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Coping with landslide risk through preventive resettlement. Designing optimal strategies through choice experiments for the Mount Elgon region, Uganda

Pieter Vlaeminck[a,*], Miet Maertens[a], Moses Isabirye[b], Filip Vanderhoydonks[a], Jean Poesen[c], Seppe Deckers[d], Liesbet Vranken[a]

[a] Division of Bioeconomics, Department of Earth and Environmental Sciences, KU Leuven, Celestijnenlaan 200 E-box 2411, 3001 Leuven, Heverlee, Belgium
[b] Faculty of Natural Resources and Environment, Namasagali Campus Busitema University, Kamuli, Uganda
[c] Division of Geography and Tourism, Department of Earth and Environmental Sciences, KU Leuven, Celestijnenlaan 200 E-box 2411, 3001 Leuven, Heverlee, Belgium
[d] Division of Soil and Water Management, Department of Earth and Environmental Sciences, KU Leuven, Celestijnenlaan 200 E-box 2411, 3001 Leuven, Heverlee, Belgium

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ABSTRACT

Landslides significantly affect rural income-generating activities in the East African highlands. In addition, the livelihoods of the poorest are most likely to be adversely affected. Traditionally, landslide risk is reduced by means of effective planning and management. In many regions, these measures are insufficient to offer a long-term solution because of high population density and land shortage. We use a choice experiment to investigate whether preventive resettlement could be a feasible disaster risk reduction strategy for the population at risk in agricultural areas in Bududa district, East Uganda. Our study provides the first analysis of resettlement-related preferences of people that are affected by environmental degradation. Our results enable us to assess community support for resettlement strategies ex-ante and provide valuable policy advice for future resettlement plans in a very cost-effective manner.

1. Introduction

The increase in frequency and intensity of natural disasters is worsened by both climate change and an increasing population living in high risk areas (Artur and Hilhorst, 2014; Rukundo et al., 2014; Black et al., 2011; WB/UN, 2010; Guterres, 2008). Since poor people tend to live on marginal lands that are most sensitive to natural hazards, they are most likely to be affected by small changes in climate variability (UNDP, 2004; FAO, 2000). One type of hazard with severe projected impact and widespread consequences are landslides. Landslides have a large social, economic and geomorphological impact as they significantly reduce agricultural productivity, increase soil degradation, damage property and infrastructure, and cause casualties (Mugagga et al., 2012; Holcombe and Anderson, 2010; Claessens et al., 2007; Knapen et al., 2006; Shiferaw, 2002). The East African Mountains are known to be a region inherently susceptible to landslides because of high annual rainfall, steep and unstable slopes, and ongoing deforestation (Broothaerts et al., 2012; Van Den Eeckhaut et al., 2009; Knapen et al., 2006; Glade and Crozier, 2004). Increasing population pressure is an important underlying factor, leading to slope disturbance, inconsiderate irrigation and deforestation. The poorest people are most likely to be adversely affected by natural hazards such as land-

* Corresponding author. Fax: +32 16 322980.
E-mail address: pieter.vlaeminck@ees.kuleuven.be (P. Vlaeminck).

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slides since low agricultural income reduces the capacity to cope with risks (Vu et al., 2014; Dercon, 2006).

Effective planning and management, such as (geo-) technical measures, reforestation and development of early-warning systems, can substantially reduce the impact of landslides (Holcombe and Anderson, 2010; Dai et al., 2002). In many regions, high population density and land shortage make these measures insufficient to offer a long-term solution (Claessens et al., 2007; Knapen et al., 2006). Preventive resettlement from high-risk areas has been considered a possible disaster risk reduction strategy in response to increased natural hazards (Artur and Hilhorst, 2014; Claudianos, 2014; Correa et al., 2011). This requires financial and social capital and might only be feasible with governmental and non-governmental support, especially if high-risk areas have a high incidence of poverty (Lübken, 2012).

In this paper, we investigate ex-ante whether a preventive resettlement policy could be a feasible long-term risk reduction strategy to cope with landslide risk in the Mount Elgon region in East Uganda. We focus on the population at risk and the necessary conditions to design community supported resettlement strategies in this area. We consider resettlement as a key adaptation for managing natural and other risks, and thus not just as a problematic outcome of global environmental change (Black et al., 2011).

Our focus on the Mount Elgon region, and more specifically on the Bududa district in this region, is particularly relevant. The region as a whole and the Bududa district in particular, are repeatedly hit by smaller and larger landslides, leading to severe calamity. The region stands as an example for the steep, upland areas of the wet tropics that face a high population density and pressure. People encroach steep slopes and clear forest to get access to land for building their houses and generating an income through agriculture. These anthropogenic factors greatly contribute to the occurrence of landslides (Gorokhovich et al., 2013; Knapen et al., 2006) which makes a focus on resettlement as a landslide risk reduction strategy pertinent.

We use a discrete choice experiment to examine whether resettlement is a feasible coping strategy to mitigate landslide risks on Mount Elgon, and if so under which conditions and compensatory schemes. This is a survey-based stated preference elicitation method that allows modelling preferences for hypothetical preventive resettlement strategies thereby revealing which strategies have a higher likelihood to be community supported. We also investigate whether the willingness to resettle depends on the landslide risk that the population currently faces.

Previous literature, especially the literature on development-induced forced displacement and resettlement (DFDR), identified two major problems with past resettlement policies. First, compensation alone does not work to restore people's livelihoods as it ignores the social and cultural consequences of displacement (Kabra and Mahalwal, 2014; Bui et al., 2013; Maldonado, 2012; Wilmsen et al., 2011a,b; Cernea and Mathur, 2007; Webber and McDonald, 2004). Second, the majority of negative consequences following involuntary resettlement could have been prevented if projects had given room for greater community participation and consultation throughout the resettlement project design and implementation (Claudianos, 2014; Diduck et al., 2013; Brand, 2001). This paper incorporates these two perspectives. Through this first consultation round, we hope to limit the possible negative impacts of a non-targeted forced resettlement in the future by giving a platform for the peoples' voices to be heard and get insights into the preferences of the local population to shape this future strategy.

Our study provides the first ex-ante analysis of preferences for resettlement from environmentally fragile areas to create room for bottom-up policy planning. Our results enable us to give valuable policy advice for different resettlement policies which are not yet implemented in a very cost-effective manner. Through a well-designed preventive resettlement scheme, government can limit the elements at risk, thereby reducing the expected economic loss and loss of life due to landslides in the future.

2. Background

2.1. Description of area and landslides

The 274 km^2 research area of Bududa district is located in eastern Uganda on the southwestern foot slopes of the extinct Mt. Elgon volcano, 20 km east of Mbale, a large trade hub (Fig. 1). Bududa district was created in 2006 when it was separated from Manafwa district. The altitude ranges from 1300 to 2850m a.s.l. and the district has a wet tropical climate. The average annual rainfall depth is 1800 mm with two separated rainy seasons, one from March to June and the second from August to November. The average annual temperature is 23 °C (BDPU, 2012) and is more or less constant the whole year round.

Topographic, climatic and soil conditions together with human activities make of Bududa district a landslide-prone area[1] (Knapen et al., 2006). Most landslides occur on east and north orientated slopes (dominant rainfall direction) with slope angles exceeding 14° (see Fig. 2 for an impression of a landslide in Bududa district).

Based on soil type, the district can be divided into three zones (Kitutu et al., 2009). The Central Bukigai zone is characterized by a carbonatite rock dome which has no landslides due to high cohesion of cementing minerals such as calcium carbonate (Kitutu et al., 2009). It has a low population density compared to the other two zones because soils are less fertile (Claessens et al., 2007; Knapen et al., 2006). The second zone is the Western Bududa-Bushika zone where different soil types can be identified i.e. Cambisols, Nitisols, Acrisols and Lixisols. Landslides are relatively rare but contribute significantly to the landslide problem due to their large dimensions and the high population density of the area (Knapen et al., 2006). In the populated Eastern Bukalesi zone, soils have higher clay contents which lead to lower sheer strengths during the rainy season. Landslides occur rather frequently and are shallower than in the Western zone because the parent material is nearer to the surface.

2.2. Agriculture and population pressure

Bududa has an estimated population of 182,867 people (BDPU, 2012), living in 16 subcounties, including one town council. Agriculture is the most important economic activity for over 86% of the households living in the 16 different subcounties (BDPU, 2012). The current farming system is mixed crop-livestock farming. The main crops grown are banana, coffee, beans, cocoyam, cassava, sugarcane, onions and sweet potato. Coffee, especially Arabica, is the most popular cash crop and almost all farmers are producing for the market. An average population density of 952 persons/km^2, rising up to more than 1300 persons/km2 in the densely populated parishes in the west, makes available land per household very small. A population growth rate of 5.6% since 1991 predicts even smaller land areas per household and more cultivation of unstable, steeper slopes (sometimes > 80%). Agricultural pressure and weak governance of land use will cause increased deforestation and excavations leading to a further reduction of slope stability in the near future (Mugagga et al., 2012). Besides, due to climate change, the

[1] Topographic conditions are mainly related to slope steepness, climatic conditions to the high annual rainfall depth and soil conditions to the high clay content. The main impacts of human presence relate to cultivation, deforestation, and excavations for housing, agricultural activities, irrigation, and the establishment of foot paths and roads.