SIANI
Swedish International Agricultural Network Initiative

SLU Global

SUSTAINABLE AGRICULTURAL PRODUCTION & FOOD SECURITY

Use of Livestock Resources for Food Security in the Light of Climate Change

Policy Brief
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Introduction

Livestock are essential for food and nutrition security in sub-Saharan Africa. They serve multiple purposes and are economically important, contributing 20–40% of agricultural gross domestic product (GDP) – in some countries, up to 80%. Globally, by 2050, food production of animal origin is expected to double, to meet rising demand due to population growth and increased consumption in developing countries.[1]

Sub-Saharan Africa has a great deal of livestock, but productivity is generally low. Climate change is expected to create new challenges, such as increased prevalence of diseases, heat stress, and reduced access to feed and water due to increased temperatures and more extreme weather conditions.

This policy brief examines the role of genetic diversity in adapting African livestock production to climate change and making it more sustainable. Some breeds are more resilient to harsh climate than others; at the same time, to the extent that breeding can improve productivity, it could reduce livestock's environmental impact, including land and water use and greenhouse gas emissions.

The brief is based on an international seminar "Livestock Resources for Food Security in the Light of Climate Change", held in March 2016 at the Swedish University of Agricultural Sciences (SLU) in collaboration between SIANI, SLU Global and SLU's Department of Animal Breeding and Genetics.

The seminar included presentations by a number of experts on the development of the Sustainable Development Goals (SDGs), livestock production systems, animal health, and the sustainable use of animal genetic resources in sub-Saharan Africa. In addition, a Swedish dimension of some of these issues was discussed. The seminar was held in conjunction with the defence of the PhD thesis Breeding Programme and Infrastructure – the Case of Red Maasai Sheep in Kenya (see Box 1), and a seminar dealing with water usage by livestock and the effects of climate change.

Red Maasai sheep are proven to function well also under harsh conditions but they are at risk through indiscriminant crossbreeding with Dorper sheep. Photo credit: Emelie Zonabend König, SLU.

KEY MESSAGES AND RECOMMENDATIONS

- Livestock are essential for food and nutrition security in sub-Saharan Africa, as well as to rural livelihoods. However, despite very large numbers of animals, production is relatively low, though with large differences between breeds, management practices, and environmental conditions.
- The conditions for livestock in sub-Saharan Africa can be harsh, particularly with regard to heat, water scarcity, and unreliable supply of feed. Climate change is likely to exacerbate those challenges. As a result, it is important to breed animals that are not only productive, but also resilient.
- The increased globalization of breeding activities provides opportunities to incorporate genes from a global pool of breeds to improve local livestock populations. Unfortunately, those opportunities have often been misused, by replacing local breeds with unsuitable exotic breeds, or through crossbreeding that has put local breeds in danger of extinction.
- Given the importance of food security on the global development agenda, including the Sustainable Development Goals, it is crucial to raise awareness among policy-makers and funding agencies of the importance and multiple roles of livestock, and of ways to improve livestock production.
- A key area to prioritize is action research to design and implement effective livestock recording and breeding programmes. These are needed to characterize potentially valuable genetic resources, to develop systems for monitoring their performance, and to provide means for management and selection of animals for particular environments.
- Systems aimed at increasing livestock productivity must include improved infrastructure and policies to support livestock breeding and sharing of genetic resources across national borders. The objective should be to support sustainable development of all important farm animal breeds and avoid the risk of extinction. In sharing genetic resources, globally, both developed and developing countries should be mindful of the risk of permanently losing genetic variation by replacing breeds.
- Capacity-building is crucial for success. More needs to be invested in training people at all levels, including women who can become livestock entrepreneurs. Higher education programmes focused on animal breeding are also important to train future leaders in the management of genetic resources.

This policy brief is based on the seminar "Livestock Resources for Food Security in the Light of Climate Change", held on 11 March 2016 at the Swedish University of Agricultural Sciences (SLU) in collaboration between SIANI, SLU Global and SLU's Department of Animal Breeding and Genetics. All slides are available at http://www.siani.se/event/livestock-resources-food-security-light-climate-change/march-2016.

[1] See http://www.fao.org/Ag/againfo/themes/en/meat/home.html.

Livestock and the Sustainable Development Goals

Many people depend on livestock for their livelihoods, especially in low-income countries. The animals provide food; manure for fuel, fertilizer and building materials; wool and hides; and draught power. They are both economically and culturally important, and in areas not suited for cultivation, they convert low-value materials such as grass and weeds into nutritious food for people. Ownership of livestock can also be a way out of poverty.

In this context, it is not surprising that food and agriculture, including livestock, play a key role in the SDGs. The first two goals aim to end poverty and hunger and achieve food security and improved nutrition by 2030. To enable this, a part goal is to double agricultural productivity and the incomes of small-scale food producers.

Livestock also play specific roles in the pursuit of goal no. 5 (gender equality), no. 6 (clean water and sanitation), no. 12 (responsible consumption and production), no. 13 (climate action), and no. 15 (life on land) emphasizing biological diversity for future use. The goals are interlinked and provide a framework for future development, including of livestock, all around the world.

Maasai livestock keeper and his indigenous hardy Red Maasai sheep (see text box 1). Photo credit: Emelie Zonabend König, SLU.

Livestock in sub-Saharan Africa

Sub-Saharan Africa is home to large numbers of livestock, especially ruminants – to 20–25% of all ruminants in the world. Yet productivity varies greatly, due to differences between breeds, management practices, and especially environmental conditions, which can be very harsh, involving extreme heat, limited water and sparse vegetation.

Many indigenous breeds are adapted to survive in harsh environments, but they are often seen as less productive. However, the perceived competitiveness of different breeds often fails to account for longer-term productivity and risks. This is especially true of rangeland-based meat production, where the resilience of the animals is crucial. Similarly, in dairy cattle, the decisive factors are often linked to opportunities for intensification and management improvements.

To boost productivity, local breeds have often been crossed with higher-yielding exotic breeds. Such crossbreds may be successful in the short run, but over time, they tend to fail, if the animals are not well suited to local climatic conditions or if adequate feed resources and management are not available.

In general, the genetic potential of livestock in sub-Saharan Africa has been largely unexploited, as there are usually no long-term breeding strategies in place, nor adequate policies, infrastructure, livestock recording schemes or trained staff needed to support them.

Box 1. Red Maasai sheep, a valuable genetic resource for sustainable use and improved livelihoods

Red Maasai (RM) sheep are indigenous to Kenya and neighbouring countries. The breed is known for its resistance to diseases and tolerance to drought. However, it has been indiscriminately crossed with a South African breed, Dorper, to increase meat production, and RM is therefore under threat. Purebred RM sheep have become rare.

A study in two environmentally different Maasai village areas keeping RM, Dorper and their crosses was conducted. The environment in one area was extremely harsh and suffered from poor pastures and was very vulnerable to effects of climate change. The other area provided better grazing opportunities, and farmers were more commercially oriented. The study showed that:

- In both areas, the breeding goals that farmers prioritized were large body size, high milk production, drought tolerance and disease resistance.
- Dorper sheep were heavier than RM in the best environment, while no breed differences in live weight were found in the harsh-conditions area.
- The carcasses of crossbred lambs were superior to those of purebreds of either breed. Pure Dorper sheep were generally overvalued on the market relative to RM.
- Simulated breeding strategies showed best results for pure-breeding of RM in the harshest environment, whereas some crossbreeding for production of lambs for slaughter was slightly preferable in the best environment.

In sub-Saharan Africa women play an especially important role in caring for and handling livestock to generate food for the households and marketable products for income. Photo credit: Jan Philipsson, SLU.

Livestock and climate change

Climate change is expected to bring even harsher conditions to sub-Saharan Africa, with rising temperatures, more irregular rainfall, droughts and floods. In arid and semi-arid areas, livestock may be left with nothing to graze on. Forage production and feed availability will also be affected.

The heat may adversely affect the reproduction and health of animals, directly through heat stress, and indirectly through the increased presence of mycotoxins in feed.[2] The risk of infectious diseases is likely to rise, leading to higher mortality and lower productivity. Several of these diseases are also zoonotic, meaning they can be transmitted between animals and humans, threatening human health.

Water scarcity is another major concern. Agriculture uses 85% of the present global freshwater consumption, of which nearly 30% is for livestock, primarily for feed production. However, water use levels vary greatly among production systems. Dairy production is especially demanding. High-productivity and farm-based feeding systems are associated with most efficient water usage. In the future, dairy production may need to move more towards naturally rainfed areas. Genetic variations that affect water needs should also be considered in future breeding programmes.

As noted earlier, livestock also affect the climate, through greenhouse gas emissions. However, emissions per unit of output can be reduced through increased productivity and better reproduction, animal health and survival, so more is produced from fewer animals. Technologies to measure emissions per animal, which were previously rather imprecise, are also improving, offering new opportunities to make more informed choices of climate-smart feeds and animals.

Gender and livestock

Women play important roles in the livestock sector in sub-Saharan Africa. They tend to be responsible for caring for young and sick animals, and milking. Women also contribute substantially to the production of marketable products, such as milk, eggs, wool, hides and fuel (dung cakes). Box 2 offers an example of women in arid areas discovering the value of sheep milk when cows starved to death.

Given that women also tend to provide their households' basic needs, there is a strong link between improvement of livestock and livelihoods. Women play a key role in the selection of animals, as well as in decisions about how to use livestock products and dispose of or keep animals. In this context, there is a need to further empower women through education in order to enhance their benefits from livestock.

[2] See, e.g., http://grist.org/food/climate-change-is-making-food-more-toxic.

Pastoralist woman milking sheep. Photo credit: Julie Ojango, ILRI.

Box 2. Pastoralist women make business of milking sheep

In 2008–2009 extreme droughts hit East Africa. Animal mortality was extremely high, and people were forced to rely on food aid. While millions of cattle and imported exotic sheep and goat breeds died, indigenous sheep and goat breeds proved to be well adapted to the environment, tolerate droughts and be resistant to diseases.

After the cattle died, women instead relied on milk from sheep. After the severe droughts, the women continued milking their sheep and were asked to sell the surplus sheep milk to a processor. A women's group was formed around collecting and marketing of the sheep milk.

Women requested training on management of sheep and managed to strategically influence the selection and use of rams within their flocks. The women's group also continuously kept performance records of the sheep. The sale of milk enabled the women to support higher education for their children, create further employment for youth, and buy household assets.

Improving the use of animal genetic resources

The challenges of producing more foods of animal origin while reducing environmental impacts make it a priority to **increase productivity per animal** and reduce the number of unproductive animals. Breeding goals must consider efficiency in production, reproductive capacity and the health of animals, while also recognizing the environmental conditions and feed available in each place.

Globalization of breeding activities, through the use of artificial insemination or embryo transfer, provides excellent opportunities to benefit from a global pool of breeds to improve local livestock. Many positive experiences of using exotic genetic materials have been demonstrated. However, many cases of failures have also been reported, where through uncontrolled crossbreeding and breed replacement programs, important local genetic resources have been lost without good reasons, or where the imported stock cannot cope with the new environment. The globalization of breeding thus requires efficient **systems for risk analysis** based on continuous **monitoring of all relevant breeds** for important characteristics and of the genetic make-up of the populations. This also applies to breeds in developed countries, where livestock recording is more established.

Sustainable use of animal genetic resources means that the populations should be used in environmentally friendly and socially acceptable systems, with productive animals that are competitive on the market. **There is no better way to conserve a breed than to keep it competitive**. Conservation can focus on genotypes (breeds) or genes (e.g. semen).

Continued crossbreeding with high-producing breeds has proven difficult to manage in practice when infrastructure fails, whereas continued selection within a crossbred population, **forming a synthetic breed**, often provides better opportunities to incorporate desired genes into a population while conserving genes for traits important for adaptation to the specific environment. Historically, most breeds have developed this way.

The sustainable use of AnGR requires **long-term breeding strategies** considering both the desired breeding goals and the selection practices in order to manage risks of inbreeding.

A prerequisite for any sustainable breeding programme and monitoring system is that it is based on factual information about performance and ancestry of the individual animals. Efficient **livestock recording systems** offer such opportunities and have been the key to any animal improvement programme worldwide, independent of species. Such systems could also provide key information to use for **action research** on design of alternative breeding strategies to further improve and manage livestock populations.

However, livestock recording is largely missing in sub-Saharan Africa, due to insufficient supportive policies, governance, extension services, physical infrastructure, and trained staff. **Capacity-building** at all levels, especially higher education in animal breeding, is necessary to achieve sustainable improvements of animal genetic resources in sub-Saharan Africa.

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