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Research article

Facilitating smallholder tree farming in fragmented tropical landscapes: Challenges and potentials for sustainable land management

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ABSTRACT

Under changing land use in tropical Asia, there is evidence of forest product diversification through implementation of tree-based farming by smallholders. This paper assesses in two locations, West Java, Indonesia and eastern Bangladesh, current land use conditions from the perspective of smallholder farmers, the factors that facilitate their adoption of tree farming, and the potential of landscape-scale approaches to foster sustainable land management. Data were collected through rapid rural appraisals, focus group discussions, field observations, semi-structured interviews of farm households and key informant interviews of state agricultural officers. Land at both study sites is typically fragmented due to conversion of forest to agriculture and community settlement. Local land use challenges are associated with pressures of population increase, poverty, deforestation, shortage of forest products, lack of community-scale management, weak tenure, underdeveloped markets, government decision-making with insufficient involvement of local people, and poor extension services. Despite these challenges, smallholder tree farming is found to be successful from farmers' perspectives. However, constraints of local food crop cultivation traditions, insecure land tenure, lack of capital, lack of knowledge, lack of technical assistance, and perceived risk of investing in land due to local conflict (in Bangladesh) limit farmers' willingness to adopt this land use alternative. Overcoming these barriers to adoption will require management at a landscape scale, including elements of both segregation and integration of land uses, supported by competent government policies and local communities having sufficiently high social capital.

1. Introduction

At the United Nations Conference on Sustainable Development (Rio+20) in 2012, the UN Secretary General proposed an ambitious goal to eliminate global hunger by 2025, the 'Zero Hunger Challenge' (Vira et al., 2015). This requires year-round access to food for the world's growing population,[1] while enhancing livelihood security, by improving the productivity of agricultural systems, without causing ecological harm or compromising biodiversity and ecosystem services (Garnett et al., 2013; FAO, 2011). Furthermore, the state of tropical forest resources in most Asian countries has reached a critical point; never before have forest ecosystems been so greatly affected by human activities as during recent decades (Snelder and Lasco, 2008). In addition to declining forest area, the area of land suitable for productive agriculture is also dwindling, particularly in developing countries where approximately one quarter of all farmland has been degraded (Garrity, 2004), through unsustainable cultivation practices causing nutrient deficiency and loss of soil organic matter and physical structure.

The urgent need to reduce both rates of deforestation and forest degradation and the degradation of agricultural land, through

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[1] The global population was approximately 7.32 billion in 2015 and is predicted to reach over 9 billion by 2050. Consequently the issue of food security is increasing in importance in academic and policy debates, especially in relation to the global development agenda beyond 2015 (Vira et al., 2015; FAO et al., 2014).

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improved sustainability of land use, has been widely recognized. This has triggered projects and programs on forest conservation, reforestation, and agroforestry aimed at the integration of trees in predominantly agricultural landscapes (Snelder and Lasco, 2008). Agroforestry practices by smallholder farmers are considered a potential strategy for poverty reduction (FAO, 2005; ICRAF, 2003). Agroforestry is increasingly important for sustainable food production (Ickowitz et al., 2014; Johnston et al., 2013; Rahman et al., 2013), and restoring and safeguarding ecological and socio-economic sustainability in agricultural landscapes (Roshetko et al., 2007a; Swallow et al., 2006; Garrity et al., 2002). Trees on farms can also relieve the pressure on remaining forest resources (Murniati et al., 2001).

There is evidence of spontaneous forest product diversification through implementation of tree-based farming by smallholders, especially in Asian countries (e.g. the Chittagong hill tracts, Bangladesh; North and West Sumatra, West Java, East Kalimantan, Indonesia; Cebu, Philippines) (Rahman et al., 2014; Roshetko et al., 2013; Snelder and Lasco, 2008; Michon, 2005). The state policies of banning logging or restricting forest product harvesting in countries such as Indonesia, Thailand and the Philippines are also leading smallholder farmers to search for alternative sources of tree products through integrating trees into their farming systems. Moreover, it is expected that, with increasing population size and consequent land shortage, the number of farmers with smallholdings will remain high or may even increase in the near future.

The success of smallholder tree cultivation depends on farmers' ability to overcome a number of barriers. Previous research has indicated the importance of investment capital, sufficient production technologies and knowledge, secure tenure, and adequate physical infrastructure and policy support for the transport of tree products to market (Rahman et al., 2008, 2014; van Noordwijk et al., 2008). However, due to socioeconomic and environmental challenges at a landscape scale – which are increasingly complex, widespread, and variable between landscapes – there is a debate on the sustainability of smallholder tree cultivation as a land use strategy, especially when compared with food crop agriculture and the sparing of land from agriculture for biodiversity conservation and the delivery of a range of ecosystem services (Sayer et al., 2013; van Noordwijk et al., 2012; van Noordwijk et al., 2008). The importance of the social and policy components of this challenge is increasingly recognised, yet remains under-represented in published research (Kiptot and Franzel, 2011; Mercer, 2004; Mercer and Miller, 1997). To contribute to this need, the present study addresses the agroforestry adoption gap by analyzing conditions of smallholder farmers that are relevant to the potential for adoption of tree farming in two contrasting tropical Asian locations – West Java, Indonesia and eastern Bangladesh. It specifically seeks to answer the following questions. 1. What are the most important challenges facing farmers in their current land use systems? 2. Which policies are most likely to be successful in facilitating farmer adoption of successful tree farming? 3. Which approaches are likely to work best across scales from the landscape (to reconcile food production and environmental goals) to the individual farm household? The results are synthesized for each of the major land use systems currently practiced by smallholders in the two locations, including their products and services; and the major land use challenges faced by the farmers. This informs a discussion focused on the potential for intensification of current farming practice through increased conversion to tree-based farming, what conditions facilitate successful tree-based farming, and the applicability of landscape-scale approaches (land sparing and land sharing) as a framework for the development of land use systems that are more sustainable from a local perspective. The assessment includes the policy context needed to support sustainable land management to provide both goods for local livelihoods and ecosystem services of wider societal benefit.

2. Materials and methods

2.1. Study site

The study sites are located in Gunung Salak valley, Bogor District, West Java, Indonesia and Khagrachhari District, eastern Bangladesh. The Gunung Salak site lies between 6° 32′ 11.31″ S and 6° 40′ 08.94″ S latitudes and between 106° 46′ 12.04″ E and 106°47′ 27.42″ E longitudes. With an equatorial climate and average yearly precipitation of 1700 mm this area is more rainy and humid than most parts of West Java. Three villages, Kp. Cangkrang, Sukaluyu and Tamansari, in the northern part of Gunung Salak valley were purposively selected[2] for the study. Sukaluyu and Tamansari contain a mixture of households practicing both subsistence seasonal swidden farming and agroforestry, that form the major comparison of this study. Kp. Cangkrang is located in a different part of the valley, most of its households practice permanent monoculture farming, and it is included as an outgroup comparison. During the data collection in 2013, there were approximately 1600 households (10,200 people) living in these three villages. Agriculture is mainly a subsistence practice in the study site, conducted by small-scale farmers. Household incomes are mainly based on agricultural and forest products, sold in local and district markets, in addition to wage labor and retailing (Badan Pusat Statistik, 2013).

Khagrachhari District is part of the Chittangong hill tracts, which is the extensive hilly and forested area in Bangladesh, and lies between 21° 11′ 55.27″ N and 23° 41′ 32.47″ N latitudes and between 91° 51′ 53.64″ E and 92° 40′ 31.77″ E longitudes. The average yearly precipitation is 2540 mm (BBS, 2014). Two villages, Mai Twi Para and Chondro Keron Karbari Para, were purposively selected[3] for the study. During the data collection in 2013 there were approximately 135 households (750 people) living in these two villages. Agriculture is a subsistence practice practiced by small-scale farmers. Household incomes are mainly derived from wage labor and selling agricultural and forest products in local and district markets.

2.2. Data collection

Rapid rural appraisals (RRA) were used with the support of village mapping and key informant interviews for the socioeconomic and geographical characteristics of the research sites (FAO, 2015; Angelsen et al., 2011). For each village, the mapping sessions and key informant interviews were conducted with the village head and three farmers. These three farmers were selected purposively[4] based on their knowledge about the village and surrounding areas.

One focus group discussion (FGD) in each village[5] and field observations were used to collect information on local land use systems, the services that they deliver, and the land use challenges

[2] The villages were selected based on stratification by watershed location and having the largest sample size of farm households that practice their associated land use systems, i.e. in the lower watershed permanent monoculture (Kp. Cangkrang), and in the middle (Sukaluyu) and upper (Tamansari) watershed agroforestry and swidden.

[3] The area consists of hills, and the two villages were selected as those with the largest sample size of farm households that practice agroforestry and swidden.

[4] This selection was made with the help of expert local informants.

[5] One semi-structured questionnaire interview (village survey, consisting of a set of questions related to basic information about the village, e.g. demography, infrastructure and land use) was also conducted during the FGD.