Land Use Policy 44 (2015) 76–89

Contents lists available at ScienceDirect

Land Use Policy

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

Economic and institutional incentives for managing the Ethiopian highlands of the Upper Blue Nile Basin: A latent class analysis

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ARTICLE INFO

Article history:
Received 28 March 2014
Received in revised form
10 November 2014
Accepted 23 November 2014

Keywords:
Attribute non-attendance
Spatial preferences
Watershed management
Labour contribution
Developing countries
Common vs private land management

ABSTRACT

This article identifies incentives that motivate land users to participate in the management of private and communal lands in the Ethiopian highlands of the Upper Blue Nile Basin, where on-farm and off-farm impacts of soil erosion are threatening the livelihoods of millions of farmers and damaging water infrastructure across the Blue Nile River System. A choice experiment was set up requiring farmers to contribute with labour and to implement specific watershed management (WM) activities in exchange for subsidised credit facilities, better opportunities for livestock production in the form of grazing land reform, and an additional extension service. Thus, we address farmers' combined choice of management of private and communal lands. We use a latent class model with attribute non-attendance for one class to accommodate the preferences of farmers who always select the status quo option without making a trade-off for experimentally designed policy attributes. Moreover, we estimate individual specific and socio-spatial group specific preferences across 90 units. Farmers' preference within the same socio-spatial unit is fairly homogeneous. Apart from the non-attendance class, the study reveals two classes. One class, which is probably dominated by literate farmers and farmers who have easy credit access, is willing to contribute more labour and requires fewer subsidies than the other class. Furthermore, the two groups have opposite viewpoints on management (semi-privatisation of common land). Our results also revealed that the seasonal concentration of the WM workload is less preferred by all farmers than an evenly distributed workload. Thus, policy design to address both the on-site and off-site effects of soil erosion in the Ethiopian highlands of the Upper Blue Nile Basin should consider the workload distribution of various aspects of WM, as well as the heterogeneity of preference for incentives across different groups of farmers.

Introduction

Soil erosion is the main environmental threat to the Blue Nile River System (BNRS). Annually about 302.8 million tonnes of soil is eroded from cropland and communal grazing lands in the Ethiopian highlands of the Upper Blue Nile (Abay) Basin (Awulachew et al., 2008, 2009). Soil erosion affects land productivity and thereby threatens the livelihoods of millions of farmers as well as the global food supply (Grepperud, 1996; Pimentel, 2006; Ye and Van Ranst, 2009). Furthermore, soil erosion has off-farm impacts such as reservoir siltation and water infrastructure damage (Awulachew et al., 2008; Steenhuis et al., 2009; Bashar et al., 2010).

In the context of international river basins, the effectiveness of a policy instrument to minimise the impacts of soil erosion largely depends on international cooperation, national and regional policies, but also on local land users' management (Ostrom et al., 1999; Conway, 2005; Paisley and Henshaw, 2013). In the past 2 years, following the initiation of the construction of the multibillion dollar hydropower project of the Grand Ethiopian Renaissance Dam on the Blue Nile, Ethiopia has, started to consider the off-site impacts of soil erosion by putting a massive effort into mobilising farmers to implement soil conservation technologies (SCT) on cultivated land (de Graaff et al., 2013) with dual objectives; on the one hand, to improve crop productivity for subsistence farmers, and on the other hand, to decrease the off-site impacts of soil erosion. However, this effort may not allow the efficient minimisation of soil erosion and its negative impacts for two main reasons.

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http://dx.doi.org/10.1016/j.landusepol.2014.11.017

First, quotas specifying the conservation effort are given to each community without consultation and adjustment for farmers' preferences (Emmenegger et al., 2011; de Graaff et al., 2013). This raises issues with regard to incentive compatibility and sustainability (Ostrom, 2007), and therefore, in the present study, we emphasise the farmers' preferences. Second, to be effective, SCT has to take place on both private farm land and communal grazing land as communal grazing land is the major source of soil erosion in the Blue Nile Basin (Awulachew et al., 2008, 2009). Currently, an effort has only been made on private farm land[1] (ECSNCC, 2011; de Graaff et al., 2013).

Since the start of soil conservation projects in the 1970s, many problems have been identified as explanations as to why the low voluntary adoption rate of SCT continues today (Amsalu and de Graaff, 2007; Kassie et al., 2010, 2011; Tesfaye and Brouwer, 2012; de Graaff et al., 2013; Teshome et al., 2013). The problems include: low credit facility, high initial investment cost, low return on investment, poor incentive mechanism, overall poor agricultural extension service systems, and a top-down approach. For example, Kassie et al. (2011) report that in the highland of Ethiopia, the return from the soil conservation terrace called "Fanya Juu" is lower than the investment that farmers make individually. However, farmers are forced to implement this conservation type through a top–down approach. The implication is that widespread adoption of soil conservation practices can reduce farm household incomes.

Even if Ethiopia achieves the adoption of SCT on private farm lands successfully, until now there are no national or regional rules and regulations for managing and monitoring communal grazing lands (ECSNCC, 2011). Moreover, every year, a considerable number of articles are published in scientific journals related to effective control of soil erosion in Ethiopian highlands (Tesfaye and Brouwer, 2012; Teklewold et al., 2013). Nevertheless, almost all studies focus on private farm land management and ignore the proportion of land under common pool resource management.

Therefore, a successful management strategy to tackle soil erosion and its consequence in the BNRS has to consider existing rural land use and ownership type, spatial differences, incentives and the preference of individual farmers at the grass root level. This facilitates computing the responsiveness of preferences to different watershed management instruments such as subsidies, labour, extension services, and grazing land reform. It also allows consideration of the distributional consequences of incentives on wealth. An improved understanding of local farmers' preferences is critically important for designing policies that address both the on-site and off-site impacts of soil erosion in the BNRS.

Thus, the overall objective of this article is to identify the incentives that motivate land users to participate in an Innovative Integrated Watershed Management Programme. The participation requires land users to contribute labour to watershed management for a period of 4 years in exchange for institutional and economic incentives. The first specific objective of this article is therefore to estimate both the willingness to contribute (WTC) labour and willingness to accept (WTA) incentives for implementing and monitoring watershed management activities. Households may not have equal labour and capital budgets, and therefore considering both measures is important for welfare estimates as they may not lead to the same result. Furthermore, it resembles the real situation where both measures may be used in combination. The second specific objective is to analyse simultaneously the decision of management on both private and common land as farmers use both types of land and may make trade-offs between them. The last specific objective is to identify individual and socio-spatial group specific preferences across the selected sub-watersheds. To analyse this we use a choice experiment (CE) by integrating land management options on private land and incentives in the form of extension service, credits, and grazing land reform on common land to the preference of land users.

[1] In Ethiopia, farmers have both private and communal land property rights under the umbrella of state ownership (FNFDRE, 2005). However, there is a bias in favour of private property in both national and regional policy regarding natural resource management (ECSNCC, 2011).

Motivation of the research approach and previous research

The need to design policy incentives and strategies to promote good environmental management has received more attention due to the increasing rate of natural resource degradation and the subsequent loss of valuable ecosystem services throughout the world, and also in the BNRS (Awulachew et al., 2009). However, lack of a common understanding among scientists, policy makers and resource users about how the complex social–ecological system works to shape the sustainability of the resource system has been regarded as the main constraint to designing policy incentives (Ostrom, 2008, 2009). For example, Ostrom (2007) demonstrates several cases where scholars have made models which are too simplistic to represent complex natural resource governance problems assuming that users have homogeneous preferences, so that uniform solutions to multidimensional social–environmental problems have been prescribed. In another case, Pelosi et al. (2010) point out that the spatial scale mismatch between ecological processes and agricultural management is a major obstacle to the effectiveness of a policy design. Thus, policy analysis of complex, sustainable, social and ecological systems not only requires an understanding of how ecological processes work and interact, but also requires understanding of the preferences and interaction of resource users (Ostrom, 2009).

Although the choice experiment (CE) method attempts to bridge the gap between social and ecological sustainability policy analysis (Kragt et al., 2011), its performance depends entirely on the ability of the choice modeller to work very closely with scientific and non-scientific communities. CE is based on Lancaster's demand theory (Lancaster, 1966) in which individuals derive utility from the characteristics of goods rather than directly from the goods themselves, and on random utility theory (Thurstone, 1927; McFadden, 1974), which assume that an individual chooses so as to maximise his utility and that this utility consists of a deterministic and a random (unobservable) component. Since the introduction of CE to the field of marketing in the early 1980s (Louviere and Hensher, 1983; Louviere and Woodworth, 1983), its application has become widespread in various fields including environmental economics.

However, in the context of developing countries, the successful implementation of CE requires considerable effort to improve its performance at various stages of method development and implementation of the final survey instrument (Bennett and Birol, 2010). While these steps are also part of a good study in developed countries, they typically include more iteration in developing countries. The steps include mandatory focus group discussion and pre-test, selection of a realistic payment vehicle, face-to-face interview with visual aids, and training of enumerators. Moreover, the survey and sampling design should account for spatial heterogeneity. This is because regions are poorly integrated in developing countries (Bennett and Birol, 2010) and furthermore the spatial variation is large and of importance to ecosystem service provision.

Another important issue likely to affect the CE result is attribute non-attendance (AN-A). Most choice experiment analyses are performed assuming that respondents emphasise all attributes and make a trade-off between attributes (Campbell et al., 2011). However, in reality, respondents may ignore attributes partially or completely in the process of choice decision. Thus, making an