Forest Policy and Economics 84 (2017) 83–91

Contents lists available at ScienceDirect

Forest Policy and Economics

journal homepage: www.elsevier.com/locate/forpol

A methodological approach for assessing cross-site landscape change: Understanding socio-ecological systems☆

Terry Sunderland[a,b,*], Rabdo Abdoulaye[a], Ronju Ahammad[c], Stella Asaha[d], Frederic Baudron[e], Elizabeth Deakin[k], Jean-Yves Duriaux[e], Ian Eddy[f], Samson Foli[a,g], Davison Gumbo[a], Kaysara Khatun[l], Mumba Kondwani[a], Mrigesh Kshatriya[h], Laurio Leonald[a,i], Dominic Rowland[a,j], Natasha Stacey[c], Stephanie Tomscha[f], Kevin Yang[f], Sarah Gergel[f], Josh Van Vianen[a]

[a] *Centre for International Forestry Research, Indonesia*
[b] *James Cook University, Australia*
[c] *Charles Darwin University, Australia*
[d] *Forests, Resources and People, Cameroon*
[e] *CIMMYT, Ethiopia*
[f] *University of British Columbia, Canada*
[g] *University of Amsterdam, The Netherlands*
[h] *UNEP/MIKE Programme, Kenya*
[i] *Bogor Agricultural University, Indonesia*
[j] *School of Oriental and African Studies, UK*
[k] *Opus International Consultants, New Zealand*
[l] *Universitat Autonoma de Barcelona, Spain*

ARTICLE INFO

Keywords:
Agrarian change
Forests
Livelihoods
Diets
Poverty
Biodiversity

ABSTRACT

The expansion of agriculture has resulted in large-scale habitat loss, the fragmentation of forests, significant losses in biological diversity and negative impacts on many ecosystem services. In this paper, we highlight the Agrarian Change Project, a multi-disciplinary research initiative, that applies detailed socio-ecological methodologies in multi-functional landscapes, and assess the subsequent implications for conservation, livelihoods and food security. Specifically, the research focuses on land use impacts in locations which exhibit various combinations of agricultural modification/change across a forest transition gradient in six tropical landscapes, in Zambia, Burkina Faso, Cameroon, Ethiopia, Indonesia and Bangladesh. These methods include integrated assessments of the perceptions of ecosystem service provision, tree cover loss and gain, relative poverty, diets and agricultural patterns of change. Although numerous surveys on rural livelihoods are undertaken each year, often at great cost, many are hampered by weaknesses in methods and thus may not reflect rural realities. We attempt to highlight how integrating broader socio-ecological methods can be used to fill in those gaps and ensure such realities are indeed captured. Early findings suggest that the transition from a forested landscape to a more agrarian dominated system does not necessarily result in better livelihood outcomes and there may be unintended consequences of forest and tree cover removal. These include the loss of access to grazing land, loss of dietary diversity and the loss of ecosystem services/forest products.

1. Introduction

Historically, the trade-off between increasing food security/production and the maintenance of natural systems has led to a perception that the two were mutually exclusive (Tscharntke et al., 2005; Brussaard et al., 2010). This perspective, however, has failed to account for the fact that certain levels of biodiversity exists within some agricultural landscapes which provide multiple contributions to food security and agricultural production (Perrings et al., 2006; Bharucha and Pretty, 2010; Sunderland, 2011). Managing, and negotiating, trade-offs between biodiversity and agriculture involves maximising food security benefits while minimising damage to the wider environment.

Globally, the total area of cultivated land increased by 466% from 1700 to 1980 (Meyer and Turner, 1992). Croplands and pastures have now become one of the largest terrestrial biomes on the planet, occupying ∼40% of the land surface (Ellis et al., 2010). Between

☆ This article is part of a special feature entitled: “Forest, Food, and Livelihoods” published at the journal Forest Policy and Economics 84C, 2017.

* Corresponding author.
E-mail address: t.sunderland@cgiar.org (T. Sunderland).

http://dx.doi.org/10.1016/j.forpol.2017.04.013
Received 17 May 2016; Received in revised form 26 April 2017; Accepted 26 April 2017
Available online 11 May 2017
1389-9341/

1980 and 2000, more than half of new agricultural land across the tropics was established at the expense of intact forests, while a further 28% was opened up to the detriment of disturbed or secondary forests (Gibbs et al., 2010). This habitat loss is further compounded by land degradation and competition from other land uses such as urbanisation (Ellis et al., 2010). Although the overall rate of agricultural expansion has slowed considerably over the last three decades the global focus on food production has ensured a rapid rate of increase in yield per unit area (Gibbs et al., 2010). Technological and scientific advancements have provided access to cheaper chemical fertilisers and pesticides, high-yielding crop varieties, advanced irrigation technologies and more efficient mechanisation (Matson et al., 1997; Motes, 2010), which have all contributed to increased crop yields. Unsurprisingly, given the dependency of this model on fossil fuels, concerns have been raised over the long-term sustainability of increasingly intensified agriculture, particularly as food demands are projected to more than double by 2050 (Green et al., 2005; Fischer et al., 2008; Godfray et al., 2010).

While there has been significant progress towards meeting global commitments to reduce hunger, levels of food insecurity remain unacceptably high. Approximately 842 million people worldwide remain hungry and undernourished (UNICEF, 2011; Black et al., 2013; FAO et al., 2013) and this can be attributed as the cause of one third of child mortality figures in developing countries. This situation is further exacerbated by global population growth and changing dietary patterns with a predicted 50% increase in the demand of agricultural products by 2030 (Bruinsma, 2003). In this context, the provisioning of food is increasingly couched within multiple objectives sought from multifunctional mosaic landscapes namely, biodiversity conservation, maintenance of ecosystem services, food production, sustainable livelihood provision, and climate change mitigation (Sayer et al., 2013; Reed et al., 2015; Khatun et al., 2016). However, in many places, land scarcity results in trade-offs between many of these components, particularly between the need for agricultural commodities and conserving biodiversity (Law and Wilson, 2015).

To this end, two contrasting landscape management approaches; 'land sparing' and 'land sharing' have been identified as potential strategies to minimise the negative consequences of agriculture on biodiversity. These consider land use change in such a way that competing demands for food, commodities and forest services can be reconciled (e.g. Pirard and Treyer, 2010; Phalan et al., 2011a). 'Land sparing' aims at intensifying production and maximising agricultural yields by trading off its negative consequences on the environment by 'sparing' areas of natural capital (often in the form of protected areas) and therefore reducing the need for agricultural expansion into forest areas (Pirard and Treyer, 2010).[1] 'Land sharing', on the other hand - where agricultural production takes place within complex multi-functional landscapes - is based on a land use model that integrates production and conservation within the same land units. It proposes to minimise the use of external inputs and to retain patches of natural habitat within farmlands in a form of extensive agriculture. Under the latter management regime, landscapes consisting of low-intensity productive areas are combined with areas of natural biodiversity (Wright et al., 2012). Such strategies include agroforestry systems and traditional swidden farming practices (Ziegler et al., 2009; Clough et al., 2011).

Land sparing offers a convincing narrative for achieving desirable agrarian change, particularly in the developing world (e.g. Phalan et al., 2011a, 2011b), suggesting that efforts to emulate land sparing through the application of incentives, regulations, and land use planning could lead to optimal outcomes for food production, climate change mitigation and biodiversity conservation. Meanwhile 'land sharing', is supported by the fact that many species are dependent on farmland and other habitats maintained by humans (Wright et al., 2012; Deakin et al., 2016), and that farmlands that are often structurally similar to the original native vegetation can support biodiversity often as effectively as native vegetation (Clough et al., 2011).

The land sparing versus land sharing debate has become somewhat polarised in the scientific literature (Law and Wilson, 2015) and, it has been argued, has actually stagnated (Bennett, 2017). There is increasing opinion that a 'black and white' dichotomy over-simplifies issues that in practice are highly complex[2] (Adams, 2012; Fischer et al., 2014). Baudron and Giller (2014) suggest that both options are equally important and can be complementary strategies under different circumstances and some landscapes may exhibit elements of both. Smallholder farmers for example, who provide up to 40% of the world's food, mostly fall somewhere on the continuum between land sharing and land sparing (Tscharntke et al., 2012). The land sharing/sparing debate also suggests there is some level of "grand design" at the landscape scale which is simply not the case (Reed et al., 2017). Most landscapes are inherently dynamic and evolve through the influence and interactions of environment, society and economies (Sayer et al., 2016).

It has also been recognised that land use strategies aimed at balancing agriculture and biodiversity conservation must also consider socio-economic outcomes and trade-offs (Fischer et al., 2014; Loos et al., 2014; Khatun et al., 2015). Landscapes should be viewed as complex social-ecological systems that consist of mosaics of natural and/or human-modified ecosystems (Bennett et al., 2006; Reed et al., 2016). However, there is a distinct lack of information on the human impacts of agrarian change in forested areas, particularly with regards to socio-economic effects of agricultural intensification, long-tesrm dietary diversity and market integration processes (Byerlee et al., 2014). Previous research within the land-sharing vs. land sparing debate has focused heavily on the trade-offs between food security and biodiversity at a macro-level (Phalan et al., 2011a; Green et al., 2005; Clough et al., 2011), while local scale effects upon livelihoods, poverty, food security and nutrition have tended to be overlooked. Furthermore, it is also important to recognise that more food production does not automatically lead to better local food security and improved livelihoods for rural communities (Powell et al., 2015).

In this paper, we present the Agrarian Change Project, a multidisciplinary, research initiative led by the Center for International Forestry Research with direct funding from USAID's Biodiversity Bureau and the UK's Department for International Development (Deakin et al., 2016). The project applies detailed socio-ecological methodologies to examine the outcomes/impacts of land use and agrarian change processes in multi-functional landscapes, and the subsequent implications for conservation, livelihood, and food security. Specifically, the research focuses on land use impacts in locations which exhibit various combinations of agricultural modification/change across a forest transition gradient in six tropical landscapes in Zambia, Burkina Faso, Cameroon, Ethiopia, Indonesia and Bangladesh. The study attempts to highlight how integrating broader socio-ecological methods, within a novel experimental design can be used to fill in gaps in assessing local food security, dietary diversity and nutrition levels, tenure, local poverty, biodiversity/forest conservation and integration with global commodity markets. Thus the project seeks to explore these landscape components by answering the following research questions

1. How is land use changing over time and what are the underlying drivers behind these changes? Are there consistencies/differences between the case study landscapes/countries?
2. What are local people's perceptions of the outcomes of land use

[1] Agricultural intensification does not necessarily mean increases in inputs such as fertilizer and capital (e.g. through mechanisation), but it can also include changes to the use of labour and environmental services. See discussion in Pirard and Treyer, 2010, p.6. Most commonly, however, intensification is understood as additional inputs to increase productivity.

[2] See also: http://blog.cifor.org/8110/land-sharing-or-land-sparing-reconciling-agriculture-and-biodiversity-conservation?fnl=en