Analysis

Wood Extraction Among the Households of Zege Peninsula, Northern Ethiopia

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ABSTRACT

The dependence of smallholder farmers on forest resources for their sustenance and livelihoods is a major driver of deforestation and degradation of forest resources in tropical countries. Understanding the socio-economic drivers that aggravate the extraction and overexploitation of forest products is vital for designing effective forest conservation and restoration measures. This particularly holds with regard to the importance of two fundamentally opposing motivations of smallholder forest exploitation, which we label "wood extraction for need" vs. "wood extraction for greed". This study was conducted at Zege peninsula in Northern Ethiopia to investigate the factors affecting the extraction and marketing of wood from the peninsula's primary dry Afromontane forest by smallholders. Data was collected using household survey, focus groups discussions and key informant interviews. Data analysis employed the Heckman two-steps econometric model. The predominant involvement of vulnerable households in forest exploitation suggests that wood extraction was driven by need and mainly served sustenance and safety net functions. In addition, we also found evidence of greed-driven forest exploitation. As a consequence of selective rule enforcement and nepotism, the forest enforcement committee was not effective in safeguarding the forest, there by contributing to increased wood extraction and marketing by community members for income generation. This suggests that, in order to protect the forest, interventions are needed that aim at creating alternative income opportunities for smallholders through improved production of non-timber forest products, enhanced market access and the provision of locally adapted technologies; as well as at increasing the integrity of law enforcement.

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1. Introduction

The dependence of smallholder farmers on forest resources for their sustenance and livelihoods is a major driver of deforestation and degradation of forest resources in tropical countries (Amare et al., 2012; FAO, 2007). African nations lead the global list of countries with the highest deforestation rates (Naoto, 2006). Forest degradation in Ethiopia is primarily being caused by human activities (Reusing, 1998; Teketay et al., 2010) and has led to considerable habitat fragmentation (Wilcove et al., 1986), a decreasing population (Laurance et al., 2006) and extinction of indigenous plant and animal species (Wright and Muller-Landau, 2006), as well as a decline in provision of soil protection, water conservation and favourable microclimate services (Aerts et al., 2011). Forest degradation is most pronounced in the highlands of the Amhara region, where natural forests and sacred groves have continuously been overexploited during past decades. The deforestation has led to high runoff resulting in degraded landscapes, decreasing crop and livestock productivity, sedimentation of water bodies, increased food insecurity and increasingly high loss of the resource base and the attached ecosystem services (Amare et al., 2016; Bongers et al., 2006; Aerts et al., 2016).

Zege peninsula, which is located in the Amhara Regional State, is one of the remnants of dry Afromontane forest patches in Ethiopia. This forest has considerable religious, economic and ecological importance as it attracts local and international pilgrims, serves as a source of livelihood for local communities, and is rich in biodiversity (Alelign et al., 2007; Teklehaymanot and Giday, 2007). However, recent studies have shown that unsustainable wood extraction and marketing of wood products by local populations have increased (Teklehaymanot and Giday, 2007; Alelign et al., 2011) thereby contributing to the degradation of the forest ecosystem and the nearby Lake Tana (Amare et al., 2012; Amare et al., 2017). This, in turn, has led to reduced livelihood options, economic and habitat losses, threatened biodiversity, undermined

the valuable services provided by biological diversity and increased the risk of climate change.

In order to reverse this trend, innovative approaches are required that integrate environmental conservation objectives and livelihood improvements for the local communities (Alelign et al., 2011). A more detailed understanding of the link between forests and local livelihoods enables the promotion of more sustainable management practices while maintaining acceptable levels of utilization (Shaanker et al., 2004; Lepetu and Oladele, 2009). Hence, investigating the dependence of local communities on their forest resources is vital to devise appropriate forest management and conservation strategies.

There is no shortage of studies that investigate how socio-economic household characteristics and local institutions affect deforestation, forest degradation and conservation (e.g., Adhikari et al., 2004; Faham et al., 2008; Bembridge and Tarlton, 1990; Lepetu and Oladele, 2009; Lockwood et al., 2010; Manyatsi and Hlophe, 2010; Amare et al., 2016; Mowo et al., 2016). However, these studies are highly specific to location and context (Kaimowitz and Angelsen, 1998; Clark et al., 2008). Therefore, little consensus exists with regard to which drivers influence deforestation and forest degradation on a generalized and abstract level (Vadez et al., 2005; Indarto and Mutaqin, 2016). Local case studies (e.g., Adhikari et al., 2004; McElwee, 2008; Inoni, 2009; Lepetu and Oladele, 2009) are thus considered to provide reliable and useful accounts of these processes and their causes and dynamics (Kaimowitz and Angelsen, 1998). Hence, in order to determine the extent of deforestation and forest degradation at the Zege peninsula and to identify the factors inducing these processes, a detailed local-level study is needed. Such a study could also serve as an initial step toward formulating policies conducive for an equitable and sustainable management of forest resources (Lepetu and Oladele, 2009).

The following socio-demographic variables have been reported in the literature as being correlated with household wood extraction: education (e.g., Ricardo et al., 1998; Baba et al., 2015) or years of schooling of the household head (Inoni, 2009), age of the household head, dependency ratio (Rahut et al., 2016), male gender (Eneji et al., 2015) and household size (Inoni, 2009; Knight and Rosa, 2012). Lack of employment opportunities (Manyatsi and Hlophe, 2010; Usman et al., 2016) was positively while income from paid wages, total land size and income from farming (Bwalya, 2013) were negatively correlated with income from forest products (McElwee, 2008). Extension services (Adugna, 2008), remittances and credit (Berhanu, 2003) enabled engagement of famers in more remunerable activities and reduced wood extraction. Dysfunctional local institutions increased the likelihood of deforestation (Lockwood et al., 2010; Mowo et al., 2016). However, the set of variables included in these analyses varied, and the direction and strength of these relationships have not always been consistent in the literature. Moreover, most of these studies fail to differentiate conceptually distinct mechanisms and motivations of smallholder-driven deforestation and forest degradation. With the current study we, therefore, aim to undertake a comprehensive empirical assessment of the factors driving deforestation and forest degradation by smallholders at the Zege peninsula.

The objectives of this study are (i) to explore the economic dependence of rural populations in the study area on wood products and their contribution to household cash income; (ii) to identify the primary motivations of smallholders to extract forest products; and (iii) to assess the effectiveness of local forest management traditions. We have used wood extraction by smallholders as a proximate measure for deforestation and forest degradation. Compared to traditional land use and forest inventory-based attempts to operationalize deforestation and forest degradation, this approach has the advantage of directly linking these processes to livelihood activities and household-level indicators of well-being (Indarto and Mutaqin, 2016). Furthermore, we have used the term wood rather than fuel wood in our study since wood biomass is used for various purposes in addition to household energy in the study area.

This paper is novel with regard to the following aspects: (i) we provide a detailed account of a specific forest management tradition in the study area that, as to the best of our knowledge, has not been presented yet elsewhere; (ii) we apply the Heckman two-steps econometric model to analyse the drivers of wood extraction and to reveal the smallholders' motivations to exploit their forest resources; and (iii) we propose to include livelihood options as a modifier variable when assessing the relationship between education and gender on smallholder wood extraction.

2. Conceptual Framework

While large-scale commercial deforestation has become a major driving force of forest destruction in the Amazon and Indonesia since the 1980s, smallholders remain the primary agents of forest degradation and deforestation in most parts of South Asia and sub-Saharan Africa to date (Rudel et al., 2009). Agricultural expansion and wood extraction are among the main direct or proximate causes of smallholder-driven deforestation, and a variety of economic, political, historical, institutional, cultural, demographic and technological factors have been identified as its underlying causes of these processes (Chakravarty et al., 2012; Geist and Lambin, 2001).

Despite numerous studies on smallholder-driven deforestation and forest degradation, the conceptual understanding of their motivations to exploit their forest resources remains relatively vague. The point of departure for our study is the empirical observation that smallholder farmers utilize and, at times, overexploit the forest driven by two fundamentally opposing motivations (cf. Shackleton and Shackleton, 2007; Wunder et al., 2014), viz. (1) the reliance on forest products as a safety net in absence of other sufficient livelihood options, in times of food scarcity or income shortage (we label this motivation "wood extraction for need"); and (2) the extraction of forest products to maximize household income when profitable market opportunities for forest products exist despite the availability of sufficient alternative, non-forest livelihood options (we label this motivation "wood extraction for greed"). This conceptual distinction is supported by the observation that often specific socio-economic strata are engaged in and linked to these opposing forms of forest utilization: while the safety net function of forests and extraction of subsistence products is particularly important for the very poor and vulnerable parts of the rural population, forest use for cash income generation is more pronounced among better-off households and their absolute incomes from forest products are often larger (Angelsen et al., 2014). Yet, in practice this distinction is less neat, as forest exploitation by the vulnerable and the better-off rural households may occur in parallel, and many rural households in fact exploit forests for subsistence and income generation at the same time. However, each of these two mechanisms of forest exploitation requires a particular and distinct set of responses to be redressed. Separating these concepts analytically may, therefore, add to an improved understanding of the factors contributing to deforestation and forest degradation in a particular case, thereby facilitating the formulation of effective location-specific policy responses.

We use the Heckman two-steps model to investigate smallholder forest exploitation at the Zege peninsula. The first model equation identifies the socio-economic determinants of the households' involvement in wood extraction. We conceptualize this step to assess the overall dependency of villagers from the forest resources and to reveal incidences of need and greed based wood extraction, if present. The second model equation uncovers the factors that determine the amount of annual household wood extraction from the forest, which we conceptualize to separate need from greed based forest exploitation.

3. Materials and Methods

3.1. The Study Area

The study was conducted at Zege peninsula (°40′ to 11°43′N and 37°19′ to 37°21′E), located at the southern shores of Lake Tana (Alelign et al., 2011). The main land use type on the peninsula was