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Managing variability and scarcity. An analysis of Engaruka: A Maasai smallholder irrigation farming community

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ABSTRACT

This article examines the common-pool regime of Engaruka, a smallholder irrigation farming community in northern Tanzania. Irrigation is a complex issue due to water asymmetry. Water use is regulated in Engaruka through boundary, allocation, input and penalty rules by a users' association that controls and negotiates water allocation to avoid conflicts among headenders and tailenders. As different crops – maize and beans, bananas and vegetables – are cultivated, different watering schemes are applied depending on the water requirements of every single crop. Farmers benefit from different irrigation schedules and from different soil characteristics through having their plots both downstream and upstream. In fact, depending on water supply, cultivation is resourcefully extended and retracted. Engaruka is an ethnically homogeneous and interdependent community where headenders and tailenders are often the same people and are hence inhibited to carry out unilateral action. Drawing on common-pool resource literature, this study argues that in a context of population pressure alongside limited and fluctuating water availability, non-equilibrium behavior, consisting in negotiating water rights and modifying irrigation area continuously through demand management, is crucial for the satisfaction of basic and productive needs and for the avoidance of water conflicts.

1. Introduction

Governance and management of limited and fluctuating water supply is a fundamental challenge facing many irrigation systems. Water allocation in such a context can generate conflict, especially when the irrigation system is the most important source of livelihood for the local community (Tang, 1992). These circumstances are further strained when population pressure increases demand for an already limited resource. In studies of common-pool resources there is consensus that small homogenous local groups can bring about successful institutional arrangements that can ensure the sustainable use of resources. However, dealing with a resource such as irrigation water, is a challenge even for the most resilient local institutions as it is mobile, variable, inherently asymmetric and tends to be in control of headenders (Komakech et al., 2012; Lein and Tagseth, 2009; Agrawal, 2001).

Often the degree of water scarcity affects the rules, and their stringency, around water use (Tang, 1992). Free-riding becomes more common when pressure on the resource augments. In common property regimes there is no individual ownership over the resource at stake, but membership and benefits are harnessed through the fulfillment of certain obligations such as construction and maintenance of the irrigation infrastructures (Lein and Tagseth, 2009; Sokile and Koppen, 2004; Boelens et al., 1998; Ostrom and Gardner, 1993). Cooperative water allocation is not a given (Lankford and Beale, 2007). However, irregular water supply generates an incentive to collaboration so that every shareholder will be granted a sufficient amount of water. While this might be especially important for tailenders, headenders also need help with headworks and maintenance of the systems (Tang, 1992). These are the premises for irrigation as common resource management.

Much can be learned from local systems of water management that have existed throughout centuries. These studies can also report on local agricultural practice enhancing food security through limited water access (Mul et al., 2011; Lein and Tagseth, 2009; Sokile and Koppen, 2004; Adams et al., 1994).

This study presents the case study of Engaruka, a Maasai smallholder irrigation farming community located in northern Tanzania. The aim of the study is to examine the local agricultural and water management practices in light of increasing pressure on resources and fluctuations in seasonal water supply. Drawing on common-pool resources theories and non-equilibrium behavior, this article investigates how locally devised mechanisms are influenced by different cropping systems and cultivation expansion and how they deal with growing tensions over water distribution in trying circumstances of water scarcity.

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First the article begins with the qualitative methods employed for data gathering. Second, the conceptual framework used for the analysis of data is presented. The third section depicts the case study context including a short review of previous studies. Results are reported according to water management, agricultural practices and recent cultivation expansions. The discussion mirrors the results by analyzing cooperative water allocation, water asymmetry and non-equilibrium behavior in Engaruka. Concluding remarks are provided.

2. Methods

Ethnographic fieldwork was conducted in four sessions alternated with four shorter field visits between 2011 and 2013. Data collection took place during a total of 3 months, primarily in Engaruka Juu and in the south eastern settlement of Neng'alah. Data was gathered predominantly in Swahili and on a few occasions in Maa. A female field assistant was employed to work also as an interpreter. As I had learnt Swahili, the field assistant only translated questions, but not informants' answers (for an analysis on translation techniques and positionality see Caretta, 2014b). Qualitative methods were employed. 39 semi-structured interviews were conducted with 20 men and 19 women, all active farmers, between the age of 25 and 65 on multiple occasions. Additionally, 16 focus groups were carried out with a number of informants ranging from 5 to 10 for a total of 118 persons consulted. Sampling of informants was done according to three criteria: (1) residing and farming in a specific location; (2) actively farming; (3) belonging to a certain age group: 20–40 or 40+. Focus groups were gender mixed and gender segregated at times. In exchange for their participation, farmers were either offered refreshments or compensation equal to the amount they would be paid for 2 h contract working, which was the average length for the focus group. Themes covered during focus groups were: (1) gender division of labor (see Caretta and Börjeson, 2014); (2) agricultural practices and the agricultural calendar; (3) perceived weather changes in the last three decades; (4) water management.

The final topic was investigated through participatory mapping: orienting themselves through a 2002 Google Earth® image, informants were asked to find their plot, Engaruka Juu locations and the irrigation canals. Every 3 months the field assistant carried out a survey of agricultural practices over the course of 2 years. The eight selected plots were situated in Engaruka Juu and Neng'alah and were chosen based on information provided by owners. Plots had different characteristics in relation to crops cultivated and cultivation history, ranging from 5 to 35 years, either continuously or with fallow periods. In this way a range of different conditions could be studied. Lastly, member checking was employed to increase the reliability and the robustness of the data. This method consists in counterchecking with informants the preliminary data. Furthermore, with every fieldwork session a pamphlet, written in Swahili including numerous images and summarizing previous findings, was presented to informants to gather their impression on the ongoing study, to verify whether data was correct and to stimulate further discussion (see also Årlin et al., in press). While triangulation is widely used in qualitative studies, this does not circumvent the risk that the data gathered is imprecise or wrong, thus member checking can enhance transactional validity and research trustworthiness by having informants correcting the researcher's understanding (Cho and Trent, 2006).

3. Conceptual framework

An irrigation system can be conceptualized as a common property arrangement because it is exclusionary, farmers can be denied irrigation if they do not comply with management rules and requirements, as well as subtractive, one farmer's use of water hinders the next farmer's access to the resource. Since water is a common-pool resource, a set of rules must be put in place to restrain farmers from free-riding and irreparably depleting the quality or quantity of water available (Ostrom and Ostrom, 1977 in Tang, 1992). Drawing on the work of Ostrom (1990) and Tang (1992) has outlined the operational rules that need to be put in place for a functioning irrigation system: (1) boundary rules delimit who has the right to benefit from the resource; (2) allocation rules detail how much, when and in which order water can be withdrawn by every single farmer; (3) input rules define the amount and type of work that needs to be put in by farmers to be able to be given water; (4) penalty rules state the amount and type of fines that must be paid whenever any other rule has been broken.

These rules can avert free-riding when all shareholders trust the local institution that monitors the use of the resource and encourages cooperation among members (Tang, 1992; Ostrom, 1990). Common property institutions are considered successful when they are long-lasting and they preserve the resource at stake. What is essential to institutional sustainability has been disputed lengthy (for an outline see Agrawal, 2001). On one hand, it has been highlighted that homogeneity among farmers is vital for the functioning of such cooperative arrangements. Differences in landholdings, religion, ethnical belonging and wealth can generate misunderstandings and effectively work against cooperation (e.g. Bardhan, 2000). On the other hand, it has been asserted that heterogeneity in endowments creates interdependence among shareholders who are forced to collaborate (e.g. Komakech et al., 2012).

Nevertheless, creating incentives for cooperation is particularly complex in common property regimes such as irrigation systems that are grounded in an intrinsic asymmetry: water flows in only one direction (Komakech et al., 2012; Zaag, 2007; Ostrom and Gardner, 1993). Hence, headenders and tailenders have different interests while negotiating equal water allocation or contributing to landesque capital investments as construction of canals and water diversion works (see e.g. Håkansson and Widgren, 2014). Headenders might want more water, but who will collaborate in the maintenance of the overall system, or how will they be sure that tailenders will not destroy upstream infrastructure? And how will tailenders ensure that water is not cut off from them? These problems were defined by Ostrom and Gardner (1993) as appropriation – i.e. water allocation for productive purposes – and provision – maintenance. Such issues are often resolved through the above-mentioned set of rules which determine the conditions for the exchange labor–water. Water users are therefore interdependent (Komakech et al., 2012).

Another element that challenges the functionality and durability of common property regimes of irrigation systems is the variability and unpredictability of water supply due to changing inter/intra-annual rainfall patterns (see also Hillbom, 2012; Ostrom, 1990). Flexibility is a key in this context. Demand must be managed to match supply as supply is exogenous and cannot be increased. Negotiations must be undertaken to cope with often changing conditions. These circumstances can be described as non-equilibrium behavior. A dynamic set of cross-scalar (e.g. time and space) non-linear trends in the supply of irrigation water result in the shifting location and extent of cultivation. Accordingly, environmental thresholds, such as overgrazing or soil erosion due to soil left bare, might be recurrently crossed without jeopardizing the sustainability of the overall system. In the specific case of irrigation, unpredictability of water supply can be connected to three levels of river flow rate: (1) critical water supply ensures the satisfaction of basic human needs; (2) median water supply sustains productive needs; (3) bulk water supply allows for storage and distribution with external stakeholders (Lankford and Beale, 2007; Lankford