



Climate change adaptation and mitigation in extensive livestock systems in East Africa

Findings from the Programme for Climate-Smart Livestock Systems

Todd Crane, Birgit Habermann, Edwige Marty, Claudia Arndt, Sonja Leitner, Tigist Worku and Leah Gichuki

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Key messages

- Pastoralists have always been flexible to work with challenging environmental conditions. But now climate change, as well as rapid economic and social transformations, are making it even more difficult than before for them to adapt.
- Pastoralist societies are complex and diverse. Long-term research is needed to understand the impacts of climate change and other stressors on different people. A good understanding of these is important for informed decision making, and in enabling pastoralists to provide inputs into decisions. No one-size-fits all solution exists.
- While the emphasis in dry, lowland pastoralist areas must be on adaptation to climate change, many adaption measures have mitigation co-benefits: they reduce greenhouse gas emissions either absolutely or per unit of meat or milk produced.
- It is possible to reduce the intensity of emissions by improving productivity. Options include: providing feed, water and veterinary care, conserving and maintaining emergency grazing areas, switching to better-adapted breeds or species, and using manure to fertilize crops. Reducing herd sizes and migration, especially before predicted droughts, can cut economic losses as well as emissions.
- “Adaptation pioneers” – herders who experiment with new management methods – can help spread innovative ideas to other herders.

PASTORALISTS IN EAST AFRICA are used to uncertainty. Indeed, their whole livestock production system is based on working with changing environmental conditions. To deal with sporadic rainfall, they rely on the ability to move their herds from one grazing area or water source to another. They also need to be flexible in the face of changing socio-economic, political and climatic conditions.

But the rangelands are now changing much faster and on a wider scale than ever before. In part this is because of climate change: rainfall patterns in the region are shifting, and the rains are becoming more erratic and unpredictable. Drought, flooding, heat stress and pests such as mosquitoes, ticks and flies are now bigger threats than previously.

The climate is not the only thing that is shifting. Human populations are growing. Farming is expanding into areas where pastoralists graze their animals. Land is being privatized, sometimes illegally or in obscure ways, and urban growth is encroaching into the rangelands. Land is allocated for irrigation or nature reserves, often without the involvement of the pastoralists who have grazed their animals there for centuries. Profound economic, social and political changes – in education, government, infrastructure, communication, and employment – are pushing and pulling pastoralists in different directions: some of them positive, but others negative.

Adapting to change

How are pastoralists adapting to these challenges? Which measures and strategies can help them adapt to climate change and to create a better future for themselves? The Programme for Climate-Smart Livestock Systems has been looking for some answers. This programme has been implemented by GIZ, the International Livestock Research Institute (ILRI) and the World Bank, with funding from the German Federal Ministry for Economic Cooperation and Development (BMZ).

Pastoralism can have many advantages. It produces food and supports livelihoods in areas where few other alternatives exist. It conserves the environment and can help avert degradation: appropriate levels of grazing can lead to less erosion than intensive cropping.

Pastoralist groups in East Africa are as diverse as the landscapes that they manage. They keep a range of different species (cattle, sheep, goats, camels and donkeys) and breeds. Some grow crops and fruits for food and to feed to their animals. Unlike fully nomadic groups, agropastoralists (who grow crops as well as herd livestock) are tied to one location, often near a river or other source of water, at least for part of the year, but they still have strategies to maintain their herd mobility and flexibility. The best



Photo: Tigist Worku

Unloading water, Afar, Ethiopia

management approach depends on the particular combination of factors at their disposal: location, natural resources, labour, capital, skills and interests.

The need for flexibility

Pastoralists adapt to climate change, and the many other pressures that they face, in many different ways. Some choose to stick with livestock, but change their mix of species, breeds and management methods. For example, they swap some of their cattle for sheep and goats, or start to keep chickens (which reproduce more quickly and produce both meat and eggs, which are easy to sell). Others split their herds, move them to other locations, or change their feeding practices, for example by reserving certain areas for grazing only during emergencies – a practice that many pastoralists have used for generations. Many grow and store feed, use crop residues and weeds, or buy feed from neighbours or commercial providers to tide the herd over times of shortage.

Mobility has been the cornerstone of pastoralism for millennia, and climate change will only increase the need for it. In some

Before

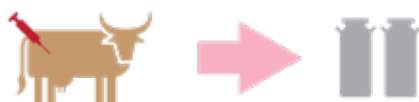


Adaptation with possible mitigation co-benefits

Better feed and housing



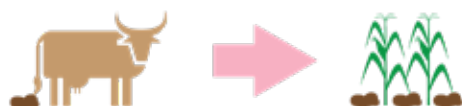
Better veterinary health



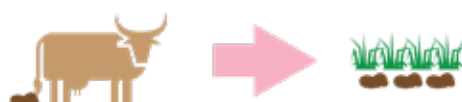
Switch to better adapted breeds or species



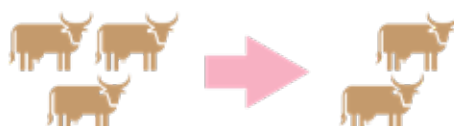
Use manure as fertilizer



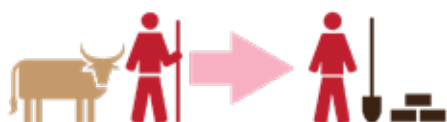
Improve carbon sequestration



Reduce livestock numbers e.g., before drought



Diversify economic activities (mitigation benefits depend on activity)



Extensive livestock keepers can adapt to climate change in various ways

regions, policy mechanisms try to induce pastoralists to settle in a permanent location, but doing so removes their very ability to adapt to the changes in their surroundings. If a drought strikes and they are tied to a particular place, they have much less ability to move their animals in search of fresh pasture. Facilitating large-scale mobility by pastoralists across East Africa will be a necessary element of an effective climate change adaptation strategy.

Diversification is an option for some pastoralists. They may start growing crops and fruits (if they have suitable land or access to irrigation), launch a small business (such as trading or handi-

crafts), or invest in other productive activities such as beekeeping or fishing. Many seek wage employment elsewhere. Some households or wider groups do a combination of several of these activities. Some shift out of livestock altogether, migrating to one of the growing small towns in pastoralist areas, or to a bigger, more distant city. Such a shift may be either permanent or temporary – such as seeking a seasonal job in town but coming back to the home area during critical times of year. The options depend on many factors, including access to stable markets, infrastructure such as roads and electricity, personal skills and educational levels.

Pastoralism is diverse, and there is no one-size-fits-all solution for adaptation to climate change, nor to the many other changes that are affecting extensive livestock systems. Livestock are increasingly just one part of the livelihood strategies that a household pursues. The household may be able to rebalance its mix of livelihoods, but the differences in adaptive capacities between and within households need to be carefully considered.

Adaptation pioneers

The lives of pastoralists have always been shaped by the highly variable climate. That means they are generally more proficient at adaptation than farmers or other livestock keepers, who are used to a more stable environment. But even among pastoralists, some local champions are more successful than others in adapting and securing their livelihoods in the face of a changing world. ILRI has identified such “positive deviants” or “adaptation pioneers” at its pastoralist research sites.

In Kajiado county, Kenya, adaptation pioneers use irrigation to grow feed and store it for their animals rather than relying only on natural pastures. They also experiment with different breeds of cattle and goats to find crosses that are both productive and resilient. Some of these ideas are promoted by the extension services and development projects. But the specific ways the pioneers implement these ideas are often entirely new.

While the adaptation pioneers are generally known as innovators in their communities, the particular techniques they have developed are not widely known. ILRI is trying to change this by supporting the pioneers in facilitating field days where the pioneers show their techniques to interested neighbours, explain their reasoning, answer questions, and get advice from others. This herder-to-herder approach is different from the conventional, top-down “technology transfer” model where extension specialists introduce farmers and livestock keepers to new technologies developed through research. Such an approach often fails for a variety of reasons. Many recommended practices have been developed under controlled conditions but prove impractical, unaffordable, or unsuited to the pastoralists’ resources,



Photo: USAID/Donatella Lorch

Pastoralists need to be mobile so they can deal with a changing climate. Samburu herders in northern Kenya.

knowledge bases or cultural values. Extension services often have inadequate resources and are not as mobile as the pastoralists they serve.

With neighbours, it is different. Herders know, trust and understand each other. They are more likely to accept what they say and consider trying it out themselves. As a result of the field days, many of the adaptation pioneers have begun to form their own groups and knowledge networks where they support one another in changing certain practices. The next task is to support their networks by providing them with information they ask for. This may take the form of trainings, manuals or videos, or creating linkages with providers of artificial insemination, seed or extension advice.

Mitigation and adaptation

Just as the rangelands are diverse, so too is their role in carbon storage. The amount of carbon that rangeland soils can store depends on the location and how they are managed. ILRI research has found that the rangelands may be a small overall carbon sink, or they may be a net source of CO₂ once livestock emissions are included.

Conventional thinking is that climate change mitigation – reducing greenhouse gas emissions – is something that intensive livestock keepers need to address. Little scope is seen for cutting

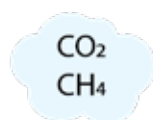
emissions in the dry, pastoral lowlands. But ILRI's research has found that possibilities do exist to reduce emissions in the pastoralist areas. Fortunately, many of these are by-products of attempts by pastoralists to adapt to climate change. Climate specialists refer to them as “adaptation measures with mitigation co-benefits”.

Such measures can take on various forms. One is to provide feed and access to water to ensure that the animals can maintain their body weight and hence their productivity. This includes enhancing feed production, conserving feed and creating emergency grazing areas. Another is to improve livestock health. A sick or worm-infested animal is an unproductive animal: it produces little meat or milk, but it still emits greenhouse gases. Switching from cattle to other species – camels, sheep or goats – which are better adapted to heat and drought is another option. Using manure to fertilize crops in agropastoral zones can boost overall output especially because fertilizers are not widely used.

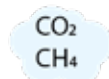
A further approach is to sell finished animals quickly rather than keep them in the herd. That increases the meat output, so boosting productivity. Selling animals is especially important before a drought, as herders may lose half their herd – or even up to 95% during a severe drought. The animals produce less milk (while they are still alive) and no meat – but they still emit

Total greenhouse-gas emissions

Before



After: Lower total emissions

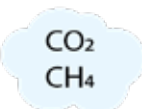


Climate change mitigation: Reducing total emissions

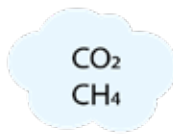
Emission intensity:

Quantity of emissions per unit output

Before



After: Higher output, same or higher total emissions, but lower emission intensity



Emission intensities are the amount of greenhouse gas per unit of output

greenhouse gases while alive. But reducing herd sizes is difficult given the importance of large herds to pastoralists as a store and multiplier of wealth, an insurance policy, and a source of status, and the lack of suitable ways to sell finished animals.

It is important to recognize the distinction between total emissions and emission intensity: the amount of greenhouse gases emitted per kilogram of meat or milk produced. In Africa, most mitigation strategies aim to reduce emission intensities by increasing productivity. Various ways exist to reduce absolute emissions. One would be to reduce the number of ruminants, for example by bringing beef cattle to market more quickly. That would produce as much meat (and more income for their owners) but create fewer emissions. Another would be to decrease emissions from livestock enclosures by removing the manure and using or selling it as fertilizer. A third would be to increase the amount of carbon that is stored in grasslands (carbon sequestration), for example by reducing the overgrazing and degradation of pastoral lands.

Making decisions

Pastoralist societies are complex. Many are organized hierarchically into households, extended families, clans and ethnic groups, each with their own responsibilities and ways to make decisions, for example on where and when to move, whether to buy or sell stock, and how to use the land. Men are generally responsible for the herding, while women often take care of young, sick and pregnant animals, and do the milking as well as household tasks such as cooking and fetching water.

Pastoralists traditionally use a range of mechanisms to make decisions on livestock management. These include decision-making structures in the household or group, agreements between groups, and knowledge of their livestock and the environment. Extended social networks and traditional forms of communication facilitate access to different resources across vast landscapes. But as the world around them changes, these systems have been evolving. For example, women are more and more involved in herding, filling the gap left by children who now go to school. In those households that diversify their income sources, women may also be mainly responsible for the crops and for rearing chickens. In Afar society in Ethiopia, it is the task of women to sell milk to the market. Decisions at higher levels that were often made by elderly men are now influenced by younger, educated men who take on positions of authority.

Pastoralists are usually far from the centres of power. In climate change planning processes, they should be included and consulted on a routine basis. Such consultations must ensure that all groups (even those often side-lined in decision-making processes, such as pastoral women) and forms of governance systems are included.

This means involving pastoralists' representatives in decision-making processes at every level, and ensuring that decisions are made as close to the locale as possible. Decentralized decision-making and community consultation facilitate empowerment, enable flexibility, and permit experimentation and learning. They can ensure that the suggested solutions build on the resilience of the system rather than undermining it. Facilitating adaptation (such as by supporting adaptation pioneers) is likely to be more successful than trying to enforce it. Pastoralist areas need better infrastructure and services such as transport, communications, marketing, education and veterinary care.

The complexity and diversity of pastoralist systems have implications for both research on adaptation practices and measures and policymaking. Long-term research is needed to understand the changing structures and dynamics of both the production and decision-making systems within the context of a changing climate. A thorough understanding of the system and who is impacted in what way is in turn needed for informed policymaking.

References

- Carbonell, V., L. Merbold, E. Di'az-Pin'es, T.P.F. Dowling, and K. Butterbach-Bahl.** 2021. Nitrogen cycling in pastoral livestock systems in Sub-Saharan Africa: knowns and unknowns. *Ecological Applications* 00(00):e02368. 10.1002/eap.2368
- Graham, M.W., K. Butterbach-Bahl, C.J.L. du Doit, D. Korir, S. Leitner, L. Merbold, A. Mwape, P.W. Ndung'u, D.E. Pelster, M.C. Rufino, T. van der Weerden, A. Wilkes, and C. Arndt.** 2022. Research progress on greenhouse gas emissions from livestock in sub-Saharan Africa falls short of national inventory ambitions. *Front. Soil Sci.* 2:927452. doi: 10.3389/fsoil.2022.927452
- Habermann, B., T. Crane, L. Gichuki, T. Worku, and R. Mugumya.** In preparation. A new kind of margin: Working with positive deviants as pioneers of adaptation in livestock management.
- Habermann, B., T. Crane, T. Worku, L. Gichuki, and R. Mugumya.** 2021. Research protocol: Adaptation practices in livestock systems. Participatory adaptation analysis.
- Habermann, B., T. Crane, T. Worku, R. Mugumya, and L. Gichuki.** 2021. Research protocol: Adaptation practices in livestock systems. Scoping study.
- Habermann, B., T.A. Crane, L. Gichuki, T. Worku, R. Mugumya, N. Maiyo, E. Kiptoo, S. Goshme, F. Moham-mednur, G. Tugume, K.A. Satia, and J.R. Siamito.** 2022. The art of letting go: Transforming participatory research on adaptation practices among local livestock-keepers in East Africa in times of covid-19. *Front. Sustain. Food Syst.* 5:768445. doi: 10.3389/fsufs.2021.768445
- Marty, E., R. Bullock, M. Cashmore, T. Crane and S. Eriksen.** 2022. Adapting to climate change among transitioning Maasai pastoralists in southern Kenya: An intersectional analysis of differentiated abilities to benefit from diversification processes. *Journal of Peasant Studies*, DOI: 10.1080/03066150.2022.2121918
- Merbold, L., T. Dowling, S. Leitner, M. Wooster, A. Vrieling, F. Fava, and I. Gluecks.** 2022. Continuous observations of CO₂, H₂O and CH₄ exchange in an East-African rangeland. Paper presented at the EGU General Assembly 2020.
- Wolz, K., S. Leitner, L. Merbold, B. Wolf, and M. Mauder.** 2021. Enteric methane emission estimates for Kenyan cattle in a nighttime enclosure using a backward Lagrangian Stochastic dispersion technique.

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Programme for Climate-Smart Livestock Systems

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Photo credits
Front: Chopping sugarcane leaves as feed, Afar, Ethiopia. Tigist Worku/ILRI.
Back: Cattle drinking from water pan built by an adaptation pioneer, Kajiado, Kenya. Tigist Worku/ILRI.

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