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Pastoralist landuse systems and sustainability in a “high-tech” world

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Introduction

We are living in a “high-tech” world. What is the role of African pastoralists in such a world? And what is the role of high tech for African pastoralists? “High tech” is a fuzzy term that is at the opposite pole to low tech and is relative in time and space. What may be high tech for one society in comparison with what was previously practised may be low tech for another. Using motorbikes or helicopters to herd livestock or transporting animals by truck instead of trekking them are examples of higher technology levels. Concepts of high tech shift over time, and what was considered high tech decades ago would be considered perhaps “medium tech” or “old-fashioned” now, e.g. the use of television or landline phones. Seen from a global perspective, some examples of high tech in current definitions include advanced computer electronics in its many forms – above all, the Internet – as well as satellites, mobile phones and various energy-generating technologies. In a “high-tech” world, based on current standards set by the global “society”, how do changes in technology influence pastoralism and the people who live from it, i.e. pastoralists?

“Pastoralism” is a land-use system through which grazing livestock make productive use of natural vegetation in marginal areas that are too dry, high, steep and/or infertile for crops. It is a labour-intensive way of production that involves a wide range of animal species and produces a wide range of outputs: milk, meat, fibre, manure (fertilizer, fuel, building material), leather, transport etc. The growth of the plants on which the animals graze depends on rainfall and varies greatly between years. Rainfall and thus pasture are also unevenly spread over space within a wet season. Thus, the natural conditions in the drylands are uncertain, and there are few economically viable opportunities to influence or control them.

To achieve food security with increasing human population, the non-arable areas used for pastoralism will become even more important for the world than they are today. These are areas where the local people are used to dealing with unpredictable climatic conditions and can continue to produce food. African pastoralists have proven themselves to be highly adaptive to changes in climatic, economic and political conditions, especially by virtue of their mobility.

Some effects of high tech on framework conditions for pastoralism

Seen from a global perspective, high tech applied in industrialised livestock production, such as in Europe or North America, has led to cheaper and more uniform animal products, which are transported to all parts of the globe. This increasingly marginalises produce coming from the African drylands. However, this industrialised production is costly in terms of fossil energy use, environmental impact and climate change.

New technologies in animal health and food safety control have led to higher standards in “developed” countries and are undoubtedly necessary for mass production in large-scale livestock units and processing plants, in order to decrease risks for animal and human health. However, when the controls and standards required for such mass production are also enforced in Africa, where many producers and consumers are relatively poor, then poor producers are denied access to the formal markets and poor consumers have to pay much higher prices for products on the formal markets – or, as is more often the case – cannot afford to buy them. This has implications for human nutrition and health, as animal products are vital sources of protein throughout sub-Saharan Africa (Roesel & Grace 2015). Intermediate-level technology plus a policy favouring the processing and marketing of smaller quantities of animal products from pastoralism sold to small-scale butchers and milk processors could bring greater benefits to poor producers and consumers than applying the highest levels of technology available.

Technological developments have led to the intensification of alternative uses of rangelands. As examples: new technologies to find and extract minerals and water have led investors deeper into pastoral areas; new

irrigation technologies have allowed crop farmers to expand into rangelands that had earlier been the sole preserve of pastoralists for food production; the rising demand for energy has led to establishment of parks to generate power from the sun or wind as well as plans for plantations of bio-energy crops that require relatively little water. High-tech equipment needed for these alternative uses of drylands consume non-renewable resources and require highly trained external experts to produce and operate the equipment. High tech usually means high cost, at least in initial stages while the technology is new, and often means also high risk, as the impacts of the new technology are initially not known. However, they also have the potential of bringing high profits in the short term, which is why investors are interested in them.

A good example of high tech in alternative uses of drylands is the exploitation of deep aquifers for irrigated farming. Water needs of plants depend, among other things, on potential evapotranspiration, which is higher in arid than in e.g. temperate areas. High-tech equipment makes it possible to access deep aquifers e.g. in the Sahara desert, often of fossil water that has very little natural recharge. The high water needs of the crops requires extraction of large amounts of water, which lowers the water table. This way of exploiting natural resources is not sustainable. In semiarid areas, good cropland is taken over by large commercial and mechanised farms, driving smallholder farmers onto more marginal land, which used to be grazed by pastoral herds, leading to more conflict between pastoralists and farmers.

Such developments have led to situations where pastoralists have lost access to land and water resources they had been using for generations, with no consultation and no compensation, because of unclear rights to communal resources (e.g. *Volkskrant* 2015). Especially where irrigated farming is introduced in the name of increasing food production, pastoralists are excluded from key grazing and watering sites that are used only at critical times of the year or in particularly critical years. Their entire production system depends on their ability to move their livestock to access grazing and water in different areas, as a strategy to deal with the high variation in rainfall in the drylands. If they cannot use a valley bottom for only a few weeks in the year because, e.g. a company has set up a sugarcane plantation there, then the pastoralists cannot make productive use of the other areas (not suitable for cropping, irrigated or otherwise) at other times of the year. This is not to argue that rangelands should be closed to alternative uses but rather to stress the importance of consultation and negotiation so that the pastoralists' livelihoods are not destroyed and ways are found for them to benefit from the alternative uses of their land and to continue pastoralism.

Some effects of high tech within pastoralism

Pastoralism is not a system that has remained unchanged for generations. Pastoralists in Africa do not live in isolation from advanced technologies. They have long had market relations with urban areas and other countries, and many pastoralists have worked abroad for some years as labourers, e.g. in the Arab States. Many pastoralists have part of their (extended) family based in a town or city in their own country or abroad. They are aware of many of the new technologies available and readily apply those that improve how they produce and sell livestock and their products and improve their lives without foregoing mobility.

One of the main technological advances quickly welcomed by pastoralists is the mobile phone, which highly suits the pastoralists' oral culture and mobile way of life, which telephony based on landlines did not. Pastoral men and women, young and old, in Kenya are increasingly using mobile phones to obtain information about conditions (pasture and water availability, weather, animal disease, conflict etc) along different possible routes; to inform themselves about market prices, make transactions with traders and send and receive payments, also remittances from relatives living abroad; and simply to communicate with each other (Little 2011, Reinke & Sperandini 2012). Improvements in weather prediction using satellites, providing information accessible by mobile phone, gives pastoralists additional sources of information on which to base their decisions about moving their herds or selling their animals. Especially the pastoralists in Somali exhibited great innovation in using communication technologies for informal banking, insurance and marketing systems – also internationally – after the Somali state broke down (Little 2011).

Technological advances in the production and use of veterinary drugs and vaccines are highly valued by pastoralists, who will travel long distance to obtain the drugs needed to treat or protect their animals. Such drugs are now more widely and easily available than in the past. Some pastoralist groups are also operating their own animal health services, through community-based health workers linked with governmental or private veterinary services. On the downside, the easier availability of drugs can lead to widespread inappropriate use of drugs, which speeds up the development of disease agents that are resistant to these drugs. Especially bacteria resistant to antibiotics are a reason for concern.

Pastoralists are making ever-increasing use of trucks to transport water to animals or to transport livestock to distant pastures in times of crisis, as well as to transport livestock to markets in urban areas. This can be high-tech for a pastoralist group that has never used motorised vehicles for this purpose before. Not only the richer pastoralists do this; also groups of pastoralists (often related) combine their money from selling a few animals to be able to hire a truck to transport the remaining animals to better pastures or to bring water to their herds during drought.

In Tanzania and Ethiopia, some pastoralists are working together with the NGO Project Concern International (PCI) in combining low-tech methods of scouting and oral communication about pasture conditions with satellite-derived vegetation data to help herders make critical decisions on where to find good pasture throughout the year (Maratea 2014). Another NGO Lay Volunteer International Association (LVIA) working in southern Ethiopia found that pastoralist men, women and youth showed great ability in interpreting geo-referenced maps and satellite imagery and could combine this with participatory mapping techniques to depict land and water use by pastoralists and support their negotiations over resource use with other stakeholders (Rossi & Rizzi 2009). In Kenya, university researchers are working with pastoralists using satellite imagery and cell-phone apps to find suitable grazing and browse for their cattle, camels and small ruminants. The cell-phone reports made by herders using simple icons are tagged with GPS coordinates and fed to a computer that helps identify different kinds of vegetation from the satellite image. The herders collecting the data are paid for their work in cell-phone minutes (Steele 2015). In Kenya and Ethiopia, some pastoralists are working together with researchers and insurance firms to experiment with livestock insurance schemes based on an index according to assessment of the state of vegetative cover determined by satellite data (Chelan'ga *et al* 2015).

In Botswana, incidence of cattle theft have been greatly reduced since the introduction in 2001 of the Livestock Identification and Trace-Back System that uses radio frequency technology to identify livestock throughout the country. This electronic tracking microchip encased in a ceramic capsule inserted into the rumen is now being tested in Kenya to reduce cattle rustling, which has increased in recent years with the increasing use of trucks and weapons. The digital identification system can also help trace the provenance of livestock, which can be useful in penetrating markets such as the EU that require such data. However, problems arose in Botswana because of equipment failure and non-visibility of the bolus, which led the government to switch to digital eartags in 2013 (Maramwidze 2013). Another disadvantage of such systems is that they facilitate government monitoring of herd movements, a development that many pastoralists do not regard favourably. It remains to be seen whether they will value the benefits sufficiently to accept the downsides of this high-tech approach to identifying and tracing animals.

One aspect of technological “progress” that has highly affected the pastoralists’ lives and livelihood systems has been the development of modern, high-power weapons that are used in livestock raiding and conflicts between pastoralist groups or between them and settled farmers in areas into which pastoralists bring their herds for dry-season grazing. Modern weaponry has exacerbated conflicts in the drylands and has led to higher death tolls and complete abandonment of certain grazing areas between rivalling groups. This is an example of introduced technology which some pastoralists as well as large-scale livestock traders are using to their own advantage and is obliging all pastoralists to arm themselves for protection.

Discussion and conclusions

High tech is influencing pastoralism in both positive and negative ways. The application of advanced technology in livestock production elsewhere in the world, together with policies that favour application of this technology, is changing the framework conditions for pastoralism in sub-Saharan Africa, especially with regard to marketing. Also the application of high tech in extractive industries and irrigated farming in the drylands is ousting pastoralists from strategic areas and threatening the entire pastoral production system. These new technologies and the land or water on which they are being applied are not in the control of and are not benefitting the pastoralists.

Belief in high-tech “solutions” to alleged “problems” in food production overlooks the fact that agriculture – in this case, animal agriculture – is being practised in the drylands by accepting the natural limitations and making the most of them to produce food. Pastoralism is a form of low-external-input and sustainable agriculture (LEISA). It makes efficient use of scarce resources – above all, water – with minimal use of fossil-based inputs. It produces nutritious high-protein food from plants that cannot be eaten directly by humans and in areas where food cannot be grown without high levels of external inputs. It is an efficient and environmentally sustainable way of making the existing resources productive for human beings.

Some high-tech innovations can support pastoralists in making decisions about moving their herds, in managing animal health and in marketing livestock and their products. On the other hand, high-tech weapons – also being embraced by pastoralists especially in eastern Africa – are an additional threat to security in the rangelands.

Many of the high-tech interventions in pastoral areas are leading to depletion of non-renewable resources and are, at the same time, destroying the basis for pastoralist livelihoods and endangering the future of pastoralism. International and national government support is being given to high-tech agriculture, especially for irrigated cropping in the river valleys in the drylands. These are areas that pastoralists need at critical times of the year and in critical years to be able to maintain their production system and to be able to use the drier areas during other times of the year. If these vital links in the pastoral seasonal cycle are broken, the drier areas can no longer be used to produce food in the form of livestock products.

Often, the external investors can make high gains from extractive industries or irrigation schemes for only a relatively short timespan, until the resources are depleted or the high production costs and the salination on irrigated land lead to the demise of these projects. But, in that period, they may have destroyed the system of land use that pastoralists have been using in the larger area for generations and would have had the knowledge and skills to continue doing so for generations to come.

High tech does not mean economically efficient, environmentally sound and socially just. The most efficient, sound and just way of producing food in the rangelands remains pastoralism, using high tech very selectively. Where new technologies can improve the livelihoods of the people living in these dry and often remote areas, it is the local people who are usually best situated to select the advances in technology that are most suitable for their area. However, it cannot be assumed that all of them are well informed about the impact of the new technologies on their environment. This is obvious since years in the way that batteries have polluted the environment in pastoral areas – and now also discarded mobile phones. It is therefore necessary that pastoralists have opportunities to learn about and reflect on the benefits and risks of the new technologies they are embracing. They need more information on the pros and cons of investing in different types of new technology.

At the same time, pastoralist civil society needs to be strengthened in its arguments for continuation of their highly mobile way of producing valuable livestock products from marginal land. Advanced ICT could help them in this, by supporting mobile forms of education and information exchange and by using blogs, websites, web-based videos etc as tools to lobby for recognition of pastoralism as a “modern” production system and for pastoralist rights, including land rights. Especially training of young people in pastoralist societies could contribute to their being able to use ICT for such purposes.

Thus, African pastoralists are threatened by inappropriate interventions with modern technology for food production in the drylands but are also embracing modern technologies appropriate for improving their production systems and their lives under remote dryland conditions. We all – including the pastoralists – need to take a critical look at what forms of high tech make land use for food production in dryland areas more sustainable, and what forms do not.

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