



Natural resource opportunities and challenges for rural development in marginal grabens – The state of the art with implications for the Rift Valley system in Ethiopia



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ABSTRACT

With increasing global population, the production of more food and fiber has led to an expansion of the areas under cultivation, of which low-lying flat areas (including marginal graben bottoms) are of particular interest. Marginal grabens have been the center of agricultural development around the world. This paper examines the opportunities and challenges related to natural resources in rural development and highlights the knowledge gaps and priorities for the research and development of marginal grabens with specific reference to Ethiopia's Rift Valley marginal grabens, which have sufficient land banks to accommodate irrigated agriculture. Repeated transect walks, focus group discussions and interviews carried out in Northern Ethiopia, have been employed to address these research questions, while content analyses and descriptive statistics have been used to analyze the data. This paper shows that marginal grabens are rich in blue and green waters due to their topographical and geological characteristics, and are fertile plains suitable for irrigated agriculture. However, marginal grabens can reach closing and closed basin status in arid and semi-arid environments. Salinization, waterlogging, incisions and sedimentation also threaten the livelihoods of smallholder farmers in the grabens. Thus, appropriate river basin governance, integrated land management, and wise water allocation is needed to optimize land and water resources during rural development in the (semi)closed marginal grabens of northern Ethiopia and elsewhere in the world with similar geographical settings.

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1. Introduction

Land resources are an indispensable natural resource for rural development (FAO, 2007), and are continuously exploited to satisfy human needs (Gerber et al., 2014; Goudie, 2013). However, natural resources have been under pressure due to the persistent interactions of land degradation, climate change and the decline of biodiversity resources (Hochstrasser et al., 2014). The magnitude of land degradation is more severe in arid and semi-arid regions as a result of unfavorable climate conditions, poor cultivation practices on steep slopes, the concentration of farmers on fragile mountainous terrain, high population growth and striking poverty (Hurni et al., 2005; Nyssen et al., 2014).

In a human-modified world, droughts bring dramatic ecological and economic impacts (Van Loon et al., 2016b). The frequent occurrence of drought and water scarcity is a particular concern in arid and semi-arid areas (Bossio et al., 2010; Salvati et al., 2015). In such areas, meteorological (a shortage of precipitation), hydrological (a lack of blue water resources) and agricultural droughts (moisture deficient for plant growth) are serious problems for crop production and livestock keeping (Falkenmark and Rockström, 2008; Kiem et al., 2016). Van Loon (2015) further presents findings in which hydrological drought has devastating impacts on the ecological system of arid environments. Crop harvests decline and thereby affect the lives of smallholder farmers in developing countries, leading to critical food shortages (Olaka et al., 2010; Pereira et al., 2002; Van Loon et al., 2016a).

Food demand affects natural resources use in agriculture (Odegard and Van Der Voet, 2014), the growing population's food demands requires a significant increase in crop production (Jouzi et al., 2017). Thus, producing enough food to meet the needs of a growing population has always been the greatest concern of food policy-makers. In recent years, agrarian states have explored underutilized suitable lands for agricultural development, and globally, a great deal of attention has been paid to low-lying flat areas (Bayabil et al., 2010).

A graben is a block of land bounded by parallel faults in which the block has been downthrown, producing a distinctive structural valley with straight, steep-sided fault scarps on both sides (Williams, 2016), while according to Mcknight et al. (2014), a marginal graben is a narrow faulted valley running along the margin of a rift valley. Marginal graben systems make up a substantial agricultural area under rural development due to the presence of fertile flat land, surface and groundwater resources. In the USA, graben floors are the most desirable sites for economic activities (Cooke and Reeves, 1976). Recently, Zegeye et al. (2014) and Teklemariam et al. (2017) found that graben bottoms in northern and western Ethiopian regions have been brought into intensive agricultural production to feed the growing population and for agricultural investments, and exports. As a consequence, they have undergone substantial agricultural intensification. With

infrastructure development, investors, highland farmers and lowland pastoralists are increasingly attracted to these areas for irrigated agriculture use due to the groundwater potential found in alluvial deposits (Alemu, 2012; Berhane et al., 2010; Fenta et al., 2015; Okonkwo et al., 2014; Tsegaye et al., 2013; Turton and Ashton, 2008). In this regard, there is competitive demand for these low-lying areas from various users with divergent interests (Teklemariam et al., 2017).

Given this trend, competition for natural resources in marginal grabens is projected to increase (Venot et al., 2008; Viala, 2008). However, these closed basins are sensitive to environmental changes (Tsegaye et al., 2010). The growing government interest in economic development and the movement of farmers into marginal grabens in search of productive land will further accelerate natural resource degradation (Smakhtin, 2008). Consequently, closing marginal grabens will become more widespread across the world (Falkenmark and Molden, 2008; Johnson and Malala, 2009). Moreover, much of the marginal graben resources depend on the climate, soil properties and human activities in the adjacent escarpments (Molden and Bos, 2005). Like the inter-montane areas, intensive agriculture, industries, infrastructures and settlements are located in the dryland marginal grabens.

During this profoundly human-influenced era, understanding the sensitivity of natural resources is important for unlocking the potential of marginal grabens for sustainable rural development. However, knowledge about the status of natural resources in marginal grabens is scarce. Therefore, the objectives of the paper are to review global experiences about marginal graben resources and expose knowledge gaps and priorities in research and development related to the natural resources of these environments. To complement this review, transect studies were conducted across the marginal grabens of the Rift Valley in northern Ethiopia. Both the systematic literature review and the transect studies address the following research questions:

- What is the potential of natural resources in marginal graben systems to boost rural development?
- What are the challenges for rural development in marginal grabens taking into account the sustainability of natural resource usage?
- How can the benefits of natural resources in marginal grabens be optimized?

2. Conceptual framework

Along the Rift Valley, there are many marginal grabens (Chorowicz, 2005; Grosvenor and Vaughn, 2002). These are structurally depressed crustal areas bound by faults with adjacent horst escarpments (Mcknight et al., 2014). In Ethiopia, for example, marginal grabens are located between escarpments, and lowland

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