Pastoralism: A critical asset for food security under global climate change

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Implications

• Pastoralism is defined by a specialization to take advantage of the characteristic instability of rangeland environments. Through strategic mobility, pastoralism finds an asset in the existence of dynamic variability in the drylands, where sedentary agriculture or mixed farming find a problem in their lack of uniformity and stability.
• It is crucial to distinguish between the vulnerability that is the business of pastoral systems to manage and the vulnerability that arises from obstacles to operate the system.
• Unless investments are shifted from replacing pastoralism to developing pastoralism on its own terms, we risk jeopardizing the continuity and stability.
• Pastoral production systems are found in climatic zones as different as deserts, dry plains, savannahs, steppes, tundra, and high-altitude mountain ranges, but all have in common the exploitation of ephemeral concentrations of resources (Behnke et al., 2011; Figure 1). Asner et al. (2004) estimate that about 26 million km² of land in these biomes worldwide are

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Introduction

Pastoralism is often written off as an unsustainable system. This paper takes a closer look at this position and examines the role that pastoralism plays in relation to food security, particularly in a future in which climate variability features more prominently. We focus on sub-Saharan Africa, where problems around food security are supposed to be more alarming and which is now also in the spotlight of development policies concerned with global food security (e.g., World Bank, 2009).

The economic rationality and ecological sustainability of pastoral systems are amply documented (Homewood, 2008) and are attracting new attention vis-à-vis emerging interests in resilience and adaptability (e.g., African Union, 2010). However, there is still a deeply rooted apprehensiveness in rural development circles at national and international levels, that investments in securing pastoralism hold back development rather than promoting it, both with regard to the people in pastoralism and to the livestock sector as a whole (with important exceptions, for example, the African Union Policy Framework on Pastoralism; African Union, 2010). In the 21st century, this concern intersects with four crisis scenarios that have come to dominate global agricultural policies: the ecological crisis around the degradation of agricultural land, now accompanied by new alarms for greenhouse gas emissions and climate change; the fuel crisis which transformed allegedly “empty” and “resource-poor” drylands into a sought-after asset for producing biofuel or securing the subsidies associated with governments’ pledges for green energy; the financial crisis, as the collapse of the subprime mortgage market in the U.S. and in Europe in 2005–2006 made commodities index funds, including those for agricultural land and grains, an attractive alternative for investors; and finally the food crisis, as alarm over food-price volatility during the 2007–2008 spike highlighted the dependency of agricultural commodity prices on the oil price and the influence of the global financial market.

At the crossroads of these scenarios lies the ongoing global undertaking of incorporating communal land into commodity markets, especially in Africa, legitimized, in ways that are disturbingly recalling of colonial times, by arguments that link entitlement to “natural” resources to the relative “potential” of production systems. Narratives of chronic food security in pastoral drylands, underpinned by the presupposition of pastoralism’s structural low-productivity and endemic vulnerability should be read against this background (Levine, 2011).

In this article, we look beyond these general narratives, where pastoralism and the drylands often serve as a negative benchmark while remaining marginal to the main concern. We start by addressing the economic importance of pastoral production in arid and semi-arid areas in Africa compared with other production systems in the same conditions. Second, we focus on the pastoral system of production and provide evidence of the contribution it makes to food security in these areas. Third, we consider the current and prospective constraints to the realization of the potential of pastoral production in relation to food insecurity. Finally, we examine a range of options that might enhance the contribution pastoral production is able to make, both to food security and economic prosperity in the region, and potentially elsewhere.

Importance of Pastoralism

Pastoral production systems are found in climatic zones as different as deserts, dry plains, savannahs, steppes, tundra, and high-altitude mountain ranges, but all have in common the exploitation of ephemeral concentrations of resources (Behnke et al., 2011; Figure 1). Asner et al. (2004) estimate that about 26 million km² of land in these biomes worldwide are
under managed-grazing systems, which is more than the combined areas of United States, China, and the European Union.

Claims about the number of people involved in pastoralism vary widely (±10-fold), largely depending on how pastoralism is defined. Rass (2006) estimates about “120 million pastoralists/agro-pastoralists worldwide,” 50 million of which are in sub-Saharan Africa, 31 million in West Asia and North Africa, 25 million in Central Asia, 10 million in South Asia and 5 million in Central and South America. The economic importance of pastoralism has long been hidden by data aggregation in national statistics, but some figures have started to emerge from a growing number of country studies (see box to the right).

In the first pan-African policy on pastoralism, the African Union claims that pastoral systems make a substantial contribution to both national and regional economies and describes them as the most important and sustainable economic activity in the rangelands (African Union, 2010).

**System of Production and Contribution to Food Security**

**Moving to Meet Ephemeral Concentrations of Resources**

The term “pastoralism” refers to both an economic activity and a cultural identity, but the latter does not necessarily imply the former. This is often a source of confusion. As an economic activity based on animal production, pastoralism is defined by a specialization to take advantage of the characteristic instability of most rangeland environments, where key resources such as nutrients and water for livestock can be relied on in the form of unpredictable and short-lived concentrations more than in uniform and stable distributions. In pastoral systems, the herders are mobile with...
the livestock to target the patchy availability of resources, while other household members might be sedentary for part or most of the year. Herders target areas of prime pasture with species combinations they know to be beneficial to their animals. The goal of this “strategic mobility” (African Union, 2010) is to enhance production by keeping the livestock on a diet that is higher in nutritional value than the average value of the range (first recorded by Breman and De Wit, 1983; Figure 2). Ruminants respond to a poor diet by decreasing intake. For this reason, as grazing livestock cannot trade quality for quantity, the most specialized groups of pastoralists try to breed animals particularly competent in feeding selectively, that is capable of avoiding the less nutritious opportunities and only feeding on the best bites (Krätli, 2008).

If not constrained, pastoralists target optimal animal nutrition by monitoring the range and leading their herds onto the best available pastures throughout the year (first recorded by Wilson and Clarke, 1976). There is a great deal of knowledge management involved in these processes (Kaufmann, 2007). This routine mobility for production is fundamentally different from the mobility as a coping strategy aimed at minimizing the negative effects of drought, epidemics, or conflict. The conceptual difference is evident in pastoralists’ languages but usually lost in translation. Pulled by relative abundance rather than pushed by scarcity, this production-boosting mobility is much more intense during the wet season, when returns are highest. This is well understood by livestock traders in East and West Africa, who use pastoral strategic mobility to fatten their animals on the hoof while marching them to the terminal markets during the wet season (Dirani et al., 2010; Thébaud and Corniaux, 2011). In economic terms, the rangeland environment experienced by the herds under this regime is significantly more favorable than the same environment described from the perspective of sedentary agriculture or mixed farming. Through strategic mobility, pastoralism finds an asset in the existence of dynamic variability in rangeland environments where sedentary agriculture finds a problem in its lack of uniformity and stability (Figure 3). This distinction is, ultimately, what characterizes the pastoral system.

Strategic mobility offers the highest returns but requires relatively large herds and extensive social networks. Livestock in impoverished households with shrunk social capital is moved much less, both in frequency and intensity. Households may try to minimize offtake and save on subsistence costs by taking up farming. When herds are too small for specialized pastoralism, households are forced to focus on short-term benefit at the expense of the long-term viability (e.g., selling male animals before they reach the age and condition for the best market price). For this reason, and because less mobile herds have a poorer diet and therefore lower productivity, this condition quickly becomes a poverty trap. Impoverished pastoral households (as long as they see an opportunity) are usually committed to increasing the size of their herds so to be again able to enter the virtuous cycle of mobile strategies of production. Dryland pastoralists might also balance mobility against perceived risks (for example, insecurity) or advantages (e.g., the wish or necessity to access services still only provided in settlements), or against land access constraints. Mobility requires functional land tenure and access arrangements, typically institutions of communal management, that without permitting unlimited open access, are flexible enough to accommodate highly dynamic land-use patterns.

In all cases, reducing mobility lowers the returns of dryland animal production and compromises both economic and ecological sustainability (IUCN, 2012). One of the most critical analyses of the environmental impact of the livestock sector, The Livestock’s Long Shadow, found that “If properly managed, nomadic pastoral livestock production is potentially the most environmentally compatible agricultural activity in this ecosystem [drylands]” (Steinfield et al., 2006, p. 260)

**Making Food from Environmental Instability**

In September 2011, then CEO of the CGIAR Consortium, Lloyd Le Page, was quoted as saying: “Livestock provides more food security than growing crops in many arid and semiarid areas…. The food crisis in the Horn is essentially a livestock crisis” (Tran, 2011). Comparing nutritional

**Figure 2.** Red Bororo zebus in Niger on the move with their herder (source: Saverio Krätli).
status of children from nomadic and sedentary population groups in Mali, Pedersen and Benjaminsen (2008) conclude that farming appears to be a poorer adaptation than nomadic pastoralism in arid environments such as the northern Sahel. Mobile pastoral systems in both West and East Africa were found to perform better than sedentary systems under the same conditions. In Sudan, Wilson and Clarke (1976) found that “in almost every production parameter, the performance of the former is superior to that of the latter.” In Niger, nomadism was found to increase productivity by 27% compared with sedentary livestock systems and by 10% compared with transhumant systems (Colin de Verdière, 1995).

Comparisons between ranches and pastoral systems by 26 independent studies between 1974 and 1993, looking at nine countries in East, West, and Southern Africa, consistently found returns per hectare several times greater in pastoralism (Scoones, 1995). In a more recent example from southwestern Uganda, returns per hectare were found 6.8 times greater in pastoralism than ranches (Ocaido et al., 2009). Figures recently published by the FAO indicate that human-edible protein from livestock is produced much more efficiently in countries where the sector is dominated by pastoralism, with protein input/output ratios between 1:4 and 1:21 in India, Sudan, New Zealand, Mongolia, Ethiopia, and Kenya compared with those of intensive livestock systems where the ratios are well below or around 1:1 in Saudi Arabia, USA, Germany, China, the Netherlands, and Brazil (Steinfeld, 2012). This also highlights the comparative advantage for livestock production in pastoral systems over intensive systems with regard to the dependence on fossil fuels (as pastoralism is a low-carbon production system) and the limited use of cultivated fodder or competition with food crops (Steinfeld et al., 2010).

**Resilience and Viability**

Beside using strategic mobility and livestock feeding selectivity, pastoralists interface the instability of their operating conditions with a high degree of diversity within the production system itself. A common strategy is keeping a variety of livestock species with different feed requirements and providing different products and functions to the household (e.g., small stock for covering small expenses and large stock for milk production and annual sales). Examples would include breeds or lines with different kinds of performance, not only absolute productivity but also productivity sustained over long periods of time (several years, and therefore including crises); low maintenance requirements; the capacity of quickly accumulating reserves of fat (during the short rainy seasons) and losing them slowly (during the long dry seasons); the capacity of tolerating (or even thriving on) long watering intervals during the dry season, and therefore gaining access to better pasture areas far away from watering points; or the capacity of different complex patterns of interaction with their environment (including conspecifics and humans), which facilitate herd management strategies and, in combination with one another, enhance the overall (sustained) productivity of the herd (Kaufmann 2007; Kräti 2007).

**Pastoralism Supports Livelihoods Outside of Pastoralism**

Supplying both domestic and export markets, pastoralism provides growing urban populations with meat at competitive prices and secures livelihoods, not only for millions of primary producers, but also for tens of thousands people working in and around the livestock trade (Aklilu and Catley 2011; Gertel and Le Heron, 2011). For example, the primary production of livestock in Sudan (dominated by pastoral systems) supports thousands of trading and non-trading market operators, transporters, drovers, hundreds of feedlot operations, and more than 50,000 jobs (estimate) between meat and skin processing (Kräti, unpublished). Pastoral systems also support important auxiliary market chains such as fodder and crop residues and water for livestock. They are specialized but rarely isolated. In many parts of sub-Saharan Africa, pastoral systems are still (or sometimes again) part of a regional integration with crop systems, for example where pastoral herds feed regularly on crop residues on the fields, either in exchange for manure or for cash (Powell et al., 1994). They provide small-scale farmers with draft-oxen, as well as the cheapest and often the only source of regeneration of soil fertility: manure. In Ethiopia, for example, pastoralism was estimated to contribute 20% of the draft power used in agriculture, with almost three million oxen (EEA, 2005), and produce manure for an estimate value of US$34 million (SOS Sahel Ethiopia, 2007).
Inhibiting and distorting pastoral systems increases vulnerability, not only in the drylands and among livestock primary producers, but all along the market chains driven by livestock production and trade and across networks of regional integration with farming.

Understanding the Vulnerability of Pastoralism

Jeff Hill, in his role as director for policy at USAID Bureau for Food Security, was recently quoted as saying that “It is not drought, but vulnerability to drought that is eroding food security in [the drylands of Somalia, Ethiopia, and Kenya] and this vulnerability is a result of chronic underinvestment” (Tran, 2011). Besides underinvestment, we would add, the vulnerability of pastoralism is also the result of substantial investments in the wrong direction, often misguided by inadequate analysis. In a recent paper, the United Nations Special Rapporteur on the Right to Food, Olivier De Schutter (2011), argues that using the current performance of small-scale farming systems as a baseline for measuring their productive potential is methodologically flawed as it ignores decades of underinvestment. The argument is particularly pertinent to pastoral systems, the current performance of which should be balanced against the background of at least half a century of antagonistic policies and neglect. But vulnerability itself needs a closer look.

Strategic Vulnerability

A degree of vulnerability is inherent to pastoralism as it is inherent to any system operating by harnessing risk and instability (e.g., sea fishery or the military; Figure 4). When addressing vulnerability in pastoralism, it is therefore crucial to distinguish between this “baseline vulnerability,” which is strategic and the managing of which is the business of the system, and the unnecessary and dysfunctional vulnerability that arises from the sudden or cumulative incapacity to operate the system due to structural changes triggered by external forces, internal adjustments, or disasters. For pastoralist households, this “non-strategic vulnerability” increases as their capacity to operate pastoral production strategies decreases (Little et al., 2001). These strategies enable pastoralism to “float on instability,” so to speak, using it as a swimmer uses water. Those who stop swimming go down: when pastoralists cannot operate pastoral production strategies (for example, when there are too many constraints to mobility), instability can take over and trigger a crisis. To the outsider, it is easy to lose sight of the actual causes and attribute these crises to the baseline vulnerability of pastoral systems, seeing liability in pastoralism rather than in the obstacles to operate it. A recent policy document produced by the Ministry for Development of Northern Kenya makes a clear link between food insecurity among pastoralists and the incapacity to operate the pastoral system: “Eighteen of the 20 poorest constituencies in Kenya, where 74 to 97% of people live below the poverty line, are in Northern Kenya. The greatest rates of poverty are observed among those who are no longer directly involved in pastoralism, particularly those without livestock who depend on casual labor or petty trade in towns.” (MDNKOAL, 2010, p. 5)

Induced Vulnerability

But what prevents pastoralists from operating the production strategies that enable them to harness instability for their own economic goals? Numerous processes are at work. We list four that appear to us particularly

Figure 4. Wodaabe camp north of the 16th parallel in Niger at the peak of the dry season, more than 100 km from the nearest center: notice the abundance of straw all around (source: Saverio Krätli).
critical. The first is straightforward alienation of pastoral resources, for example to conservation, mechanized agriculture, and irrigation schemes, and more recently, to biofuel plantations, carbon-trade speculation, and the widening gap between wealthy and poor within the pastoral system itself, which secures resources for some but at the expense of many (Catley and Aklilu, 2012). These processes are amplified by the vicious cycle of “shrinking resource base–overuse–degradation.” Second, agricultural land tenure reforms that overlook and thus undermine the ways rangelands are actually used for production in pastoral systems. Third, there has been a long and widespread undermining of pastoralists’ socio-cultural apparatus of values, codes of conduct, and institutions through programs aimed at “changing pastoralists’ mindset,” from overt indoctrination through missionary and development work to anti-pastoralism teaching embedded within formal education curricula, without asking whether or not such values, codes of conduct, and institutions play a role in securing the resilience and performance of pastoral production (Figure 5). Fourth, replacing diversity and complementarity between production systems with uniformity and competition results in the generation of resource scarcity and increases the risk of conflict. For example, replacing livestock–crop integration between specialist pastoralism and farming at a regional scale, with the farm-scale crop–livestock integration of mixed farming systems, bears high ecological (Powell et al., 1994), logistical, and organizational costs (Pedersen and Benjaminsen, 2008) and can deprive both systems of the advantages from specialization, thus decreasing the overall efficiency. Agro-pastoral systems, as opposed to mixed farming, often combine within the same household specialized farmers and mobile specialized pastoralists, and therefore maintain livestock–crop integration also at the regional scale. These four processes described above inhibit both the systemic and the capacity of the individual to harness the instability of dryland environments for animal production, triggering a vulnerability chain reaction, not only to droughts, but to any crisis, from epidemics and conflict to the volatility of food prices.

Reversing the Trend: Moving Forward

Regarding dryland development, policymakers must decide whether they view the drylands and pastoralism as characterized by deficit or, rather, by “unreleased potential” (MDNKOAL, 2010). The question whether pastoralism is “on its way out” or is “the way forward” is of the kind that Heinz von Foerster (2002), the founder of second-order cybernetics, called “undecidable questions”: questions for which there is no compellingly conclusive answer. As with subscribing to a development narrative (Roe, 1991), the subjective choice that “decides” an undecidable question creates a cascade of logical implications, channelling action and making it politically possible.

Based on our analysis, we choose to view pastoralism and drylands as characterized by unreleased potential: historically undervalued (producing economic growth out of persistent underinvestment) and a depository of a sustainable alternative way of approaching environmental instability in agriculture at times when instability is becoming routine also outside of the drylands. We encourage decision makers to invest in pastoralism, identifying and implementing strategies to understand, consolidate, and increase the present contribution of pastoral systems to food security, and livelihood, from the local to global level.

Rural development has been locked onto command-and-control approaches to food production (Folke et al., 2002) that try to “correct” environmental instability rather than use it. In the drylands, this perspective has driven attention and resources away from the study of existing and
sustainable production systems, especially mobile pastoralism, focusing instead on alternative kinds of livelihood. Options to secure livelihoods within the pastoral system have been closed down rather than strengthened. This trend must be reversed. In the pan-African policy-making context, this door has been opened, but it is crucial now to walk through it and not let it close again. By calling for reversing present trends, we do not advocate the return to a primeval state but, rather, a move to innovative and imaginative forms of integration. Crucially, we advocate a shift from a focus on replacing pastoralism to a focus on developing it on its own terms, namely turning instability into an asset. More than a need to invent altogether new development tools and strategies, this seems to us a matter of re-qualifying existing sets of problems and solutions. In this final section, we articulate this approach in two examples of well-known “dead ends” of pastoral development: modernization and education.

Modernization

While pastoralists have been grabbing any opportunity to acquire innovations and technologies that could be integrated into their production system (the fire-like spread of mobile phones, despite illiteracy, being the most obvious example), a serious attempt to modernize pastoralism as such has yet to be made (Figure 6). The assumption at work so far has been that modernization necessarily leads out of pastoralism. We have seen that pastoral systems specialize in exploiting the short-lived concentrations of resources characteristic of unstable environments. A “perfect market” of modernization would have developed innovative solutions to the pastoral problems associated with these strategies. Instead, the real market has tried to cut corners, putting pressure on pastoralists to transform their production system to accommodate ready-made problem-solution sets that, developed in temperate environments, are designed to capture economies of scale by maximizing the exploitation of uniform and stable conditions (Kräti and Schareika, 2010). Re-qualifying problem-solution sets under this respect would start from asking how scientific research and technological development in the making can work with specialized producers to support and improve their strategies for exploiting environmental instability. It would start from generating knowledge and developing technologies capable of assisting strategic mobility and feeding selectivity to achieve their goals, and supporting the conditions that make these strategies sustainable.

Pastoralism is a knowledge-intensive system that needs to operate with real-time intelligence (Kaufmann, 2007). Existing drought early warning systems (DEWS) have sometimes developed as knowledge management systems, systematically collecting and analyzing information on pasture quality, market prices, and several other indicators. Although very useful, this is still happening within a framework that understands environmental instability only as a problem. Pastoralists do use risk-aversion strategies in case of serious droughts, but there is more to pastoralism than risk aversion (Roe et al., 1998). Re-qualifying the problem-solution set here, taking the “instability-as-an-asset” perspective seriously, would mean to develop DEWS into knowledge management frameworks able to simultaneously inform both dimensions of pastoral systems (as pastoralists’ institutions for knowledge management do): not only for risk aversion as in traditional DEWS, but also for improving sustained production through informing and optimizing strategic mobility. This form of knowledge management is already operated by pastoralists but could be potentiated with the help of coordination and information and communication technology. One way to do it might be to use a tool such as crowdsourcing (e.g., see http://www.ushahidi.com), with community-based, real-time micro-monitoring of pasture conditions and herd movements, with information inputted directly by herdsmen (e.g. through mobile phones). The data would be continuously analyzed and made available to herdsmen (e.g., through mobile phones) in a way similar to existing services offering real-time information to drivers on road conditions, roadworks, and traffic jams.

Education

Formal education is seen as a crucial step in the modernization of pastoralism. However, as in other modernization programs, this view is usually based on the assumption that educated pastoralists will settle, take a job in town, and therefore “modernize” not as pastoralists, but by abandoning pastoralism. In actuality, there is little modernity in most “modern education,” delivered through a classroom model (a teacher in front of a group of children) that has remained fundamentally unchanged since the 15th century. Nevertheless, why change a system that works? The problem here is that, for children in pastoralism, it has rarely worked. Also in this case, with few exceptions, the expectation has been that pastoralists transformed their production system to accommodate the constraints imposed by the service. As with most agricultural systems worldwide, an increasing proportion of pastoral youth will not find employment in the pastoral sector or will turn to alternatives that appear more attractive. Providing this group with education is very important, but it is not going to produce a new generation of educated pastoralists. Demand for high-quality education is now strong also among pastoral producers, who want it to secure their livelihood as pastoralists in a globalized world where a specialized business like dryland animal production cannot be separated from formal education. However, having to accommodate the constraints of traditional delivery systems based on the classroom model remains a major obstacle, and even more so for girls (Figure 7). Re-qualifying the
problem-solution sets under this respect would start by asking how scientific research and technological development can work with specialized producers to remove the barriers to learning that, for such a group, are associated with the school model. In an attempt to respond to this question, the government of Kenya is in the process of finalizing a strategy for delivering a full course of primary education using a combination of audio files/radio programs, visiting tutors, and print material for “broadcasting a full primary curriculum to individual children and their families directly at the camps” (Siele et al., 2012). These examples are necessarily cursory, but we hope that they help at least to clarify what we mean by re-qualifying problem-solution sets in pastoral development to invest in supporting pastoralism on its own terms. The process necessarily starts with learning to see pastoralism and understand the way it works. To do so, new analytical tools are needed, capable of representing the reality of food production systems that operate by harnessing instability rather than by suppressing it. In a world that has taken up the challenge of reversing global climate change, reversing the processes that undermine pastoral systems, from the erosion of critical resources to compromising the dignity and values of the occupation, seems a realistic and pertinent undertaking. Whether to continue in the same direction, and miss out on an important lesson on turning instability into an asset, or reverse these trends and invest in developing and potentiating the principles at work in pastoral production, is entirely a matter of political choice.

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