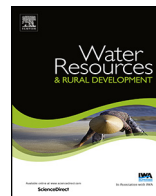




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Agricultural water management and livelihoods in the crop–livestock systems of the Volta Basin

S. Douxchamps ^{a,b,*}, A. Ayantunde ^b, E.K. Panyan ^c, K. Ouattara ^d,
A. Kaboré ^d, N. Karbo ^c, B. Sawadogo ^d

^a International Water Management Institute (IWMI), Fondation 2iE, GVEA/IWMI, 01 BP 594, Ouagadougou, Burkina Faso

^b International Livestock Research Institute (ILRI), c/o CIFOR, 06 B.P. 9478, Ouagadougou, Burkina Faso

^c CSIR-Animal Research Institute, P. O. Box 52, Tamale, Ghana

^d Institut National de l'Environnement et de Recherches Agricoles (INERA), Saria BP 10, Koudougou, Burkina Faso

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ABSTRACT

With mixed crop–livestock systems projected to be the principal source of food in developing countries in the coming decades, opportunities exist for smallholders to participate and benefit from emerging crop and livestock markets in the Volta Basin. Given the economic, social and environmental vulnerability due to high water scarcity and variability in the basin, improvements in agricultural water management (AWM) are needed to ensure sustainable benefits. A survey was conducted among 326 crop–livestock households in four water scarce sites of the basin in Burkina Faso and Ghana to characterize households in terms of access to water, services and information, AWM intensity and livelihoods, and to explore the linkages between these characteristics.

The sources of water were more diverse for study sites in Ghana than in Burkina, allowing different types of AWM strategies. Most of the farmers perceived a strong positive impact of AWM strategies on their livelihoods. Almost 70% of the variation in livelihood assets was explained by variation in AWM intensity, affecting mainly food consumption, sources of income and housing index. With increasing access to water, services and information, AWM intensity significantly increased, as well as labour for water-related

* Corresponding author. Tel.: +226 7592 1622; fax: +254 204223001.
Email address: s.douxchamps@cgiar.org (S. Douxchamps).

activities and food consumption. This increase in AWM was significantly related to an increase in livelihood assets ($R^2 = 52\%$). Policies should be developed to improve access to information and services as well as access to market in rural areas of the Volta Basin, to enhance positive impact of AWM strategies on livelihoods of the rural households.

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1. Introduction

The Volta basin covers an area of around 395 000 km² across six countries, with more than 80% located in Burkina Faso and Ghana. The basin is inhabited by about 20 million people, from which 61% and 45% live with less than 1\$ a day in Burkina Faso and Ghana, respectively (Hanjra and Gichuki, 2008). In Ghana, 70% of the poor are located in the north of the country. Population is expanding at an annual growth rate of 3.0% in Burkina Faso and 2.4% in Ghana (IFAD, 2010), thus increasing the pressure on natural resources for livelihoods and economic gains. Of this population, 90% and 76% rely on rainfed crop–livestock systems for their livelihoods in Burkina Faso and in Ghana, respectively (Thornton et al., 2002). Annual rainfall is characterized by a marked gradient between North Burkina (500 mm, uni-modal distribution) and Southern Ghana (1200 mm, bi-modal distribution). While at basin scale, population is a little above the water scarcity threshold of 1700 m³/yr per capita, most of the northern part of the basin suffers physical water scarcity with only about 900 m³/yr per capita in Burkina Faso (Lemoalle and de Condappa, 2010).

The frequency of annual droughts and of extreme seasonal hot temperatures has increased from the 1970s and will likely become worse in the future (Battisti and Naylor, 2009; Kasei et al., 2010). With regard to these scenarios, agricultural production must increase significantly in ways that are sustainable and acceptable by rural smallholders (Lemoalle, 2007). This will only be achieved through efficient management of scarce water and nutrients. Various agricultural water management (AWM) strategies were developed to this end in the Volta Basin. Their principles, effects and history are detailed elsewhere (Douxchamps et al., 2012).

According to a few case studies, farmers practicing AWM strategies profit from higher food security and higher income (Vohland and Barry, 2009), but the increase in crop production is not always sufficient to feed all members of the household, especially in years with low rainfall (Maatman et al., 1998).

Although AWM strategies seems to unambiguously improve livelihoods of rural households (Molden, 2007; de Fraiture et al., 2010; Namara et al., 2010; Awulachew et al., 2012), attempts to quantify this impact are rare. Such an effort is naturally challenged by the multidimensional nature of the livelihood concept and the diversity of its potential indicators, as well as the effects of factors influencing this impact upstream, such as access to water and access to services and information related to AWM. Indeed, the lack of access to water imposes high labour costs associated with travelling to water sources and any constraint on household labour supply greatly affects efforts to reduce poverty (Kinyangu et al., 2012). Similarly, access to markets and information and development of human resources could enhance the contribution of AWM strategies to livelihoods (Sullivan, 2011; Awulachew et al., 2012).

The objectives of this study were to characterize crop–livestock households in four contrasting sites in the dry areas of the Volta Basin in terms of access to water, services and information, AWM intensity and livelihoods, and to explore the linkages between these characteristics.

2. Materials and methods

2.1. Household survey

The study sites were located along the north–south rainfall gradient and correspond to different levels of access to markets and information (Table 1). In each site, four villages were selected, using

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