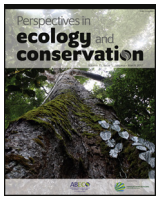
Perspectives in Ecology and Conservation xxx (2017) xxx–xxx

Perspectives in ecology and conservation

Supported by Boticário Group Foundation for Nature Protection

https://www.journals.elsevier.com/perspectives-in-ecology-and-conservation/



Essays and Perspectives

Perspectives for environmental conservation and ecosystem services on coupled rural–urban systems

Ramon Felipe Bicudo da Silva [a,*], Marjorie Delgado Alves Rodrigues [a], Simone Aparecida Vieira [a], Mateus Batistella [a,b], Juliana Farinaci [c]

[a] Núcleo de Estudos e Pesquisas Ambientais, Universidade de Campinas (UNICAMP), Campinas, São Paulo, Brazil
[b] Brazilian Agricultural Research Corporation (EMBRAPA), Brasília, Federal District, Brazil
[c] Instituto Nacional de Pesquisas Espaciais (INPE), São José dos Campos, São Paulo, Brazil

ARTICLE INFO

Article history:
Received 20 December 2016
Accepted 25 May 2017
Available online xxx

Keywords:
Best management practices
Territory
Ecosystem services
Local development
Consumption behavior

ABSTRACT

Using a territorial and integrative approach based on ecological and socioeconomic factors, we envision innovative policies and initiatives aiming to reconcile urban economic development with rural conservation and restoration projects. The Paraíba Valley of São Paulo State represents an example of territory where the region's urban development has affected land use and land cover changes, rural production systems, economy, and population dynamics with effects on environmental conservation. Forest restoration projects, rural tourism, urban to rural migration, and demands of urban consumers for more sustainable food production are becoming important linkages of the Valley's coupled urban-rural system. In this study, we demonstrated how place-based policies and payment for ecosystem services may foster rural socioeconomic development allied with environmental conservation outcomes. The coupled rural–urban systems emerge as a strong concept to deal with the synergies and potential linkages among rural and urban areas, capable to promote more sustainable farming systems and improve ecosystem services.

Introduction

Society and the environment co-evolved through feedbacks between human demands for natural resources and environmental carrying capacity. Coupled socio-ecological systems are complex, adaptive and delimited by spatial or functional boundaries surrounding ecosystems (Glaser et al., 2008) in which natural components (e.g., water, land, forest) are affected by human interactions (Liu et al., 2007). Globally, croplands and pastures cover an area of about 43 million sq km (Ramankutty et al., 2008). Although seen as an important land change and ecosystem services (ES) depletion driver (Robertson and Swinton, 2005), these areas also sustain the global agri-food demand (Tilman et al., 2011). Over the last decades, given the environmental changes and their consequences, such as deforestation and biodiversity loss, governments and civil society (e.g., NGOs) have invested in incentive mechanisms to enhance the provision of ES (Milder et al., 2010; Fischer et al., 2012).

The United Nations define the Payment for Ecosystem Services (PES) as a preservation strategy to avoid agricultural land use pressure and ensure biological conservation (FAO, 2011). Wunder's (2005) characterized PES as: "(1) a *voluntary* transaction where (2) a *well-defined* ES (or a land use likely to secure that service) (3) is being 'bought' by a (minimum one) ES *buyer* (4) from a (minimum one) ES *provider* (5) if and only if the ES provider secures ES provision (*conditionality*)" (Wunder, 2005, p. 3). The incentive provided by a PES scheme can be a cash or in-kind transaction, which includes seedlings for reforestation, beehives for increasing pollination and food production, technical assistance, infrastructure, education, and health services (Wunder, 2005; Guedes and Seehusen, 2011; Grima et al., 2016). Grima et al. (2016) demonstrated that PES with only in-kind contributions has quite better success compared to programs based on cash payments. Also, in kind incentives help avoiding cases of corruption or unfair distribution of benefits. Muradian et al. (2010) pointed out that PES based only in cash payments have a limited effect and can cancel other ethical and motivational incentives to conserve the ecosystems, such as acting in favor of the community, local cultural traditions and religious beliefs. Moreover, programs including co-benefits may increase productive and human standards while decreasing cash payment dependence (Torres et al., 2013).

* Corresponding author.
E-mail address: r114857@unicamp.br (R.F. Silva).

http://dx.doi.org/10.1016/j.pecon.2017.05.005

In Brazil, there are numerous PES programs varying from the national to state and regional levels with a predominant focus on water security (Santos et al., 2012). In 2011, Brazil had more than 80 PES projects at different development phases, most of them located in the Southern and Southeastern regions, mainly in the states of São Paulo, Minas Gerais, and Rio de Janeiro (Guedes and Seehusen, 2011). Most Brazilian PES schemes are in the Atlantic Forest and are based on restoration and reforestation strategies (Guedes and Seehusen, 2011; Alves-Pinto et al., 2017). Some of the most known and older PES programs developed in Brazil are: 'Conservador das Águas' in Extrema – MG/public local program; 'Projeto ProdutorES de Água' and 'Programa Florestas para a Vida' in Espírito Santo state/public state program – both programs were combined into one called 'Programa Reflorestar' in 2013; 'Programa Bolsa Floresta' in Amazonas state/public and private program; 'Projeto Oásis' in São Paulo – SP, Apuracana – PR, São Bento do Sul – SC and Brumadinho – MG/private local program; and 'Programa Produtor de Águas bacia do Piracicaba/Capivari/Jundiaí' in the municipalities of Piracicaba/Capivari/Jundiaí river basin/public regional program (Pagiola et al., 2013; Young and Bakker, 2015; Grima et al., 2016).

The PES programs and other conservation mechanisms are usually implemented in rural areas. However, the rural–urban synergies through a territorial perspective are not commonly well defined as potential links to foster place-based policy and local rural development. The territorial perspective can enhance local knowledge about natural landscapes assets (e.g., soils, water, climate, scenic views), processes such as forest transition (i.e., increase of forest cover area) and socioeconomic dimensions, which can promote social and economic development in rural areas ensuring sustainable land management practices and environmental conservation.

To encourage sustainable land management practices, as well as financial and environmental sustainability in rural properties, we present a territorial and integrative approach based on ecological and socioeconomic factors, envisioning innovative policies and initiatives aiming to reconcile urban economic development with rural environmental conservation and restoration projects. This approach is used in the Paraíba Valley context, a region within the Brazilian Atlantic Forest biome, a biodiversity hotspot (Myers et al., 2000). We used census based-data at regional and municipal level, public documents (e.g., websites, magazines, books, newspaper), fieldwork knowledge from previous studies conducted in the region, and geospatial information on natural forest cover change, topography and road infrastructure.

The Paraíba Valley

The Paraíba Valley of São Paulo state (14,500 sq km) (Fig. 1a), hosts significant Atlantic Forest remnants (Ronquim et al., 2016). It is a major water source for a population over 10 million inhabitants living between São Paulo and Rio de Janeiro states and is an industrial region connecting these two metropolitan areas. The Valley has only 3.8% of urban and built-up areas (Silva et al., 2016), which concentrate 94% of its population, 2,086,722 inhabitants (IBGE, 2010). The Paraíba Valley is occupied by approximately 51% of pasturelands, 6% of eucalyptus plantations, and 32% of forest areas (Silva et al., 2016). Among the croplands, rice is one of the most important, mainly concentrated along the Paraíba do Sul river floodplains (Itani et al., 2011). Rural properties occupy 71% (1,035,200 ha) of the Valley's total area (SAA/CATI/IEA, 2008) with a rural population of up to 6% of the Valley's total population (IBGE, 2010) as observed in Fig. 1a and b.

The countryside of the Paraíba Valley is a significant example of the traditional farming culture with the predominance of small properties of up to 50 hectares (70% of the rural properties) corresponding to 13% (203,012 hectares) of the region (SAA/CATI/IEA, 2008). They are characterized by low-intensity land use and high labor demand, particularly in dairy farming. The biophysical landscapes dominated by steep slopes and hilly terrain hampers mechanization and large-scale production of agricultural commodities. Since the 1950s, the Paraíba Valley faced major socioeconomic changes following the Brazilian industrialization and agricultural modernization period. While the country developed a highly-intensified agriculture in central regions, mainly at the Cerrado biome, former agricultural landscapes within the Paraíba Valley were marginalized. At the same time, Paraíba Valley hosted important industries attracting workers and boosting the urbanization process. From the 1950s to the 1980s, the Valley reached higher standards of economic development pushed by the industrial decentralization of the metropolitan region of São Paulo. In 1950, the rural population of Paraíba Valley was of 64% and in 2010 of only 6% (IBGE, 2010). As a result, pasturelands were abandoned and replaced by forest cover through natural regeneration (Silva et al., 2017), a phenomenon known as Forest Transition (FT), i.e., when net forest gain is observed in a region previously affected by deforestation (Rudel et al., 2005).

Labor shortage in the region is an important factor influencing the decline of agricultural activities and has led many dairy farmers to abandon or decrease this activity. As found by Latawiec et al. (2017) in a study conducted in Mato Grosso state, Brazil, the lack of qualified labor is the major constraint to develop best management practices in agriculture. In the Valley, the proximity to urban centers and the easy access to technologies (e.g., smartphones, internet), as well as better financial and working conditions has attracted young potential rural workers who find themselves compelled to seek better living conditions. The Paraíba Valley commercial and economic centers demand regional workers for the sectors of industry, trade, services, infrastructure, and informal jobs.

The Valley's rural population declined 4.8% between the last two censuses, ranging from 140,020 to 133,194 inhabitants (IBGE, 2010). According to a survey carried out between September and November of 2014 (Silva, 2015), there is an increasing trend toward new owners of rural properties as second dwellings, residence (mainly in the case of retired people), leisure or tourism. The 'new rural' people, as they are known, have in many cases the primary intent to occupy the countryside with non-farm activities, but with potential interest to implement agroforestry systems, subsistence crop production and native forest restoration.

Coupled rural–urban system: a territorial approach to enhance ES in rural properties

The traditional conservation approach has often disconnected ecosystems and society through the protection of species, ecosystems and landscapes from human negative impacts (Martín-López and Montes, 2015), rather than recognizing that human societies are part of nature and highly interconnected with ecological systems (Ostrom, 2009). In tropical countries, including Brazil, forest-rich regions have been converted into new agricultural lands (Gibbs et al., 2010). On the other hand, the Brazilian legislation requires a rural property to be productive and to conserve the environment, which is considered neither feasible nor lucrative for many Brazilian farmers (Rodrigues, 2016).

Approximately 70% of the Paraíba Valley is occupied by rural properties, which makes the rural area a key target for conservation policies and projects. However, the inherent linkage between forests, biodiversity, and agriculture challenges the government authorities, policy-makers and the entire society to develop rural and environmental policies that ensure environmental quality,

Please cite this article in press as: Silva, R.F., et al. Perspectives for environmental conservation and ecosystem services on coupled rural–urban systems. Perspect Ecol Conserv. (2017). http://dx.doi.org/10.1016/j.pecon.2017.05.005