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# Part B. Identifying solutions

Chapter 5

# Livestock Production Systems: Seizing the Opportunities for Pastoralists and Agro-pastoralists

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## Current situation

Livestock-keeping is one of the most important livelihood activities practiced in the drylands of Africa. In the countries of East and West Africa in which drylands are important, the livestock sector is economically significant, with production of meat and milk typically comprising 5–15 percent of total GDP and up to 60 percent of agricultural GDP. The direct contribution of livestock to GDP is amplified when the indirect benefits of livestock-keeping are factored in, such as production of organic fertilizer and provision of animal traction services. In addition, the livestock sector can be an important earner of foreign exchange, as millions of sheep are shipped every year from the Horn of Africa to the Gulf States, and more than one million head of cattle are trekked or trucked from the Sahel to coastal countries in West Africa. Significantly, with per capita incomes continuing to rise in Sub-Saharan Africa and with wealthier consumers turning increasingly to animal-source foods, regional demand for meat and milk is expected to double by 2030.

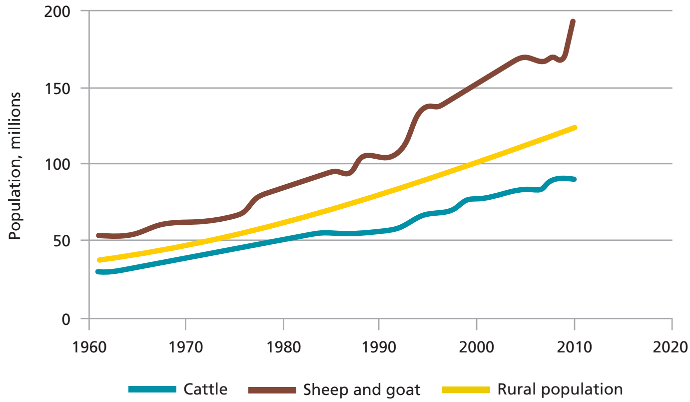
Livestock-keeping is the principal livelihood source for 40 million people in the Horn of Africa and the Sahel, and it provides a significant share of income for an additional 40 million people in the two regions. The way in which livestock-keeping contributes to the livelihoods of individual households varies depending on the production system. Two main livestock production systems can be distinguished:

1. **Pastoral systems:** Found mainly in more arid zones (Aridity Index 0.05–0.20), pastoral systems are systems in which livestock-keepers derive the majority of their income from animals that graze natural vegetation, the nutritional value and spatio-temporal distribution of which depend on the variability and intensity of annual precipitation. In pastoral zones, where the potential for crop growth is limited by moisture availability, raising livestock is often the only viable form of agriculture. In pastoral systems, cattle, camels, sheep, and goats are moved around to take advantage of patchy seasonal vegetation. The pastoral system represents a complex form of natural resource management and embodies a finely honed symbiotic relationship between local ecology, domesticated livestock, and people in resource-scarce, climatically marginal, and often highly variable conditions. As explained by Pratt, Le Gall, and de Haan (1997), pastoral systems involve interactions between three different systems in which pastoral people operate, namely the natural resource system, the resource users system, and the larger geopolitical system.
2. **Agro-pastoral systems:** Found mainly in semi-arid zones (Aridity Index 0.2–0.5) and subhumid zones (Aridity Index 0.5–0.65), agro-pastoral systems are systems in which livestock-keepers derive one-half or more of their agricultural income from crop farming and in which crop residues make up an important share of livestock rations (usually 10 percent or more). In semi-arid zones, cattle typically perform multiple roles; in addition to producing meat and milk, they contribute to increased crop productivity by providing draft power and manure, while at the same time converting organic material not suitable for human consumption into high-value food and nonfood products. Agro-pastoral systems also represent a complex form of natural resource management that allows efficient exploitation of a limited and highly variable natural resource base.

The distinction between pastoralists and agro-pastoralists, once quite clear, is becoming increasingly blurred, as pastoralists are increasingly engaging in opportunistic planting of small plots in wetter areas or years as a diversification strategy to complement their livestock production activities.

Over the past four decades, livestock numbers have increased rapidly in the drylands (Figure 5.1). Between 1980 and 2010 the livestock population in drylands (expressed in Tropical Livestock Units, TLU)[1] grew at an annual rate of about 3.5 percent per year, faster than the human population in these areas, which grew by about 2 percent per year during the same period. Thus on average the herd/flock size per household and per pastoralist have gone up.

**Figure 5.1** **Growth in livestock numbers and rural human population, 1960–2010**




*Source:* FAOSTAT 2015

Livestock ownership in the drylands is highly skewed. Based on World Bank Harmonized Household Surveys (SHIP) data and rural Gini coefficients, it is estimated that the wealthiest 1 percent of livestock-keepers own between 9 percent and 28 percent of all animals. The regional averages mask important differences between regions and among species, however, and they do not reflect changes taking place in the composition of the livestock population. For example, Desta and Coppock (2004) also mentioned in a report by Headey et al. (2014), report that in many areas in Ethiopia and Kenya covered by the USAID-funded Pastoral Risk Management (Parima) project, the cattle herd has declined, probably as the result of a series of droughts that reduced herd sizes below the minimum level needed to recuperate.

The vast majority of livestock-keepers in dryland regions of Africa are poor. Estimates reported in the literature, supported by modeling carried out as part of this study, suggest that about 3.5 TLU/capita are needed to meet the basic needs of a typical pastoralist household; the number can be half that much for the typical agro-pastoralist household that is able to supplement income from animals with income from cropping activities. In Sub-Saharan Africa, most households that keep livestock do not have anywhere near that many animals. The estimated 40 million pastoralist livestock-keepers in Africa hold about 51million TLU (equivalent to 1.3 TLU/capita), and the estimated 80 million agro-pastoral livestock-keepers hold an estimated 76 million TLU (equivalent to less than 1 TLU/capita). Based on these regional aggregates, in the drylands of Africa the "average" pastoral household of six people owns about 6 cattle, 15 sheep, and 15 goats, from which they harvest about 300 liters of milk per year (mostly destined for home consumption), while selling one cow every two years and 10 small ruminants per year. These activities generate about US$700 per year in household income (milk included), or just over US$100 per year per household member. As these numbers show, the "average" livestock-keeper in the drylands of Africa lives below the poverty line.

Livestock-keepers in the drylands of Africa are not only poor, they also face a highly variable environment that exposes them to a variety of shocks from which they may have difficulty recovering.

The most frequent shocks affecting livestock systems in the drylands are undoubtedly extreme weather events, especially periods of severe and prolonged drought. In the Sahel region, the two major droughts that occurred in the 1970s and 1980s led to the deaths of about one-third of all cattle, sheep, and goats (Derrick 1977, Lesnoff, Corniaux, and Hiernaux 2012). Also in the Sahel region the relatively mild drought that lasted from 2010 to 2012 caused about 12 million people to be food insecure (Oxfam 2012). In the Horn of Africa the livestock sector experienced five major droughts between 1998 and 2011, which killed more than one-half of the cattle in the most heavily affected areas and decimated the livelihoods of 3–12 million people (depending on the year).

In addition to being exposed to weather-related shocks, livestock-keepers in many dryland regions of Africa are vulnerable to the effects of conflict. During the past decade alone, episodes of social unrest and civil conflict have broken out in Ethiopia, Kenya, Sudan, South Sudan, Chad, Central African Republic, Niger, Mali, and Nigeria, among other countries, leading to the displacement of millions of people and extensive losses of property, including livestock.

Finally, dryland regions in Africa are particularly susceptible to the increasing criminality that has been linked to the drug and weapons trades, ransom seeking, and the rise of religious extremism. Criminality has destabilized large parts of the Sahel region and the Horn of Africa, displacing many dryland populations, destroying social infrastructure, disrupting traditional livelihood activities, and discouraging tourism (de Haan et al. 2014).

## Opportunities

In considering the prospects for livestock production systems in dryland regions of Africa, it is important not to lose sight of the potential of the sector. Livestock systems in many dryland countries have come under pressure in recent years, resulting in uneven performance, but there is scope for increasing productivity and production. Policy reforms and supporting investments could stimulate changes in production technologies and management practices that could halve the regional deficit in livestock-sourced products that is projected to develop by 2030, should current supply and demand trends continue. At the same time, it is important to recognize that even with these interventions, there will not be enough water, grazing resources, and animals to provide all livestock-keepers in the drylands with an income above the poverty line.

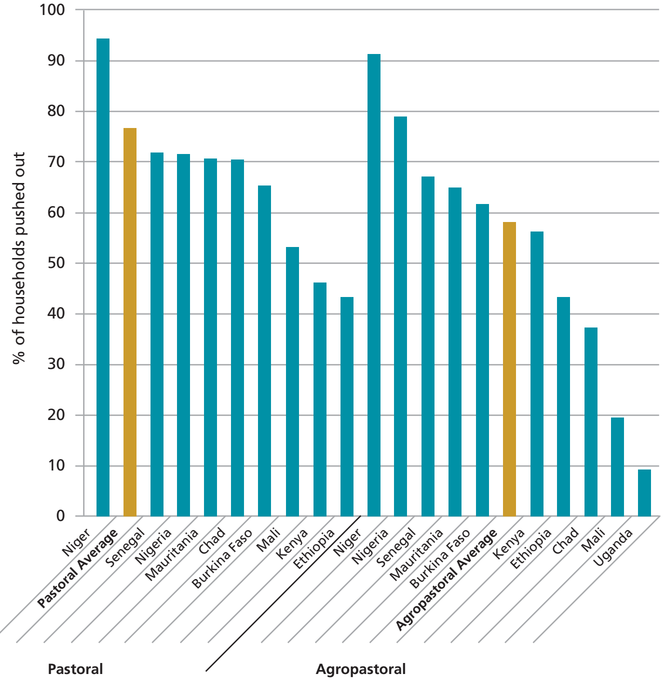
With respect to pastoralism, studies have consistently confirmed the productive efficiency of well-managed pastoral systems in the drylands of Africa, compared, for example, to ranching systems in similarly dry regions in developed countries, including Australia and the United States (see Breman and de Wit 1983).The main opportunities in African pastoral systems, therefore, lie not so much in further increasing productive efficiency, but rather to putting in place systems that will enable buffers and rapid adjustments to the "boom and bust" cycles that characterize the system. This could be achieved by maintaining the mobility of herds to allow them to avoid climate shocks, improving animal health services to reduce losses from disease outbreaks and climate shocks, facilitating early destocking when drought is imminent and restocking when rains resume, fostering better market integration, in particular by exploiting complementarities between drylands as the breeding areas and higher rainfall areas for fattening younger stock from the drier areas, and consolidating small holdings of livestock into larger, more resilient, and more viable units.

With respect to agro-pastoralism, the main opportunities lie in the intensification of production systems so as to increase the volume and value of commercial sales. This could be achieved by improving animal genetics to accelerate growth and increase offtake rates, improving animal health services to reduce losses from disease outbreaks and climate shocks, exploiting complementarities between crop and livestock production systems to improve the quantity and quality of available feed resources, and strengthening livestock value chains to increase marketing opportunities. As in the case of pastoralism, consolidation of small herds into larger holdings is needed to ensure that livestock-dependent households have at least the minimum number of animals needed to remain resilient.[2]

To what extent could currently available technologies improve the resilience of livestock-dependent populations living in dryland regions of Africa? To answer this question, it would be important first to understand what would likely happen in the absence of any interventions. The umbrella model (described in Chapter 4) was used to project the numbers of livestock-dependent households likely to be living in the dryland regions of Africa by 2030. Under the "Business as Usual" (BAU) scenario, 77 percent of pastoralist households and 58 percent of agro-pastoralist households are projected to own fewer than 5 TLUs (Figure 5.2). Expressed as a share of livestock-dependent households, the number of poor/vulnerable households is especially high in Niger.

With the BAU baseline established, the potential impacts of four interventions were modeled: (1) improving animal health services, (2) improving access to feed resources, (3) promoting off-take of young male animals from the drylands for fattening in higher rainfall areas, and (4) introducing progressive taxation policies to bring about a more equitable distribution of livestock ownership (Box 5.1).

**Figure 5.2 Livestock-keeping households likely to be forced to seek alternative livelihood strategies under a BAU scenario, selected countries, 2030 (%)**




*Source:* de Haan et al. 2015

**BOX 5.1**

## Modeling livestock systems in the drylands

An important original contribution of the study whose results are reported in this book has been to break new methodological ground in the modeling of livestock systems in the drylands. Five simulation models were used in combination to estimate the impacts of the resilience-enhancing interventions on feed balances, livestock production, and household income resilience, under a range of climate scenarios.

1. The **BIOGENERATOR model** developed by Action Contre la Faim (ACF) uses NDVI (Normalized Difference Vegetation Index) and DMP (Dry Matter Productivity) data collected since 1998 by the Satellite pour l'Observation de la Tierre (SPOT) satellite imaging system (Ham and Flliol 2011). The model was used to estimate spatially referenced usable biomass in the drylands (e.g., biomass that is edible by livestock).

*(continued next page)*

**Box 5.1** *(continued)*

2. The **Global Livestock Environmental Assessment Model (GLEAM)** developed by Gerber et al. (2013) calculates at pixel and aggregate level: (1) crop byproducts and usable crop residues; (2) livestock rations for different species of animals and production systems, assuming animal requirements are first met by high-value feed components (crop byproducts if given, and crop residues), and then by natural vegetation; (3) feed balances at pixel and aggregate level, assuming no mobility at pixel level and full mobility at grazing shed level; and (4) GHG emission intensity.
3. The **IMPACT model** developed by IFPRI is a partial equilibrium global agriculture sector model that can be used to generate baseline projections of agricultural commodity supply, demand, trade, prices, and malnutrition outcomes. On the basis of the feed rations provided by GLEAM, the IMPACT model was used to calculate the production in drylands of meat and milk and to estimate how production will affect overall supply of and demand for these products in the region.
4. The **CIRAD/MMAGE model** consists of a set of functions for simulating dynamics and production of animal or human populations, categorized by sex and age class. It was used to calculate the sex and age distribution of the four main ruminant species (cattle, camels, sheep, and goats), the feed requirements in dry matter, and milk and meat production.
5. The **ECO-RUM model** developed by CIRAD under the umbrella of the African Livestock Platform (ALive) is an Excel-supported herd dynamics model based on the earlier ILRI/CIRAD DYNMOD. The model was used to estimate the socioeconomic effects of changes in the technical parameters of the flock or herd (e.g., return on investments, income, and contribution to food security).

The modeling exercise benefitted from livestock distribution data contained in the Gridded Livestock of the World (GLW) database (Wint and Robinson 2007) and its most recent update GLW 2.0 (Robinson et al. 2014). It was also informed by information and analysis produced by the FAO livestock supply/demand model (Robinson and Pozzi 2011). For details, see de Haan et al. (2015).

The results of the above models were used as inputs for the final step of the analysis, namely the assessment of the number of households resilient, vulnerable to shocks, and likely to move out of livestock-based livelihoods. These groups were estimated as households owning livestock above or below critical TLU thresholds. The value of these thresholds was estimated using ECO-RUM; and the corresponding population shares were calculated using a log-normal estimate of the TLU distribution, which approximates quite well actual TLU distributions emerging from survey data (SHIP database). The interrelationships between model components as determined by the final analysis are shown in Figure B5.1.1.

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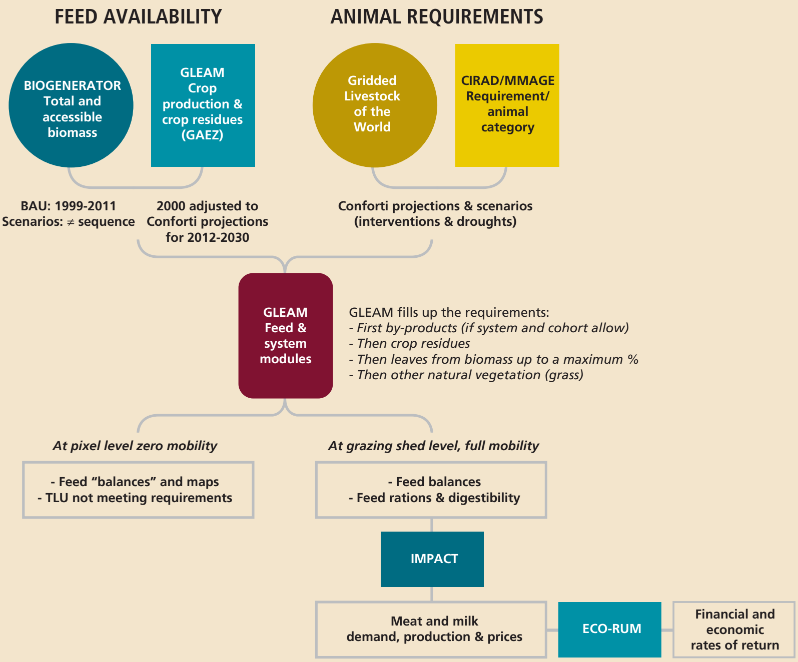
**Box 5.1** *(continued)*

**Figure B5.1.1 Interrelationships between components of livestock systems model**



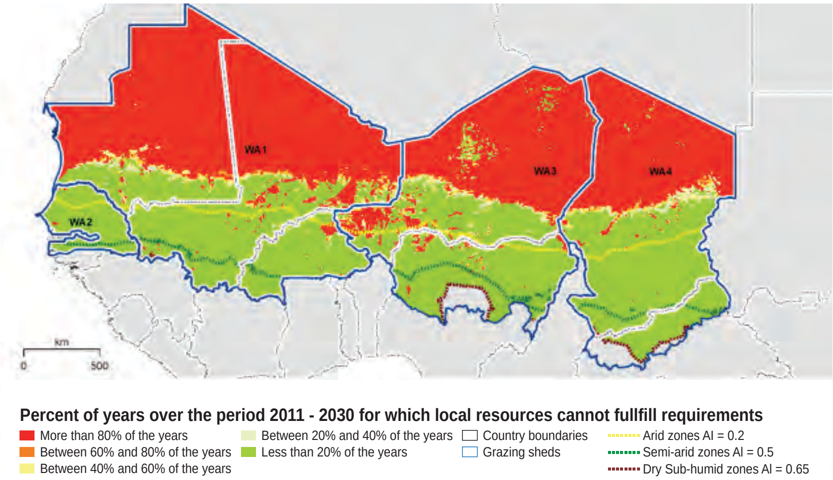

*Source:* de Haan et al. 2015

The relevance and likely effectiveness of these interventions differs according to the situation, because they address different determinants of vulnerability and resilience.

## Reducing exposure to shocks

Livestock-keepers living in drylands can avoid being affected by shocks, particularly weather shocks, if they can move out of harm's way before the shocks appear. In dryland regions of Africa, and particularly in more arid zones within the drylands, mobile pastoralist livestock systems are generally more productive than sedentary livestock systems precisely for this reason (Niamir-Fuller 1999; Catley, Lind, and Scoones 2012). Drawing on inherited knowledge that has been accumulated over many generations, plus their own personal experience, pastoralists are extremely skilled at moving their animals to take advantage of seasonal feed and water resources while avoiding locations during periods when weather-related shocks are likely to occur. Map 5.1 demonstrates, under a no-drought scenario, the areas in

**Map 5.1 Estimated need for movement of animals in relation to feed, Sahel and Horn of Africa (Baseline, no-drought scenario)**




*Source:* Authors' estimates

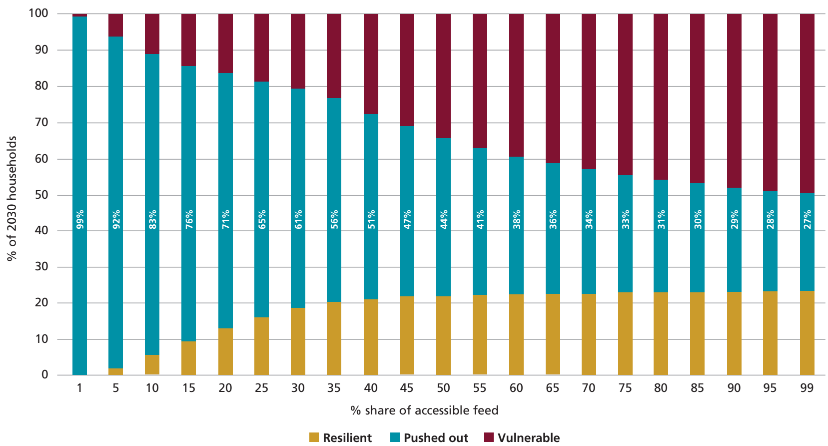
*Note:* WA1, WA2, WA3 and WA4 are labels used to identify the West Africa "grazing sheds." These are defined as areas likely to be used for transhumance predominantly by the same population and herds/flocks each year. The boundaries of the grazing sheds are based on animal mobility patterns known in the literature (SIPSA 2012) and complemented by experts' consultation.

which the local feed resources will be insufficient to provide feed on a year-round basis and for which mobility is essential (these areas appear in orange and red, depending on the frequency with which feed shortfalls occur).

Because mobility is critical, especially for pastoralists, interventions that contribute to improved mobility of livestock-keepers and their animals have the potential to significantly improve the performance of livestock systems in the drylands. Such interventions include: (1) development of water resources to allow better access to underexploited rangelands, (2) organization of feed markets to improve availability of feed in remote areas, and (3) introduction into land use planning of measures designed to facilitate movement of herds and flocks (e.g., through designation of dedicated migration corridors and dry season grazing areas). By improving access to feed, such measures designed to improve mobility can have a large impact on resilience. Figure 5.3 shows how the ratio of resilient households to vulnerable households to nonviable households changes with increasing access to feed.

Other interventions not considered in the modeling exercise can also play an important role in reducing exposure to shocks, including the following: (1) implementation of conflict resolution mechanisms in areas in which livestock-keeping competes with other livelihood activities, to ensure cooperative

**Figure 5.3** **Impact of accessibility of feed on the resilience status of livestock-keeping households, % of households**




*Source:* de Haan et al. 2015

land use; (2) development of early warning and response systems to support early destocking when a drought shock is imminent and animals can be sold before they suffer a loss in value; and (3) programs that facilitate rapid restocking after the shock has passed. Experience suggests that such mechanisms can be both effective and efficient (Feinstein International 2007).

## Reducing sensitivity to shocks

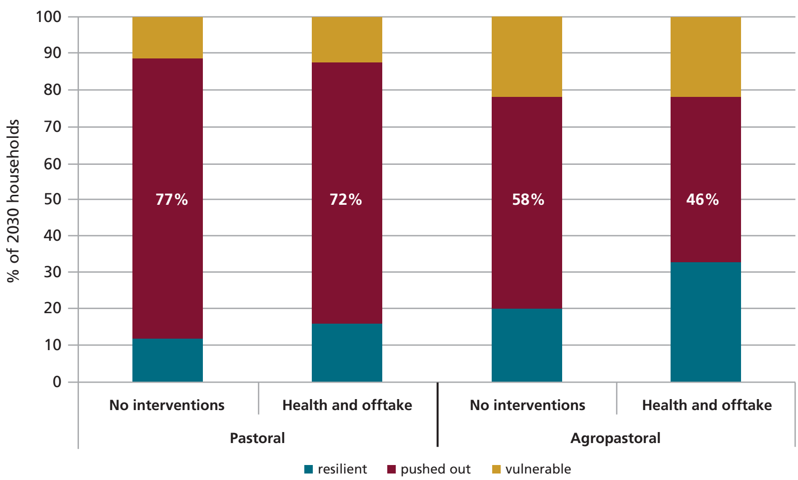
Some pastoralists will be able to anticipate shocks and move their animals to avoid them, but others will be less fortunate and will be subjected to the full force of shocks when they occur. Those adversely affected by shocks are likely to include as well the many sedentary livestock-keepers whose reliance on farming activities keeps them anchored to particular locations.

Livestock-keepers living in dryland regions who are unable to move out of harm's way when a shock occurs will be affected only to the extent that their livelihood strategy is sensitive to the effects of the shock. For this reason, interventions that reduce sensitivity to shocks have the potential to significantly improve the performance of livestock systems in the drylands. Such interventions include: (1) improving preventive and clinical animal health services to protect livestock against infectious diseases and parasites; (2) developing infrastructure and funding to promote early offtake of male animals (young bulls), to be fattened in the higher-potential areas (highlands of East Africa and more humid areas of West Africa); and (3) promoting livelihood diversification among livestock-keeping households so that they can rely on alternative sources of income when the livestock enterprise fails.

The umbrella model was used to project the impact on the resilience of livestock-dependent households by 2030 of (1) improved animal health, and (2) early offtake of young male cattle (Figure 5.4 ). The gains from these two interventions are relatively small when expressed as a proportion of all livestock-dependent households: the proportion of pastoral households owning enough TLU to be resilient would increase from 12 to 16 percent, and the number of agro-pastoral households having enough TLU to be resilient would increase from 20 to 32 percent. Still, the gains are significant when expressed in absolute terms: about 200,000 pastoral households and more than 3 million agro-pastoral households would become resilient by 2030, relative to the baseline. Similar numbers of households would emerge from the "non-viable" category, meaning they would no longer feel pressure to give up livestock-keeping. Interestingly, the projected benefits of these two interventions stand up under a range of weather scenarios.

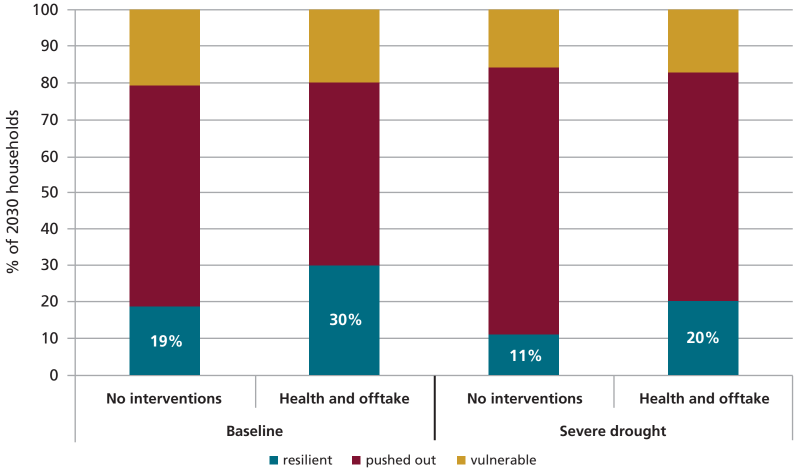
An interesting—and unexpected—finding of the umbrella modeling exercise is that strengthening animal health services in the absence of complementary measures to increase feed supplies could lead to negative outcomes. Strengthening animal health services can accelerate growth rates, creating an opportunity to boost productivity and production, but accelerated growth rates in turn will increase feed requirements, putting further strain on what will already be a constraining factor (Figure 5.5). Therefore, improvements in the delivery of animal health services will have to be accompanied by measures designed to make additional feed resources available, such as opening up underexploited grazing areas or strengthening feed supply systems (Figure 5.5).

**Figure 5.4** **Impact of improved animal health and early offtake of young bulls on the resilience status of livestock-dependent households in 2030**




*Source:* de Haan et al. 2015

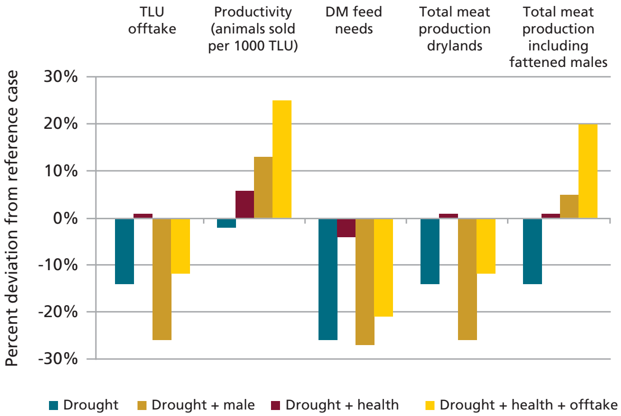
**Figure 5.5** Effect of weather on the effectiveness of improved animal health and early offtake of young bulls in improving the resilience of livestock dependent households in 2030




*Source:* de Haan et al. 2015

Figure 5.6 shows the projected impact by 2030 of improved animal health and early offtake of young male cattle on productivity and production. If implemented systematically throughout the drylands, these two practices would increase offtake by about 25 percent and production of red meat by about 20

**Figure 5.6** Average annual inputs and outputs for the different intervention scenarios compared to the baseline



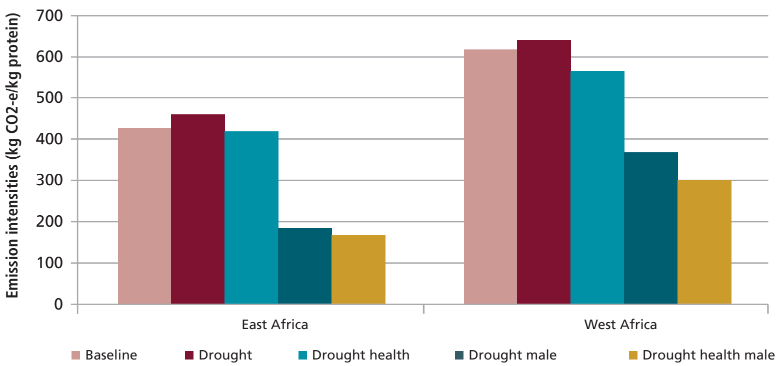

*Source:* de Haan et al. 2015

*Note:* The figures in the chart refer to the deviations from a reference scenario in which herd dynamics are driven by the same weather patterns observed in the period 1998-2011 and no policy intervention is in place.

percent, resulting in an additional 750,000 MT (metric tons) of red meat produced annually by 2030. Feed requirements in the drylands would be reduced, although they would increase significantly in the more humid areas where increased fattening of cattle would occur.

Finally, early offtake of young male cattle would have a measurable impact on greenhouse gas emissions (Figure 5.7).

**Figure 5.7 GHG emissions for different interventions and climate scenarios in the two dryland study regions**




*Source:* de Haan et al. 2015

*Note:* Average cattle emission intensities (kg $CO_2$-e/kg protein), including males fattened in humid zones.

## Improving coping capacity

Livestock-keeping households in dryland regions—unable to move out of harm's way when shocks occur and having livelihoods that are sensitive to shocks—suffer frequent income losses. For these households the ability to survive will depend mainly on their coping capacity, that is, on their ability to draw on their own accumulated resources or resources provided by others to meet their needs during a critical period until their livelihood strategies can be reestablished.

Experience suggests that many livestock-keeping households, when hit by a shock, soon exhaust their limited accumulated resources, leaving them critically dependent on public programs. Public policy thus plays an important role in supporting the recovery process, particularly for non-resilient households. In considering the instruments available to the government, it is useful to distinguish between interventions that can be implemented relatively quickly versus interventions that require time to produce results.

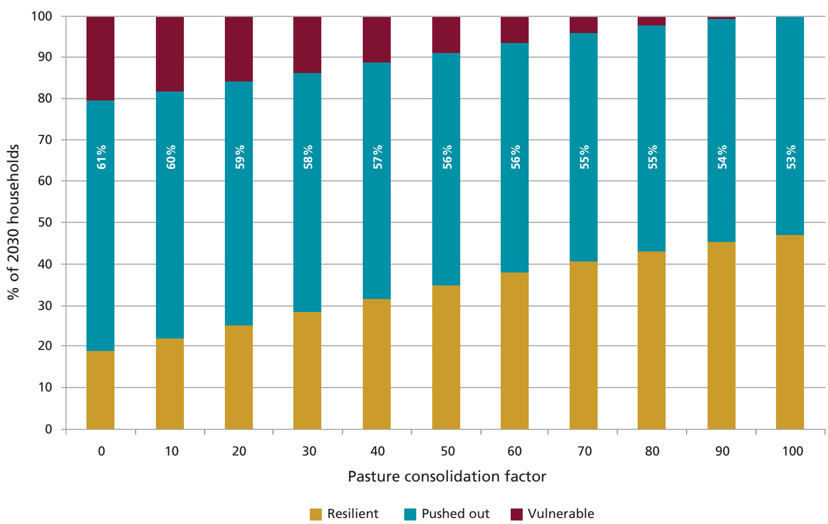
Public interventions that can be implemented in the short run to strengthen the coping capacity of livestock dependent populations include (1) introducing insurance to provide compensation for lost animals and (2) establishing scalable safety nets to provide alternative sources of income until the livestock enterprise can be fully restored. (Scalable safety nets are discussed in detail in Chapter 9.)

Over the longer term, the objective of public policy should be to make the livestock-keeping population independent of outside support as much as possible. Given finite feed resources, the only way to increase significantly the number of resilient livestock-keeping households will be to address the current highly inequitable distribution of livestock assets.

The umbrella model was used to assess the likely impact of maintaining constant at current (2010) levels the grazing area available to households that are already resilient and allocating the remaining grazing area to vulnerable households, but in a consolidated manner that ensures that every vulnerable household gains access to a grazing area that is large enough to support enough TLU to ensure that the household is resilient (Figure 5.8).

Directly allocating land and water access rights to vulnerable households while excluding resilient households, many of which own large herds, would obviously be challenging. It would not only come up against established distributions of political and economic power, but it would also run counter to the open access user rights systems that still prevail throughout most of the drylands. Still, it is possible to conceive of policies that could promote consolidation of grazing resources and lead to a more equitable redistribution, described as follows:

**Figure 5.8 Impact of consolidation of grazing area on the resilience status of livestock-keeping households, 2030**



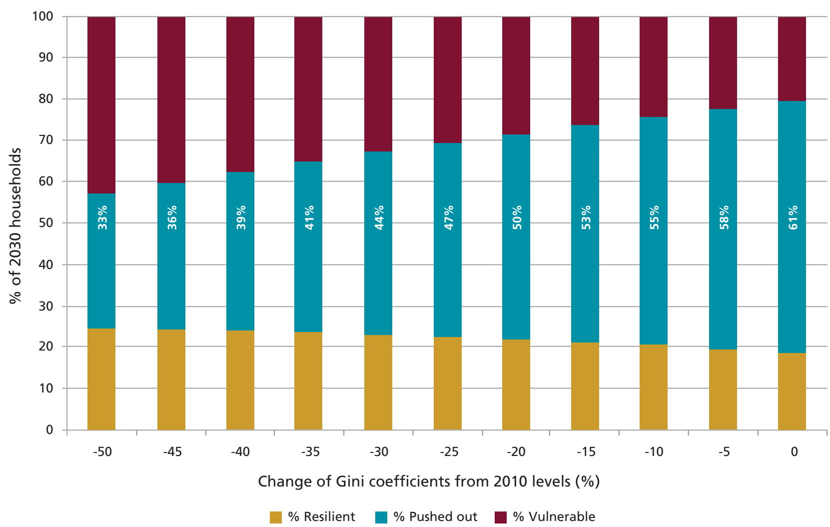

*Source:* de Haan et al. 2015

- Policies that limit land ownership (to prevent land grabbing by owners of large herds);
- Policies that enhance mobility of animals (to allow vulnerable households easier access to underutilized grazing resources); and
- Policies that allocate exclusive water use and grazing rights for the wet and dry seasons to groups of smallholder livestock-keepers (to prevent denial of access by owners of large herds).

The second intervention—redistributing assets to allow less wealthy households to accumulate larger numbers of livestock—was modeled by estimating the impact of a change in the Gini coefficient (used as a proxy for the distribution of assets). A 50 percent increase in the Gini coefficient relative to the 2010 level would cut by one-half the number of vulnerable households likely to face pressure to exit from the sector (Figure 5.9). Redistribution of assets, while always politically challenging, could in theory be achieved through the introduction of variable user fees or progressive tax policies, or both. At the practical level, a greater focus on the improvement of small ruminant production would also improve the distribution of livestock assets, as small ruminants are the main source of income for the poor.

None of interventions described above, if introduced individually, would be expected to have a transformational impact on the numbers of vulnerable

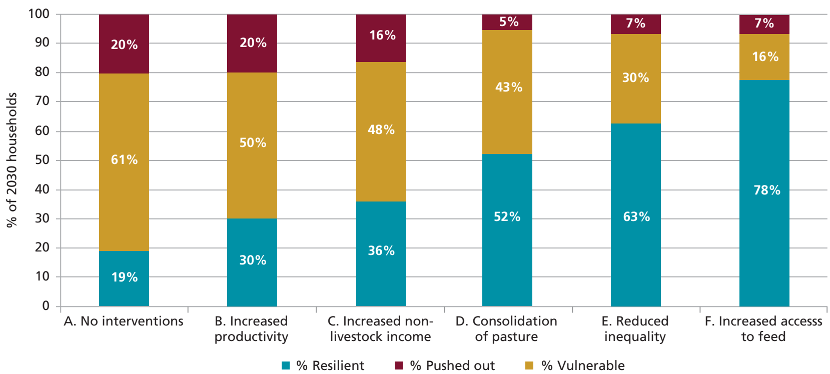
**Figure 5.9 Impact of redistribution of assets on the resilience status of livestock-keeping households, 2030**




*Source:* de Haan et al. 2015

households. For this reason, the umbrella model was used to explore the combined impact of all the interventions. Combined, the interventions could make a difference: by 2030, the number of vulnerable households could be reduced to 16 percent, and the proportion of livestock-keeping households having so few animals that they would feel pressure to exit from the sector would be reduced to only 7 percent (Figure 5.10).

**Figure 5.10 Impact of a combination of interventions on the resilience status of livestock-keeping households, 2030**




*Source:* de Haan et al. 2015

*Note:* Each intervention includes the effects of the ones preceding it; so, for example, intervention B includes the effects of intervention A; intervention C includes the effects of A and B; and so forth.

## Challenges

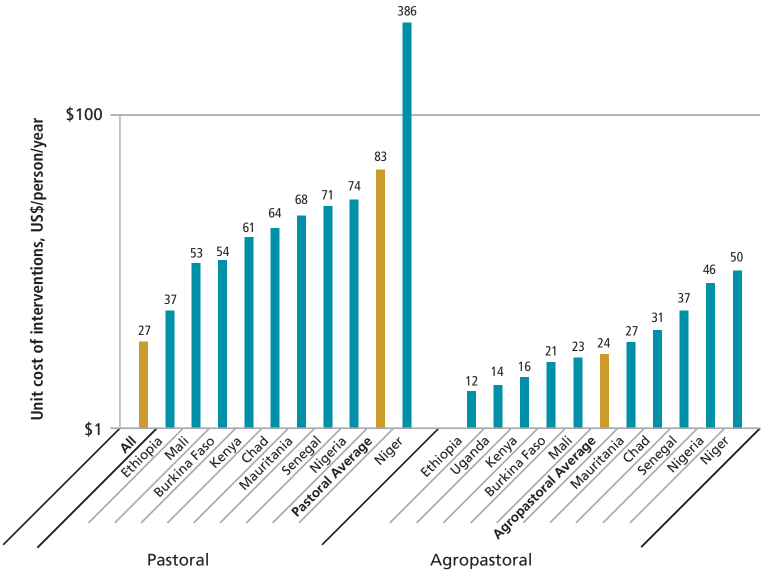
What are the obstacles to implementing these best-bet interventions designed to improve resilience among livestock-keeping populations in the drylands?

### Cost of increasing resilience

The first and perhaps most obvious challenge to overcome is cost. Analysis carried out for this book suggests that the unit cost of increasing resilience using the least-cost combination of interventions (i.e., the unit cost of making one person or one household resilient) is relatively low, ranging from US$12/person/year to $386/person/year, with an average $27/person/year for all countries and systems (Figure 5.11). Not surprisingly, the unit cost of providing resilience varies by country, by aridity zone, and by livestock system, and is significantly higher for pastoralists than for agro-pastoralists.

Using conservative assumptions, it is estimated that delivering improved animal health services and facilitating the early offtake of young male cattle would cost about US$0.5 billion per year for all the drylands of East and

**Figure 5.11** **Cost effectiveness of health improvements and early offtake measures in improving the resilience status of households**




*Source:* de Haan et al. 2015

West Africa. While this amount is not insignificant, it is certainly smaller than the average value of the economic losses caused every year by droughts, disease outbreaks, civil conflict, and other shocks. It is also well below the cost of food aid, which currently averages US$4 billion/year in the Sahel and the Horn of Africa. Compared to the cost of providing humanitarian assistance when a shock has occurred, these interventions seem like an attractive option. While certainly not insignificant, an investment of about US$0.5 billion/year would likely yield a reduction of up to US$2 billion/year in humanitarian aid.

Mobilizing the necessary funding to support these interventions will be politically challenging, of course. The interventions require recurrent funding, which may prove difficult for many governments to mobilize. Perhaps development partners could be persuaded to help ensure that the necessary financial support can be sustained over the longer term (even permanently) by recognizing the savings that will be achieved in terms of reduced need for emergency assistance.

Aside from the overall cost, successful implementation of each intervention is associated with specific challenges—technical, economic, and institutional, including those associated with the management of common property resources (Box 5.2).

**BOX 5.2**

### The challenge of managing common-pool resources in drylands

Most of the pastoralists in the drylands of East and West Africa share a strong ethos of open access to common-pool grazing resources. They believe that every pastoralist has the same rights to use grazing lands, regardless of ethnicity, nationality, seniority, or socioeconomic status. They emphatically argue that access is free and open for everyone; it does not matter where pastoralists come from, whether they are newcomers or old-timers or what is their ethnicity or nationality. For pastoralists, keeping cattle is not only a way of making a living, but also what makes life as pastoralists possible. In this sense, to deny cattle access to grazing resources is to deny pastoralists life (Moritz et al. 2013).

A large proportion of the rangelands that dominate Africa's drylands are open access. Historically there have been relatively few conflicts among African pastoralists over rights to common-pool grazing resources. Pastoralists do not live in a world made up only of pastoralists, however. They co-exist with other user groups, including farmers and fishermen, who do not share their ethos and practice of open access. Many farmers view grazing lands as lands that have not yet been made productive, and because often they do not recognize common property regimes and feel parcels can be appropriated for exclusive use by individuals, this constitutes a threat to common-pool grazing resources (Sayre et al. 2013). The result is agricultural expansion onto seasonal grazing lands and the transhumance corridors connecting them (Galvin 2009; Moritz 2006).

Many governments in East and West Africa have tried to protect pastoral resources and the rights of pastoralists to use these resources from agricultural expansion by designating agricultural and pastoral zones and delimiting transhumance corridors. These solutions have been implemented at local as well as national levels in the forms of rural or pastoral codes (Hesse and Trench 2000).

While much attention has been focused on problems of implementation and governance of rural codes (Flintan 2012; Hesse and Trench 2000; Tielkes and Schlecht 2001), there has been less discussion of the conflict between the flexibility and openness of the pastoral system and the fixing and delimitation of resources and resource use through the delimitation of pastoral zones and transhumance corridors. Turner (1999) has warned that there is a risk in formalizing pastoral tenure institutions into rural codes where flexibility is more appropriate for managing access to common-pool grazing resources, especially where there is considerable variation in the distribution of these resources through time and space. If tenure institutions become more formal and rigid, this can limit mobility, with potentially negative consequences for resilience.

*(continued next page)*

**Box 5.2** *(continued)*

Governments in East and West Africa have not always supported mobile pastoralists' use of common-pool grazing resources, for several reasons. First, while pastoralists are integrated into regional, national, and international livestock markets that reach millions of consumers, most of the trade is informal and invisible (Catley, Lind, and Scoones 2012; McPeak, Little, and Doss 2012). Governments therefore naturally favor the interests of agriculturalists whose production is more visible and more easily taxed (Behnke and Kerven 2013). Second, national laws are generally better at protecting the user rights of sedentary farmers over the grazing rights of mobile pastoralists, in part because mobile pastoralists do not remain in one location throughout the year, but also because pastoralists are not seen as making investments in the land, which is often a condition for obtaining tenure rights. Third, the processes of decentralization across Africa have resulted in more local control over natural resources, mostly at the level of municipalities. While decentralization works well for farmers who stay within a particular municipality throughout the year, that is not the case for mobile pastoralists who move through and use common-pool grazing resources in multiple municipalities over the course of a year. This means that decentralization and local control over natural resources are not accommodating mobile pastoral systems and are not appropriate for the governance of common-pool grazing resources in these systems (Turner 1999).

One of the key lessons of the "paradox of pastoral land tenure" is the need of pastoralists to secure access to pasture and water, but also to retain flexibility in resource use (Fernández-Giménez 2002). The critical lesson here is that governance needs to focus on supporting the flexibility of pastoral mobility in an open system, and this is not achieved by mapping, fixing, and delimiting the corridors, which may even have the opposite effect. The interests in support of pastoral mobility at the national and regional level are often not aligned with those at the local level, where government officials and traditional authorities tend to have primarily agricultural constituencies. At the national level, authorities benefit from the free movement of cattle because of taxes and other levies on pastoralists and livestock traders, whereas at the local level, authorities derive most of their income from agricultural populations.

*Source:* Adapted from Kerven and Behnke 2014.

## Improving animal health services

In the absence of private service providers, governments supported by development partners have often financed public provision of animal health services. Such efforts can be beneficial in the short run, but they usually prove counterproductive in the long run, as they undermine the incentives for private service providers to enter into the market once effective demand emerges. The challenge for policy makers is to create an incentive framework that can attract private service providers to enter into the market as public service providers are gradually phased out.

### Improving access to feed resources

Despite recent advances in legislation dealing with the pastoral economy, especially in the Sahelian countries, pastoral mobility is increasingly being hampered by the expansion of cultivated cropland. Land use rights in pastoral zones remain generally precarious, as often they are not recognized by institutions, especially in the strategic areas of lowlands, riverbanks, wet valleys, forestry and pastoral reserves (Ickowicz et al. 2012). Policy reforms designed to formalize access by pastoralists to rangelands, coupled with investments in water resource development (to open up underutilized zones) and protection of corridors (to facilitate movement of animals to underutilized feed resources), could allow more complete use of available feed resources.

### Consolidating herd size and feed resources

Because of the highly inequitable distribution of livestock assets and the limitations on animal and feed resources, large numbers of households will not be able to accumulate the numbers of animals needed to generate enough income for them to remain above the poverty line. One way to overcome this problem would be to provide poor livestock-keepers with alternative sources of income, which would enable many of them to exit from the sector, freeing up resources for access by others. Facilitating exit from the sector—which is already occurring and will have to accelerate in future—is likely to be challenging from a policy perspective, but it represents an opportunity for poor households to transition into more productive and more sustainable livelihoods.

### Achieving more equitable distribution of livestock resources

Evidence is accumulating that livestock ownership both in the Horn of Africa and in the Sahel is becoming increasingly concentrated. Ever greater numbers of animals are ending up in the hands of wealthy traders and government officials, who tend to manage their herds using hired labor, which crowds out many of the small-scale herders who make up by far the largest share of the livestock-keeping population. If this trend could be reversed, the households able to accumulate the numbers of animals needed to stay above the poverty line could increase significantly. Progressive taxation of livestock assets and imposition of user fees in public rangelands could discourage accumulation of large herds, but such policies are likely to engender significant resistance from politically and economically influential livestock owners.

## Key messages

The analysis summarized here makes clear that there is scope for expanding livestock production in drylands and increasing the contribution of drylands producers to the rising demand in Sub-Saharan Africa for animal-source products. Policy changes and supporting investments such as those described here could halve the regional deficit projected to emerge by 2030.

The results of the modeling exercise suggest that feed and animal resources will be insufficient to provide secure and adequate livelihoods for all of the people in the drylands who depend on livestock as their principal livelihood source. Under the BAU scenario, by 2030 about 77 percent of pastoralist households and 58 percent of agro-pastoralist households will not be able to accumulate the numbers of animals needed to generate enough income for them to subsist even at 50 percent of the poverty line. The current inequitable distribution of livestock assets, which is projected to become worse as a result of the ongoing transformation of the dryland economy, is likely to put further pressure on poor pastoralists.

Fortunately, these gloomy scenarios can be avoided. Investments in improving animal health services and increasing market integration, combined with measures to improve access to the available feed resources, could increase the share of livestock-keeping households able to accumulate enough animals to remain resilient. Adoption of the full package of best-bet interventions could reduce the share of livestock-keeping households who feel pressure to exit from the sector to as little as 7 percent.

The development of alternative sources of income, inside or outside the drylands, needs to be an integral and major component of any dryland development strategy. Going forward, the traditional narrow focus on increasing production of milk and meat will have to change so as to embrace a wider range of diversified income generating activities. There is need as well to strengthen the incentives for livestock-keepers to serve as responsible stewards of the environment.

Government policies designed to sedentarize pastoralists, particularly in the more arid zones, are unlikely to succeed. Herds and flocks must be mobile if they are to use temporally and geographically distributed feed resources, so measures that restrict their mobility will reduce productivity and exacerbate poverty.

## Notes

1. The Tropical Livestock Unit (TLU) is an artificial construct that can be used to aggregate different livestock species. For Sub-Saharan Africa, the conversion factors are: 1 camel = 0.7 TLU, I cow = 0.6 TLU, and 1 sheep or goat = 0.1 TLU.
2. Resilient households are defined as households owning at least the minimum number of TLU needed to stay above the poverty line, assuming that 70% of the income of pastoralists is derived from livestock, and 35% of the income of agro-pastoralists. Three categories are distinguished: (a) resilient households = households owning more than 15 TLU, (b) vulnerable households = households owning 7.5 to 15 TLU, and (c) non-viable households = households owning less than 7.5 TLU and likely to be forced to seek an alternative livelihood strategy. These levels increase with drought and decrease with the introduction of productivity-enhancing innovations. For details, see De Haan et al. 2015.

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