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Equity in the distribution of values of outputs from exclosures in Tigray, Ethiopia

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ABSTRACT

Land degradation is a widespread problem throughout the Tigray Region in Ethiopia, and establishing exclosures to restore degraded land has been in practice for many years. The authors examine how outputs obtained from exclosures are distributed among households adjacent to the exclosures and identify factors that influence the distribution of values of outputs. Data were collected from 446 households living next to nine exclosures in Tigray. The Gini coefficient, probit regression, and multiple linear regression were applied to the data sets. The results revealed that the distribution of values of outputs varied from fairly equal to quite unequal, depending on the exclosures' attributes and the appropriators' attributes. A more equal distribution values of outputs from exclosures was found where the density of appropriators was higher or/and in villages next to exclosures that were protected for longer periods. Wealthier households with larger herd sizes obtained a larger share of outputs from the exclosures, while households in the lowest income quantile received almost nothing. This may raise concerns among those interested in pro-poor measures. The authors did not find any evidence that household responsibility for managing and protecting exclosures had significant impacts on the distribution of values of outputs.

1. Introduction

The problem of land degradation exists throughout sub-Saharan Africa (Yayneshet et al., 2009) and threatens both ecosystem functions and economic production. The rehabilitation of degraded land can be a challenge when managing dry forests and semi-arid environments because these resources shape local communities' livelihoods (e.g., Babulo et al., 2008; Mamo et al., 2007; Soltani et al., 2012, 2014; Tesfaye et al., 2010). Large populations of humans and livestock are heavily dependent on ecosystem goods and services provided by dry forests and woodlands in Africa in general (Chidumayo and Marunda, 2010; Shackleton et al., 2007) and in the Tigray Region in northern Ethiopia in particular (Babulo et al., 2008, 2009). Therefore, any effort to rehabilitate the degraded dry forests could improve local communities' livelihoods (Shylendra, 2002). The Tigray Region suffers from extreme land degradation (Haileslassie et al., 2005; Mekuria et al., 2007), loss of soil fertility, and moisture stress (Herweg and Stillhardt, 1999).

The authorities in Tigray realized that it is less costly to address land degradation in Tigray by closing off the most badly degraded areas from agriculture and grazing to form exclosures (Aerts et al., 2009). Local communities make bylaws to govern and manage such exclosures (Yami et al., 2006); communities' bylaws are subsidiary laws established and enacted by local communities (Nkonya et al., 2008). Under the bylaws, all interventions that may hinder the regeneration capacity of exclosures, such as grazing, firewood collection, and agricultural uses, are forbidden (Aerts et al., 2009; Mekuria et al., 2007; Shitarek et al., 2001; Wisborg et al., 2000). In most areas, during specific times of the year, villagers are allowed to collect grass from exclosures. However, as some individuals from village communities may be tempted to violate the bylaws by harvesting forest products from exclosures without either permission or unchallenged by other villagers (Babulo et al., 2009;

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Yami et al., 2006), monetary and non-monetary sanctions are imposed as a deterrent (Yami et al., 2006). Following the establishment of an exclosure, guards are assigned by the district office of Agriculture and Rural Development to protect them. The guards are paid on the basis of a food-for-work program administered by the World Food Program (Yayneshet et al., 2009).

It is well documented that the establishment of exclosures in Tigray has been effective in enhancing ecosystem functions (e.g., Descheemaeker et al., 2006; Nyssen et al., 2009; Tefera et al., 2005; Yami et al., 2006; Yayneshet et al., 2009) and increasing the growth of grass and trees (Descheemaeker et al., 2006). However, despite the positive environmental impacts, the introduction of exclosures has limited local communities' access to land. Hence, such communities may consider the land use change from grazing land to exclosures as unfavorable. The success of natural restoration by the establishment of exclosures may depend on the generation of economic gains to local communities. In the absence of such economic incentives, local communities rarely support restoration projects that involve exclosures. Their lack of support becomes even more challenging when there is a growing demand among local communities to use exclosures to generate direct economic value (Gebremedhin et al., 2003). Furthermore, a controlled and moderate use of exclosures may not only provide economic incentives for local communities to participate in the management of the exclosures (e.g., Amede et al., 2007; Babulo et al., 2009; Mekuria et al., 2011) but also enhance the ecological function of those exclosures (Yayneshet et al., 2009).

Many studies have evaluated the economic values of outputs obtained from forests and assessed their impacts on local communities' livelihoods in different parts of the world (e.g., Adhikari et al., 2004; Cavendish, 2002; Fu et al., 2009; Kamanga et al., 2009; Mamo et al., 2007; Narain et al., 2008; Shackleton et al., 2007; Soltani et al., 2012, 2014; Vedeld et al., 2007) as well as in the Tigray Region in Ethiopia (Amede et al., 2007; Babulo et al., 2009; Mekuria et al., 2011). However, the distributional aspects of such values to local communities have received little attention in international literature and in the current forest management scheme in Tigray. Promoting equity in the sharing of valuable outputs is required for the sustainable management of any resources, and the meaning of economic equity has been discussed extensively (Clark, 2003; Sen and Gordon, 2015). Economic equity relates to the distribution of income and property, and is also related to opportunities and efforts. It is also associated with the redistribution of wealth and transfer of income and wealth from some individuals to others by social mechanisms such as taxation, charity, and land reform (Konow, 1996; Rawls, 2001). However, societies and communities may differ in what they consider a fair distribution (Konow, 2001; Leventhal, 1980). Equity is considered to be among the most frequently discussed measures for a successful community forest management (Pagdee et al., 2006). The aim of the present study was to assess the impact of the attributes of exclosures and the households living next to them, as well as the external context in the distribution of the economic values of the outputs from the exclosures. This was achieved by performing an econometric analysis using data from 446 households in Tigray. Despite the existence of illegal and hidden harvests from exclosures in Tigray, we examined only the economic values of legal outputs, specifically grass and fruits, which had been harvested in accordance with bylaws. The study addressed the following research questions:

1. How are the economic values of outputs from exclosures distributed among households adjacent to the exclosure?
2. What factors influence whether a household collects any outputs from exclosures?
3. What factors influence a household's share of economic values of outputs from the exclosures?

2. Conceptual framework

Exclosures are established in degraded forests and on poor grazing lands that are considered common-pool resources. Hence, the exclusion of appropriators, who do not contribute to the establishment and management of exclosures yet access them and collect outputs or other benefits from them, is difficult and costly. Ostrom et al. (1994) defined appropriators as individuals who extract or appropriate resource units from any type of common-pool resource. In this article, we define appropriators as villagers who hold access rights to adjacent exclosures and can withdraw outputs from them. With regard to any other common-pool resources, the joint efforts of individuals and collective actions are required to create management rules to protect and maintain exclosures (Ostrom, 1990; Sandler, 1992). If rules are well established, the appropriators could allocate resource benefits equitably, over long periods and in a more efficient manner than if there were no rules (Agrawal, 2001; McKean, 1992; Ostrom, 2005). The creation of rules is linked to the specification of participants' rights and duties and results in a public good for those involved (Ostrom, 2005). Any member of the community can benefit from the public good, irrespective of their contribution to the maintenance of the resource (Ostrom, 2005). The problem of free riders (Baumol, 1952) is the main challenge facing common-pool resources, and how to avoid this problem creates a dilemma. If the problem of free riders is not resolved, the tragedy of commons (Hardin, 1968) may result.

The conceptual framework of the study is presented in Fig. 1. The literature on common-pool resources specifies influencing factors and variables that can enhance the likelihood that appropriators will organize themselves by creating and following rules that will avoid the problem of free riders and the tragedy of commons (Agrawal, 2001; Baland and Platteau, 1996; Ostrom, 1990; Wade, 1988). These variables are classified into two broad sets of those describing the attributes of the common-pool resources and those describing the attributes of the appropriators. These variables affect the basic cost–benefit calculations of a group of appropriators when they aim to utilize a resource (Ostrom, 2005). Each appropriator compares the expected net benefits of harvesting from a resource in a current situation without any rules (B_{nr}) with the benefits they might achieve if the rules are established (B_{wr}), considering all transaction costs associated with the establishment of the rules. If the appropriators realize that B_{wr} is greater than B_{nr}, they will establish institutions and commit to rules (Ostrom, 2005). These influential variables are presented in Table 1 and discussed in more detail below.

2.1. Attributes of resources

Two attributes of resources have an impact on appropriators' decisions relating to common-pool resources: feasible improvement and spatial extent (Ostrom, 1990).

2.1.1. Feasible improvement

A resource should not be degraded to the extent that it is not worth any organization. The more productive the resources, the greater is the expected net benefits of organizing any rules and the higher is the probability of the establishment of rules. To represent feasible improvements in exclosures in Tigray, we used two ordinal variables: the “age group of exclosure” (a = years since establishment) and the “agroecological zone of exclosure.” Three numerical scores were calculated for each variable. Exclosures are grouped into three age classes: a $\leq$10 years (new exclosures), 10 < a $\leq$15