



## Pursuing productivity gains and risk reduction in a multi-hazard landscape: A case study from eastern Uganda



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### ARTICLE INFO

#### Keywords:

Voluntary adoption  
Land management practices  
Risk mitigation  
Disaster risk reduction  
Agricultural development  
Program impact

### ABSTRACT

Agricultural land and natural resource management has an important role to play in reducing the vulnerability of rural populations to hazard risk and to promote increases in agricultural yields. Though strategies for hazard risk mitigation and productivity gains are sometimes viewed in opposition to each other, many of the practices promoted to achieve one goal provide co-benefits toward the other. Our understanding remains imperfect with respect to the mechanisms underlying the use of such practices, and how these motivations are weighted in the context of multiple environmental hazards, multiple practice alternatives, and multiple sources of information. This study addresses these knowledge gaps by investigating the voluntary adoption of agricultural land management practices among farmers in the Bugisu sub-region in eastern Uganda. A set of multinomial logistic (MNL) regression analyses reveal that socio-economic and risk perception factors contribute significantly to the use of the more labor-intensive practices, while others are best explained by variations in household income and income streams. The village context is an important factor in explaining variation in use rates, and the contributions of village characteristics beyond the household are discussed, as is the role that risk reduction and agricultural development organizations play in facilitating adoption. The results of this study are well placed to inform the intervention targets of development and disaster risk reduction organizations seeking to increase uptake of agricultural land management practices.

### 1. Introduction

Land and natural resource management has an important role to play in reducing the vulnerability of rural populations to hazard risk (Benson et al., 2001; IEG-World Bank, 2006; Renaud et al., 2013). Organizations focused on disaster risk reduction and agricultural development often promote the use of particular land management practices to achieve these ends (Hardaker et al., 2004). Risk reduction strategies that occur at local scales are gaining prominence in both the academic and practice communities, as responsibility for taking action is increasingly in the hands of individuals and other non-state actors (Lemos and Agrawal, 2006; Smith and Petley, 2009). Improving agricultural land management is of particular interest in addressing the economic, environmental, and social challenges associated with risk reduction in some of the poorest areas of the world, whose populations frequently experience risk from exposure to multiple, overlapping and interacting threats (O'Brien and Leichenko, 2000; Pender et al., 2006). Voluntary adoption of particular agricultural land management practices, however, remains persistently low in many regions (Richards et al., 2014; Tey et al., 2014).

Managing land for risk reduction is an important component of the disaster risk reduction cycle (Smith and Petley, 2009). Since the 1990s, humanitarian aid agencies (e.g., the International Federation of the Red Cross and Red Crescent Societies) have shifted their focus from disaster relief to disaster risk reduction in the context of climate change. This move towards risk reduction aims to reduce the destructive power of hazard events over time and to acknowledge local actors as agents of change rather than victims of circumstance (Gero et al., 2011; van Aalst et al., 2008). Efforts focusing on the risk reduction aspects of particular land management practices emphasize the stabilization of slopes, buffering of coastal and riparian systems, and improving soil fertility through improved soil structure and soil management (Mercer, 2004; ProAct Network, 2008; Stokes et al., 2014).

The agricultural development sector emphasizes productivity gains, and land management is used to bolster household income and food security, two targets of the 2016 Sustainable Development Goals (Garnett et al., 2013; UN, 2016). Though strategies for hazard risk reduction and productivity gains are sometimes viewed in opposition to each other (e.g. Hardaker et al., 2004), many of the practices promoted to achieve one goal provide co-benefits toward the other. Mechanical,

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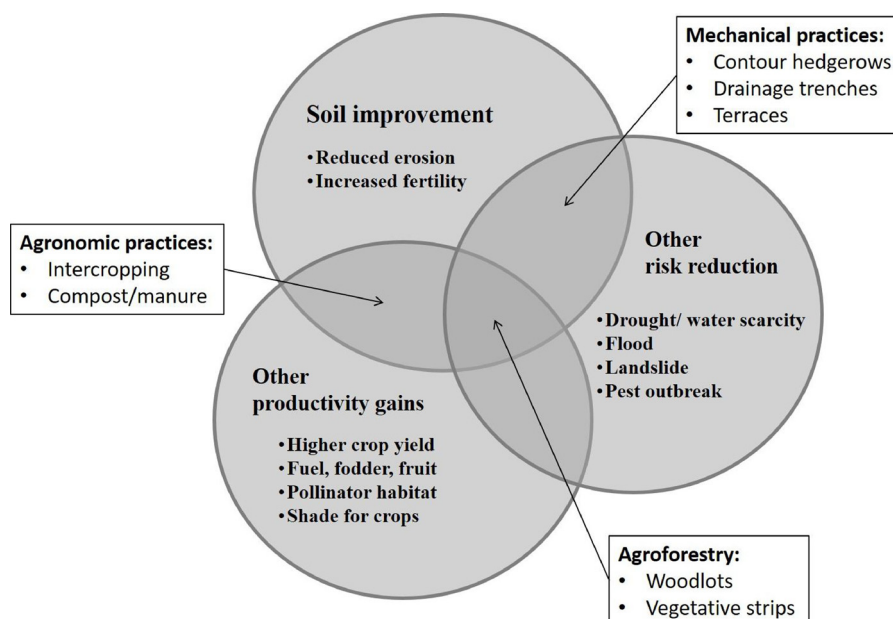


Fig. 1. Recommended land management practices for risk reduction and productivity gains. (adapted from Holt-Giménez, 2002).

agronomic, and agroforestry practices have been found to produce productivity gains and to reduce risk of natural hazards (Holt-Giménez, 2002; Fig. 1).

In this paper, we examine the use of particular land management practices among smallholder farmers in Eastern Uganda, a region with high levels of poverty and multiple environmental hazards. We demonstrate that risk reduction and productivity gains differentially motivate the use of recommended land management practices. Our work highlights the importance of both knowledge and material constraints in the use of such practices and presents evidence that complicates the information deficit model of understanding (see Burgess et al., 1998). Understanding the influence of risk reduction and development organizations (RDOs) on limiting these constraints and facilitating adoption in the context of multiple and overlapping risks could allow for improvements in program implementation and lead to higher use rates and reduced productivity deficits and vulnerabilities to natural hazards in target populations.

In the next section, we review the literature on the adoption of land management practices, the use of such practices for risk reduction and agricultural development, and the practical relationship that has emerged between these distinct fields in the recent past. Our study addresses gaps in the literature through an examination of the role of RDOs and other factors in influencing the use of alternative land management practices in a multi-hazard context. We explore these factors through a case study in the Bugisu sub-region of eastern Uganda and conclude by discussing contributions to relevant theory, practical implications and limitations, and avenues of future research.

## 2. Background

In the context of disaster risk reduction and management, the concept of vulnerability is used to denote the ways in which disasters are triggered by hazard events and mediated by social factors that can mitigate or exacerbate the impact of those disasters (Adger, 2006; Smith and Petley, 2009). Among the risk reduction and development communities, there is not a single agreed upon definition of vulnerability. Here, we adopt the UNISDR (2004) definition, which defines vulnerability as “the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the

impacts of hazards.” As such, vulnerability is understood as an important aspect of disaster risk, where risk is understood as the potential for damages or consequences stemming from the interaction of vulnerability and capacity, hazard, and exposure (IPCC, 2014; UNISDR, 2004). Risk thus depends on a hazard occurring, an entity experiencing or being exposed to that hazard, and also being vulnerable to it. However, in discussions of disaster risk reduction, the exposure of individuals and assets to the hazard event is often largely assumed (and thus rendered static), and research efforts have focused on reducing risk by reducing vulnerability (Luers et al., 2003; Eakin, 2005; Mercer et al., 2010)<sup>1</sup>. For some hazards like earthquakes and volcanoes, exposure may be immutable for a given entity, and therefore not a useful subject for research. However, for many hazards (e.g., mudslides, soil erosion, and flooding), exposure may be shaped by human land management activities that change the nature or intensity of the hazard event. The influence of land management is a social factor, and therefore has the potential to complement research in the field of vulnerability. Yet, the vulnerability literature has given little attention to understanding risk reduction through changing the exposure of populations in place.

### 2.1. The use of land management practices for risk reduction

Landowners use land management practices to manage soil and water dynamics in order to reduce the risk of various natural hazards (Fig. 1). Conservation agriculture and land management practices such as mulching, crop rotation, terracing, and grassed waterways, aim to reduce the likelihood or severity of hazards (Black et al., 2013; Marquis, 2015). Reforestation is promoted to mitigate coastal flooding and for slope stabilization (Adger et al., 2005; Jaedicke et al., 2013). Ecological agriculture practices are used to reduce soil erosion, pest loads, and surface water runoff (Magdoff, 2007).

These practices, when implemented correctly and maintained, have been found to reduce the risk of landslides, pest outbreaks, soil erosion, water runoff, and the effects of windstorms and excessive precipitation

<sup>1</sup> Mercer et al. (2010) define DRR “to encompass all applicable methods to reduce vulnerability to disaster, therefore incorporating disaster preparedness”. Vulnerability here is divorced from exposure and disaster preparedness and risk reduction activities taking place in a (basically assumed) context of hazard exposure.

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