

Producing useful knowledge for sustainable development

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Abstract: Africa makes a relatively minor contribution to global greenhouse gas emissions compared with developed nations, yet the African continent will be increasingly vulnerable to climate change processes in the coming decades. Critical challenges include meeting basic needs for food, water, shelter, and other necessities without undermining biodiversity and ecosystem services. Coordination efforts to address multiple global change related stressors has generally occurred at the national level and taken an external approach, with national governments favoring collaboration with foreign-based NGOs and other international institutions. However, the involvement of actors at the local level correlates with decisions that are better adapted to local social-cultural and environmental contexts, reducing implementation costs, and increasing trust, thereby increasing the equity and efficacy of decentralized approaches. This paper examines indigenous and local knowledge of climate change and its impacts. It addresses climate and environmental change from the perspectives of Kenyan pastoralists who identified a myriad of environmental issues that occur and interact at different scales. They also identified ways forward at several scales from the local to the global. The continued functioning of ecosystems for local populations will depend critically upon sound policy, planning, and practice that includes pastoralist leadership.

Introduction: Global drylands comprise over 40 percent of the earth's land surface, supports millions of pastoralists and accounts for half of the world's livestock. Climate change and socio-economic drivers are rapidly altering dryland social-ecological systems (SES). While climate variability defines drylands through seasonality and significant interannual fluxes in rainfall, the variability is expected to increase (Právělie et al. 2019). There are expected increases in total dryland areas, especially in arid grasslands (Jung et al. 2020). Yet, East Africa climate models suggest the future holds an increase in short-season rains with more flood and locust events (Cook et al. 2020).

Recurring droughts change ecological structure and function over time (Stringer et al. 2017). The economics of livestock production changes as plant species important to cattle disappear and invasive plants species unpalatable to livestock make it harder for herders to find pastures suitable to their herds. As cattle numbers decrease household livestock species composition change often to increasing numbers of sheep and goats and sometimes camels.

Human population pressures make earning a living solely from livestock untenable in places. The livestock to human ratio has been on the decline due to loss of livestock during drought and population growth forcing change in land use. Climate and outside forces conspire to replace livestock herding with large-scale agriculture, mining, oil and gas extractive industries, solar and wind energy, urbanization, and infrastructure expansion (Galvin et al 2020). Communal land tenure with customary use rights and management of land in the hands of communities is increasingly being privatized by non-pastoralists and pastoralists alike (Reid et al. 2014).

Pastoralists understand the drivers of change, impacts of the changes, and have potential solutions. This study sought to understand the impacts of climate and socio-economic changes to address solutions for a resilient future in Kenyan drylands from the perspective of pastoralists. A series of focus groups, community workshops, and interviews were conducted over two periods in 2011.

Methods and Study Site: A series of focus groups, community workshops, and interviews were conducted as part of the Pastoral Transformations for Resilient Futures research program. A total of 79 people were part of gendered focus groups and in two workshops. Workshop participants came from Turkana, Garissa, Narok and Kajiado counties, Kenya. Participants examined how changes in climate, ecosystems, livelihoods, land tenure, and broader Kenyan society are interacting to shape pastoralist well-being, and how local peoples are working to adapt to these changes. Additionally, 25 pastoralists were interviewed on livestock holdings, water availability, state of pastures, livestock management, livelihood diversification, changes in weather patterns, pastures, livestock condition and solutions to climate change impacts. The goal was to develop a set of concrete actions to address the myriad changes occurring in their social-ecological systems.

Results: Project participants first described several changes occurring in their regions. Just two changes

Table 1. Changes in weather

Northwest (Turkana)	Northeast (Garissa)	Southeast (Kajiado)	Southwest (Narok)
Floods in 2010 rains	T increase	Droughts have become long and frequent.	Irregular rain patterns, the long and short rains
Outbreak of cholera	Erratic rainfall (long & short rains)	Heavy rainfall over a short period of time	Frequent dry spells 1999- 2001, 2004 - 2006 and 2008 - 2009
Migration to neighboring countries	More frequent droughts & floods	New diseases such as blue tongue	Violent, scattered storms
T increase up to about 37- 40 degrees C		High evaporation - causes drying up of the soil	
Disappearance of grasses			

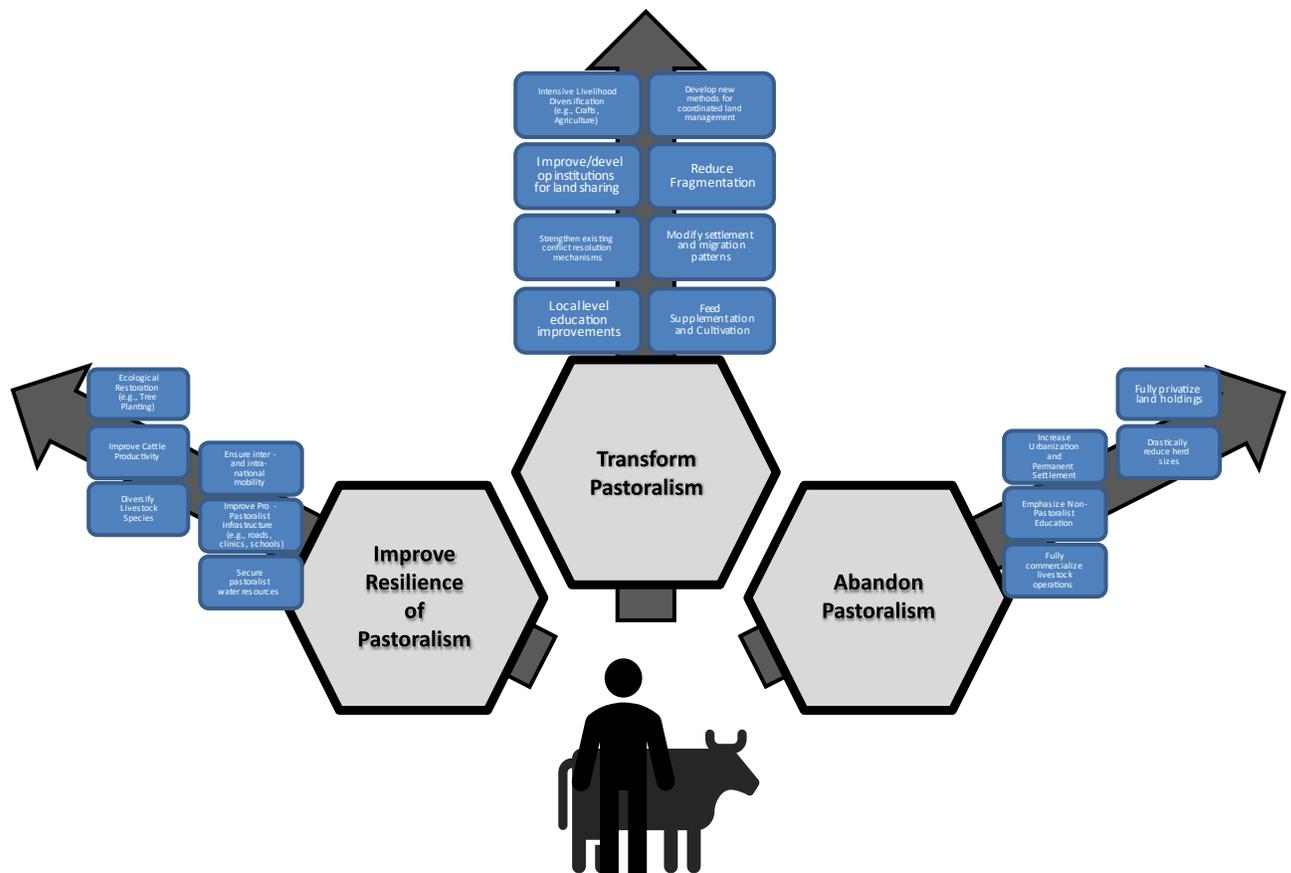
are described here (see Galvin et al. 2020 for more on this project).

Table 1 shows how people perceived changes in weather in the four regions and the data shows wide differences in weather and impacts depending on where people came from. A second change (not shown) was that people from each region agreed on a general trend throughout Kenya of a drying of water sources. These climate changes as well as the land tenure and land use changes has resulted in land fragmentation

(Galvin et al. 2008). These changes have culminated in numerous other changes that have been well documented throughout east Africa (e.g., Catley and Scoones 2013; Nkedianye et al. 2019). For example, livestock management was changing throughout Kenya including livestock movement routes being disrupted and a general move towards increasing numbers of small stock and a decrease in cattle numbers. Livelihoods were diversifying with a growth in women’s economic activities such as selling livestock, poultry, and handicrafts. All participants agreed that investing in education of children was occurring and that people wanted to be near other social services such as clinics and markets. How was the future regarded? Climate change and the other changes were big challenges in 2011 and was expected to increase in the future. Scenarios of the future of pastoralism were identified. There were three different outcomes to climate change identified by the pastoralists including improvement of

pastoralism, transformation of pastoralism or abandonment of pastoralism (Figure 1). In the first scenario actions included improve pro-pastoralist infrastructure such as water resources and mobility, as well as diversification of livestock species and access to markets. Actions under the transformation of pastoralism were livelihood diversification, expansion of women’s roles, education opportunities and new methods of land management. The last scenario of abandoning pastoralism was an undesired prospect, but workshop participants perceived it as a future that should be contemplated given the current climate and other pressures on their SES. The actions included urbanization, commercialization of livestock operations and privatization of all land. These actions would put an end to pastoralism and transform the social ecological system to something new (Galvin et al. 2020).

Discussion Climate never acts in isolation but rather there are many interacting factors at various scales that are affecting drylands. The data suggest there is no single solution for adaptation to dryland changes. Yet, dryland policy has generally focused on ‘repairing’ drylands from degradation by indigenous production systems. Global policy-science assessments like the SDGs and the IPCC have goals and policies focused on national levels relying on countries’ abilities to implement policies to achieve the goals. Most of the policies are ‘one size fits all’. Research on comparative studies among pastoral regions and scenario planning can demonstrate the variability among regions but also that pastoralists are very aware of the consequences of various adaptation strategies. Pastoralists are not helpless victims of climate change. The data here, though brief, shows that pastoralists are



very aware of changes occurring, have implemented adaptations, and have thought about scenarios of future changes. Pastoral engagement in climate change decision-making is essential in partnerships and collaborations for a just and equitable transformation to change.

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Notes ¹Videos produced as part of the study: Maasai Voices on Climate Change (and other changes too): <https://vimeo.com/73980798> ; Pastoralist Voices on Climate Change: <https://www.youtube.com/watch?v=76519XmMpDY> . Of God, Rain and Motorbikes: <https://vimeo.com/65117460>

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