Relationships between livestock production, demographic change and natural resources in Africa

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Summary

In the last years livestock research for development has been based on the concept that the demand for livestock products is increasing. This has often been referred to as the livestock revolution. Like in Europe and Asia, in Africa the local and regional demand for livestock products will increase as a result of growing populations and urbanization. To meet this increasing demand, an increase in livestock numbers and productivity per animal is needed. This study examines the development of livestock systems over time and across countries and relates this to demographic developments. This leads to a better understanding of food security and the role of animal production in consumption patterns. In addition to that, the environmental implications of the increases in animal production were studied.

This paper gives a brief overview of research efforts showing that the population growth rates in Africa are among the highest in the world, and urbanization is taking place rapidly. As expected, also the livestock production is increasing. However, this increase in production is largely attributed to an increase in livestock numbers, not in animal productivity. In some countries the livestock units per capita are even decreasing. The increase in livestock numbers has far reaching consequences on the preservation of ecosystems, land replacement and depletion, and usage of scarce water resources.

By gaining a better understanding of livestock developments and consequences on food security and environmental degradation, it is possible to better target investments in livestock production to help alleviate poverty in Africa.

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Keywords
Global change, livestock production, demographic change, natural resources

Introduction

Livestock are a key resource in African agriculture (McIntire et al., 1992; IAC, 2004), and is found in a range of agricultural production systems that range from pastoralist communities to mixed-crop livestock systems. Like the rest of the developing world, the African livestock sector continues to experience rapid structural changes due to a number of factors like demographics, economic development, environment and climate change, available technologies and knowledge, as well other factors (Moyo et al., 2009). The structural changes in the livestock sector are bringing about profound changes in livestock production systems that have significant social equity and environmental consequences. It is generally recognized that livestock have a potential to make a significant contribution to food security, poverty reduction and improved livelihoods of smallholder livestock producers in Africa and globally (Winrock International, 1992; Perry et al., 2003). However, the emergence of more vertically integrated and concentrated livestock operations can crowd out smallholders and other poor people who depend on livestock, threatening their livelihoods (World Bank, 2005).

In Africa, the population growth rates are among the highest in the world, with an average for the continent of 2.3 % per year between 1999 and 2004. In the same period the urban population increased with 3.89% per year (World Bank, 2009). In the coming decades, there generally will be a higher consumption of livestock products globally when compared to other agricultural products, like cereals. It is projected that there will be change in per capita consumption of over 40% and 60% for meat and milk production, respectively by 2030 in developing countries while in industrial countries these changes will be below 10% (IAASTD, 2007).

As expected, the total number of livestock in Africa is increasing (FAOSTAT, 2009). Currently the continent has approximately 240 million head of cattle, 233 million goats, 254 million sheep, 23 million pigs and 1400 million poultry including ducks, geese and

turkeys (FAOSTAT, 2009). It is projected that livestock numbers will increase significantly in both pastoral and mixed systems (Herrero et al., 2009).

The increase in livestock production, needed to meet the growing demand, is expected to come from the same, or even a declining, resource base. In many cases, this may lead to degradation of land, water, and animal genetic resources in both intensive and extensive livestock systems (De Haan et al., 1997; FAO, 2005; World Bank, 2005; Steinfeld et al., 2006), although the interactions between livestock and environment are not always easily understood (De Haan et al., 1997; Steinfeld et al., 2006). Some livestock systems can emit significant amounts of greenhouse gases. There are places where livestock can lead to severe environmental degradation (i.e. land conversion, nutrient loading) or where livestock can be an inefficient way of utilizing existing natural resources. However, in other parts, the positive roles of livestock in the livelihoods of poor people outweigh the environmental problems caused in many regions of the world, especially in marginal areas where alternative livelihood options do not exist (Herrero et al., 2008; McDermott et al., 2009).

Expanding domestic and export markets for livestock and rapidly growing demands create growth opportunities for livestock producers in the developing world. The poor and vulnerable people living in Africa may not benefit much from this, while they have their share of the burden on land pressure, water use, deforestation and pollution (Pica-Ciammara, 2006). There are major challenges in ensuring that intensification of livestock systems takes into account both social and environmental welfare and it needs to be targeted to sectors and areas of most probable positive social welfare returns and where natural resource condition allow for intensification (McDermott et al., 2009). The objective of this paper is to give a brief summary of research efforts study that look at the distribution of livestock systems (intensive versus extensive) over time and across countries and relates this to economic variables, production systems variables and environmental variables in order to identify some key research areas for priority setting and targeting interventions in order to reduce poverty and make sustainable development

possible, in particular, for poor livestock keepers, their families and the communities in which they live.

Changes in demographics and livestock production systems

There is a slowdown in global population growth. And for the first time in history more people live in cities than in rural areas (UN-Habitat, 2006). However, populations in developing countries remain largely rural, although rates of immigration to cities are very high (World Bank, 2007). For Sub-Saharan Africa the population growth rate of 2.3% for 1995-2004 is the highest of the world (World Bank, 2009), and urban growth rates are high with an average of 4.5% for the Horn of Africa, 4.6% for West and 6.7% of East Africa between 1999 and 2004 (World Bank, 2009). In contrast to many other parts of the world, the rural population in Africa is still growing. The majority of people are living in rural areas, but this is changing rapidly (Figure 1).

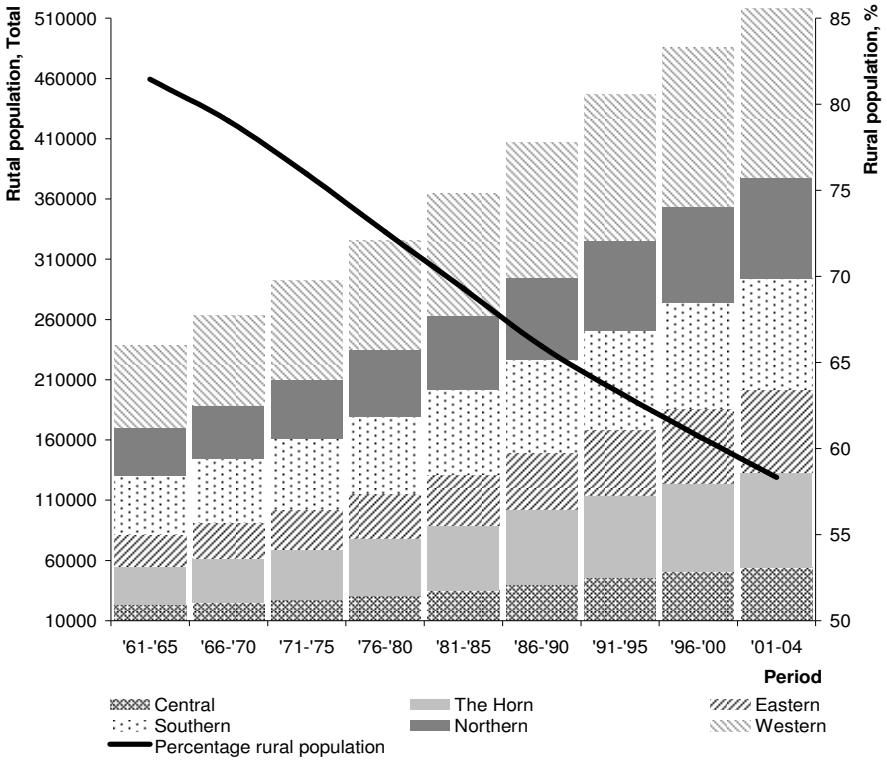

Figure 1: Total rural population and relative between 1961 and 2004 for the different regions in Africa

Urbanization is generally associated with higher average household incomes and changing lifestyles such as more food consumed outside homes (Delgado et al., 1999), fueling a demand for food including livestock products. Per capita food consumption in developing countries is shifting to fruits and vegetables, meat, and oils. Livestock products contribute to 17% of the global kilocalorie consumption and 33% of the protein consumption (FAOSTAT, 2009). For people in Africa only 6 % of kcal intake comes from livestock products (Herrero et al., 2009), however, the demands for livestock products is increasing (IAASTD, 2007).

As the demand for livestock products increases, the absolute numbers are increasing. Between 1961 and 2005, the total livestock unit for poultry have increased with 9% per year, pigs with 6.9% a year and goats with 3.4 % a year. Camels have shown the relative slightest annual increase (1.8%), followed by sheep (2%) and cattle (2.1%) (FAOSTAT, 2009). Table 1 shows the increase in total livestock densities for different regions; especially the Horn and Eastern Africa have high livestock densities. These increases in animal populations and densities are not the same all over Africa; there are large regional variation in growth rates between certain livestock species, as well the variation between species.

Table 1: Average livestock densities* (LU/ha) for different regions, between 1961 and 2005. Derived from FAOSTAT, 2009.

	'61-'69	**'70-'79**	**'80-'89**	**'90-'99**	**'00-'05**
Central Africa	0.05	0.07	0.08	0.10	0.12
Eastern Africa	0.20	0.23	0.26	0.29	0.32
Horn of Africa	0.61	0.68	0.78	0.55	0.55
Northern Africa	0.09	0.11	0.13	0.16	0.19
Southern Africa	0.08	0.09	0.09	0.10	0.10
Western Africa	0.08	0.09	0.11	0.14	0.16

*Total livestock is the sum camels, cattle, goats, pigs, poultry and sheep

The decline in densities for the Horn of Africa can be attributed to the expansion of agricultural land over the last decennia (Table 2), as the livestock numbers more doubled since the sixties. In general, the land per land available for people and livestock diminished.

Table 2: Regional distribution of agricultural land* (1000 hectares) between 1961 and 2005. Derived from FAOSTAT, 2009.

	'61-'69	**'70-'79**	**'80-'89**	**'90-'99**	**'00-'05**
Central Africa	98579	99734	101059	101563	101959
Eastern Africa	65535	71347	74918	76789	77708
Horn of Africa	45226	45274	45323	72053	85456
Northern Africa	201387	206957	209794	226656	234193
Southern Africa	342566	341537	343387	351345	359840
Western Africa	239540	240602	245493	257963	270292

*Agricultural area refers to: arable land, permanent crops land and permanent pastures land.

Beside total numbers and densities, livestock productivity should be considered to verify whether the increase in livestock production is sufficient the meet the growing demand. Table 3 shows that especially in Eastern and Southern Africa there has been an increase in productivity, both in the production of cattle and poultry meat. However, the Horn and Western Africa are lacking behind.

Table 3: Regional distribution of livestock productivity (kg/LU) between 1961 and 2005, for cattle and poultry meat. Derived from FAOSTAT, 2009.

	'61-'69	**'70-'79**	**'80-'89**	**'90-'99**	**'00-'05**
Cattle (meat)					
Central Africa	23.5	25.0	27.0	31.4	31.6
Eastern Africa	26.0	27.4	30.1	34.6	36.7
Horn of Africa	18.1	16.5	16.8	16.8	18.3
Northern Africa	37.5	37.9	40.6	37.7	36.6
Southern Africa	37.4	41.3	44.0	45.2	46.7
Western Africa	28.9	30.5	36.7	31.7	31.9
Poultry (meat)					
Central Africa	0.10	0.11	0.10	0.09	0.09
Eastern Africa	0.11	0.14	0.15	0.16	0.17
Horn of Africa	0.11	0.11	0.13	0.13	0.13
Northern Africa	0.19	0.21	0.26	0.27	0.28
Southern Africa	0.18	0.25	0.35	0.35	0.37
Western Africa	0.09	0.11	0.12	0.13	0.13

The maximum increase in meat production of about 10 kg for cattle, over a period of more than 40 years emphasizes the increasing pressure on the natural resources by the increasing demand for livestock products. The data shows that in the last decennia the

increase in livestock productivity can mainly be attributed to an increase in livestock numbers.

Changes in livestock production systems and natural resources

Over the last years, there is an increasing attention to the negative consequences of livestock production globally. In FAO's *Livestock's Long Shadow* (2006) the livestock sector comes forward as a significant contributor to some of the world's major environmental problems. About 20% of the world's pastures and rangelands have been degraded to some extent, mostly through overgrazing, compaction and erosion induced by livestock. The livestock sector accounts for over 8% of global human water use, mostly for the irrigation of feed crops (Steinfeld et al., 2006). Livestock produces 12 billion tons of waste each year, and while most is recycled for use in crop production and energy, in several countries the amount produced exceeds the adsorptive capacity of the surrounding ecosystems (World Bank, 2005). The livestock sector is probably the largest source of water pollution (Steinfeld et al., 2006). In addition to all this, the livestock sector is responsible for 18% of greenhouse gas emissions (measured in CO_2 equivalents) (Steinfeld et al., 2006).

Trying to address these environmental challenges, it is crucial to link technologies and policies to specific livestock production systems as livestock population and production vary over systems. Production systems are changing rapidly, particularly in densely populated areas of Africa, and several development trends and pathways can evolve in African livestock systems depending on the magnitude and rate of change of key factors driving the demand for livestock products and the quality of the underlying resource base that supports livestock production (McDermott et al., 2009).

<u>Agro-pastoral systems</u>

Agro-pastoral systems are almost exclusively based on livestock production, with little or no integration with crops. They are mainly based on native grasslands (De Haan et al, 1997). In terms of total production, agro-pastoral systems supply 34% of the total African beef production, 41% of total African lamb production, and 45% of total African milk

production, while providing a source of income for about 104 million pastoral people (Herrero et al., 2009).

There will be an increasing pressure on agro-pastoral systems in Africa. Land use and production systems through pastoralism can be effective and efficient ways of utilizing the natural resources. However, in many regions, an increased demand pushes these systems to produce beyond their capacity, leading to resource degradation, especially of land and biodiversity (De Haan et al, 1997).

Mixed systems

Mixed systems are defined as farming systems conducted by households or enterprises where crop cultivation and livestock rearing are more or less integrated components of one single farming system (Sere & Steinfeld, 1996). Most livestock products are produced in the mixed systems, producing the largest share of beef (59%), poultry (65 %) pork (70 %) and milk (50%) in Africa (Herrero et al, 2009). They are the main farming system for smallholder farmers in Africa and, at the same time, they contain large numbers (155 million) of poor (Thornton et al., 2003), of which a considerable number depend to some extent on livestock (Herrero et al, 2009).

Resource use in mixed farming is often highly self-reliant as nutrients and energy flow from crops to livestock and back. This self-reliance is increasingly under pressure. In many regions of the world, farm sizes in these systems are shrinking because of population pressure, urban encroachment, and subdivision among heirs. Initially the systems are able to intensify. If pressure increases further, however, crop-livestock systems may separate into specialized crop or livestock activities. If accompanied by an opening up of market opportunities, new investment opportunities can be directed towards improved, more sustainable land use management systems/techniques. Without incentives for changes towards more sustainable land use forms, however, as is the case in many developing countries, intensification will lead to increased rates of nutrient depletion and soil erosion in the arable part of the system (De Haan et al, 1997; Delgado et al, 1999; Moyo et al, 2008).

Given the importance of these systems, maintaining a nutrient equilibrium through crop-livestock integration and at the same time allowing sustainable intensification are major challenges of principal interest in strategies on rural poverty reduction and mitigation of environmental degradation (McDermot et al., 2009).

Industrial systems

Industrial systems have average stocking rates greater than 10 livestock units per hectare of agricultural land, and less than 10% of the dry matter fed to livestock is produced on the farm (Sere & Steinfeld, 1996). These highly intensive industrial production methods are the rule in developed countries and growing rapidly in importance in the developing world (Delgado et al., 1999). Industrial systems produce 7% of total African beef production, 11% of pork production and 9% of poultry production (Herrero et al, 2009).

Large industrial farms bring in massive quantities of nutrients in the form of concentrate feed. And they produce far more waste than can be recycled as fertilizer and absorbed on nearby land. When intensive livestock operations are crowded together, pollution can threaten the quality of the soil, water, air, biodiversity and ultimately public health. Pollution damage is especially harmful when large numbers of animals are concentrated in sensitive areas around cities or close to water resources (FAO, 2005).

As shown in the previous paragraphs, environmental problems play out in different ways in intensive and extensive agricultural systems. Intensive systems in high-potential areas have an advantage: their natural environment is usually fairly resilient and not easily damaged. However, high external input use often makes these systems sources of downstream pollution through fertilizer, pesticide, and animal waste runoff and increased water salinity levels. Conversely, the areas having extensive systems are fragile and easily damaged. Low input use means extensive systems are not a major source of pollution, but farming steep slopes and fragile soils can cause substantial erosion, damaging downstream areas (World Bank, 2007).

How to deal with current and future environmental challenges?

The identification of key issues in livestock system changes and their associated social and environmental consequences will result in an enhanced understanding of the major trends regional livestock systems, which can be used to guide priority setting of the livestock research and development agenda to reduce poverty.

Developed countries have been relocating their livestock production away from cities, and have established infrastructures and regulations to do so. The same is happening in emerging, first as a response to nuisance factors of livestock (odour and flies) and to the issues of nutrient loading of waterways and public health (Steinfeld et al., 2006). In Africa policies are needed in developing countries to facilitate rural-based livestock industries, and to avoid livestock production near urban areas where it has not yet occurred (Steinfeld et al., 2006).

In Africa land degradation causes a decline in the productivity of the land, reducing attainable and potential crop yields (IAC, 2004). In mixed systems the depletion of soil nutrients is severe, with negative soil nutrient balances, year on year. There is no remedy for soils that are deficient in nutrients other than adding the necessary inputs. Efforts to improve soil fertility have focused on the replenishment of nutrients by the use of inorganic fertilizers and organic manure. This has been very successful in many parts of the world, and is responsible for a large increase in agricultural production (UNEP, 2007). Moreover, mixed systems with a high degree of intensification will require higher efficiency gains in livestock production, to prevent the need for additional land and water to meet the increasing demand for livestock products (Herrero et al., 2009).

In areas not affected by the green revolution, there has been little if any agricultural intensification; instead, agriculture has grown through extensification—bringing more land under cultivation. This has led to environmental problems of a different kind—mainly the degradation and loss of forests, wetlands, soils, and pastures (World Bank, 2007). In addition, pastoralist communities are often socially and politically marginalized. Their livelihoods are undermined by inappropriate policies and laws and by

pressures on their resources from more politically powerful bodies and other competitors, resulting in a shift from pastoral to agro-pastoral systems and pushing pastoralists towards more marginal areas (IUCN, 2006). Increased research efforts are needed to develop effective risk management options that help pastoralists to anticipate on and cope with a wide range of shocks, and thus to enhance their resilience, which is only possible when such options are also based on environmental considerations.

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