.

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* Corresponding author at: Rio Conservation and Sustainability Science Centre, Department of Geography and the Environment, Pontifícia Universidade Católica, 22453900 Rio de Janeiro, Brazil.
E-mail addresses: a.latawiec@iis-rio.org, alatawiec@gmail.com (A.E. Latawiec).

1. Introduction

Decisions agricultural producers make on how to use their land have far reaching environmental, social and economic ramifications. Global land use and land-use change impact atmospheric and hydrological cycles, cause soil, water and air pollution, are the main drivers of biodiversity loss and may improve or worsen food security of the world's poorest (Lambin and Geist, 2006; Lambin and Meyfroidt, 2011). For instance, the global hydrological cycle has been transformed to provide freshwater for irrigation, and agriculture impacts water quality and coastal and freshwater ecosystems through high sediment loads and nutrient inputs from fertilizers and atmospheric pollutants (Tilman et al., 2001). Agricultural mismanagement and overgrazing may lead to soil chemical and physical degradation (Foley et al., 2005). Land-use change causes declines in biodiversity through degradation of soil and water, and the modification, fragmentation and loss of native habitats. Between 1980–2000, more than half of the new agricultural land throughout the tropics came at the expense of intact forests (Gibbs et al., 2010) and habitat loss has been identified as the principal cause of species extinction worldwide (Baillie et al., 2004). Finally, land use and land-use change is the main source of anthropogenic greenhouse gas emissions (IPCC, 2007)

Degraded and low productivity pasturelands are prevalent throughout the tropics and are associated with a wide range of negative environmental impacts at multiple levels, including land degradation, water and air pollution and greenhouse gas emissions (Soares-Filho et al., 2014). Land use in Brazil is predominantly dedicated to cattle ranching, which is the principal driver of deforestation in the Amazon and the Cerrado, the vast, biodiverse savannahs of central Brazil (Soares-Filho et al., 2013). The majority (85%) of Brazilian cattle farms are extensive, low-productivity systems (Dias-Filho, 2014) that are commonly degraded and provide very low economic returns for farmers (Walker et al., 2000).

Accordingly, to mitigate the negative impacts of unsustainable cattle ranching and to meet the growing domestic and export market demands resulting from diminishing land resources, there is an urgent need for this situation to change (FAO, 2014). At the same time, Brazil has recently announced plans to restore some 12 million hectares of forest, one of the biggest pledged restoration targets of any country worldwide (INDC, 2015). Therefore, efforts to improve the efficiency of cattle ranching is not only paramount for better management of land resources and Brazil's agricultural sector, but it is also vital for reconciling increased agricultural production with the country's ambitious conservation and restoration targets (Latawiec et al., 2015). Furthermore, increasing cattle ranching efficiency may improve the direct economic benefits for hundreds of thousands of farmers who rely on the cattle sector for their livelihoods (Soares-Filho et al., 2014).

The yield gap in the efficiency of cattle ranching in Brazil is high, and current productivity is at approximately one-third of what may be considered a sustainable carrying capacity (Strassburg et al., 2014a). As such, improving the efficiency of low-productivity pasturelands is widely viewed as an important pathway for improving agricultural output and farmer income (Ramsey et al., 2005) and as a method to reduce the need to clear more new land for farming (Strassburg et al., 2014a). In a modelling exercise, Strassburg et al. (2014a) have demonstrated that improvements in the productivity of cattle ranching in Brazil can also, in theory, free up large areas of land for the production of other agricultural commodities, including those for which the export demand is also increasing, such as maize, soybeans, and sugarcane, and staple crops that play a key role in regional food security, such as manioc. Simultaneously, the government's goal of large-scale restoration could be achieved (Strassburg et al., 2014a).

Substantial attention has been paid to the social and environmental problems associated with extensive and under-productive cattle ranching by government programmes and a range of non-government-led trial initiatives to improve both the productivity and sustainability of cattle farming systems in many areas. In 2005, the Brazilian Agricultural Research Corporation (EMBRAPA – *Empresa Brasileira de Pesquisa Agropecuária*, in Portuguese) launched a package of good agricultural practices for cattle ranching (hereafter GAP) to "ensure the production of safe food and quality attributes that meet the interests of major markets" (EMBRAPA, 2007). There are 12 sets of GAP that may be broadly divided into practices focused on (i) animals (animal wellbeing, identification, sanitary control, reproductive management, pre-slaughter management and supplemental feeding), (ii) the environment (environmental management, which includes compliance with environmental legislation), (iii) pasture management, which includes recuperation or pasture renovation, and (iv) administration (management of rural property, social functions of the property, human resources management and farm facilities maintenance). Given the focus of the GAP to increase farm productivity through improved pasture management, animal wellbeing and improved breeding, and its support of the adoption of environmental and labour laws, these practices can contribute significantly to a transition away from low-productivity pasture systems (EMBRAPA, 2007). In addition, in 2010, the Brazilian government, perceiving the potential of low-productivity pastures to diminish carbon emissions, launched the 'Low-Carbon Agriculture Plan' (*Agricultura de Baixo Carbono* in Portuguese, hereafter ABC), with a primary goal to restore 15 million hectares of degraded pastures and to incentivize the adoption of improved agricultural practices. However, most pasturelands remain underproductive, with less than one animal unit per hectare (AU = 0.7 of cattle head) (Nogueira et al., 2013; Dias-Filho, 2014).

Given the persistence of extensive and unsustainable cattle farming across Brazil and elsewhere in the tropics, there is an urgent need to better understand the factors affecting farmers' decisions regarding land use, and cattle farming in particular. Despite widespread recognition of, and intense policy interest in, the problems associated with extensive cattle farming, the barriers facing the adoption of improved cattle management practices have been relatively poorly explored in Brazil. Previous studies have focused on issues related to cultural resistance and attitudes (Wagner and Rocha, 2007), education (Vicente, 2002), financial aspects (Wagner and Rocha, 2007), technical extension services (Buainain and Souza filho, 1998), labour availability (Souza-Filho et al., 2011), property size (Souza-Filho et al., 2011) and biophysical conditions (Vicente, 2002). However, few of these studies are empirically based and none have systematically assessed the perspectives of cattle farmers regarding the relative importance of different barriers facing the adoption of improved management practices. Understanding farmers' perceptions is essential if the desired behavioural changes are to be achieved at scale and over the long term (Edwards-Jones, 2006; FAO, 2014; Halbrendt et al., 2014; Lastra-Bravo et al., 2015).

This study seeks to overcome this knowledge gap by systematically assessing the opportunities for and barriers to adoption of improved cattle management practices in Brazil. We first report the benefits of the adoption of better land management practices as perceived by cattle ranchers. Second, we identify the principal bottlenecks to this adoption and propose recommendations regarding how to overcome some of these obstructions. Third, we analyse whether the adoption of good agricultural practices is associated with increases in cattle productivity, and we explore the possible relationship between changes in farm productivity and forest cover. We focus on the state of Mato Grosso in Brazil, a major agricultural-forest frontier region where