



Investing in Maintaining Mobility in Pastoral Systems of the Arid and Semi-Arid Regions of Sub-Saharan Africa

An ALive Policy Note¹

1. Introduction

Pastoral systems in arid and semi-arid regions of Sub Saharan Africa used to cope effectively and in an environmentally sustainable manner with the prevailing harsh and erratic ecological conditions of those regions. The ability to move their herds over large distances, grazing the diffuse and scattered vegetation of the regions' rangelands, and being able to take refuge to more favorable sites during droughts, rather than being restricted year-around to one site where the rain could blow over for any given year, was the foundation of their system, and was critical to their livestock and their own livelihoods. Unfortunately, mobility is increasingly being constrained by encroachment of arable farming on livestock routes and watering areas, and the effectiveness of the pastoral system is deteriorating fast. As a result, pastoralists are now burdening rather than supporting larger societies. This paper seeks to provide national and international policy makers interested in the development of arid and semi-arid areas with background information and policy options, on whether and how to invest in mobility of pastoral systems in Africa. It first describes the trends leading to the declining mobility, follows with a description of the key underlying causes for these trends and of the impacts of these trends on mobile pastoralists. It then provides the rationale for investments and finishes with policy options, which policy makers have to face, when deciding on the priorities to be allocated to overall pastoral development, and to specific actions, within pastoral development.

2. Trends in Pastoral Mobility

2.1. Settlement of Pastoralists

During the last century, frequency and distances of herd movements have declined (e.g. Niamir-Fuller, 2000), and various forms and degrees of settlement occur. Spontaneous settlement is usually caused by long droughts, encroachment of other land uses (e.g. Mkutu 2004, Cullis and Cathy, 2004, Leloup 1994), comparative lack of infrastructure and social services, disease control policies (e.g. Morton 2001), shifting ownership (Niamir-Fuller, 2000), breakdown of customary pastoral social hierarchies and social

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insecurity. Governments are sometimes promoting settlement to intensify and commercialize animal production, as they seek to provide cheaper meat to urban areas or facilitate social control, administration and delivery of social and livestock specific services (Pratt et al. 1997). Involuntary settlement of pastoralists by Governments has also been reported because of dam construction, famine, and civil war (Larsen and Hassan, 2003).

2.2. Reduced Mobility of Pastoralists

a. Expansion of other land uses

Since about the 1920s, vast areas of natural rangelands in arid and semi-arid regions have been taken over by cropping systems, (semi-) private livestock and game ranches, nature reserves and infrastructure. The encroached rangelands included the better dry season grazing areas with easier access to water. They are the key resources ensuring the overall sustainability of the pastoral system. As a result of the encroachment, the total area and overall diversity and condition of the remaining rangelands have declined, and through fragmentation their accessibility has become constrained. Long range migration is being replaced by much shorter grazing treks;

b. Inadequate supply of infrastructure and social services

In the process of allocating infrastructure (e.g. roads, water) and social services (e.g. education, health care, veterinary care) central government bureaucracies often overlooked the changing spatial and temporal needs of mobile pastoralists (Pratt et al. 1997). The lack of social services is becoming increasingly important for the younger generation of pastoralists, which seek more comfortable standards of living;

c. Insecurity

Large areas of arid and semi-arid rangelands resources have become more or less inaccessible to pastoralists, as a result of enduring political tension -often directly involving pastoralists- and a greatly increased accessibility of automatic arms, following the end of the Cold War. Avoidance of remote rangelands due to risk of animal theft, often also involving modern arms, has become common (e.g. Morton, 2001), and restricts herd movements.

3. Underlying causes of the Loss of Mobility of Pastoral Systems

3.1. Population Growth

As shown by several studies (for example, Breman and de Wit, 1993), the rangelands of the arid and semi-arid regions of SSA are used at the maximum of their potential, and the prospect of feeding a growing population is dim.

3.2. *Erroneous Public Policies*

Public administrations have introduced, sometimes unknowingly and with good intentions, sometimes intentionally, policies, which undermined the basic foundations of pastoralism. These included:

a. *Inadequate fit between administrative and ecological units*

The drawing of state boundaries by the European colonial powers neglected the interest of local land use patterns and societies. Centralized administrations restricted pastoral movements within administrative units, irrespective of the ecological needs of the pastoralists, even dividing the same pastoral ethnic group over different States;

b. *Weak representation at the national level*

Pastoralists, often belonging to ethnic minorities and grazing their animals in remote areas, are intrinsically less involved in national policy debates, although more recently a number of pastoral advocacy groups, have emerged, for example in Kenya, Mali, Mauritania and Nigeria. Furthermore, pastoralists are badly represented by their own ministries, as ministries in charge of livestock generally do not address issues of accessibility of natural resources or availability of social services (education, health care and infrastructure);

c. *Inadequate land use policies and legislation*

During and following the colonial period, resource tenure systems were established which neglected existing customary tenure systems and undermined relevant local authorities, in particular with regard to the use of natural rangelands (Kirk, 2000). Land became either owned by the State or was privatized to serve colonial settlers and/or national elites. Traditional resource management and conflict resolution mechanisms were thereby seriously weakened. Land use reform activities since about the mid 1990s, with decentralized land use planning and access rules has evolved in some of the Sahelian countries and Kenya, within the concept of overall decentralization policies, and has led to a greater inclusion of the interest of pastoral systems, however not unchallenged.

d. *Biased incentive policies*

The pastoral sector suffered from several unfavorable incentive policies:

- *At the international level*, dumping of beef, in particular by the EU under its Common Agricultural Policy, and favored by African governments, because it provided cheap meat to the urban areas, reduced in particular the income of West African pastoralists, and caused them to take up arable farming to supplement their subsistence food and income needs, and give up their mobile life style ;
- *At the national level*, government policies to attain food security have favored cropping systems for cereals over pastoral systems through subsidizing of input prices such as agricultural equipment and fuel (Pratt et al. 1997). These policies, in turn, favored crop-encroachment in pastoral areas. Moreover, subsidy of livestock ranching at the expense of rangelands for pastoralists and wildlife is still ongoing (Cullis and Watson 2004).

3.3. Inadequate and Poorly Focused Research

Studies on traditional pastoralism started late. Till the seventies, pastoralism was considered inefficient and backward, and livestock research and development focused on veterinary care and increasing beef productivity per animal. Only from the mid seventies, field studies on pastoral systems emerged on seasonal livestock movements, herd-sex structures and productivity, rangelands ecology and the multiple functions of pastoralism (Blench and Marriage, 1999). More widespread appreciation of mobile pastoral systems developed by two studies demonstrating the superiority of these systems in terms of natural resources use efficiency and animal protein productivity versus modern livestock holding systems in similar environments in Australia, the United States and Botswana (Bremen and de Wit 1993, de Ridder and Wagenaar 1984). In the early nineties, the usefulness of the “carrying capacity” of rangelands, or the theoretically estimated fixed maximum animal numbers to be allowed to sustain rangelands, was questioned. As a result, the concepts of the dynamic non-equilibrium of the ecology of arid lands and the advantages of opportune and flexible use, rather than controlling stocking rates, have now being generally accepted as the recommended scientific basis of livestock development (Behnke and Scoones 1993)

3.4. Narrowly Focused Pastoral Development

Pastoral development has gone through several phases, moving from a focus on veterinary services and water development in the fifties and sixties, to the development of ranches with reduced stocking rates and supply of water and veterinary services from the mid sixties to the early eighties (Swallow and McCarthy 2000, de Haan 1998, Pratt et al. 1997, de Haan 1994), all with the objective to increase the production of meat for the urban areas. From the late seventies to the early nineties support shifted to rangeland management and empowerment of pastoral organizations, while continuing to advocate lower stocking rates and to provide services which tended to restrict animal movements.

Since the late 1990s, however, pastoral community-based development programs, with a human, rather than animal focus, seeking to include the interests of mobile pastoralists, without restricting stocking rates emerged, and have been quite successful, for example in Kenya. True inclusion of pastoral interests and enhancing mobility however remain a challenge. Other positive notes include attempts to establish corridors to enable passage of livestock, to tolerate livestock in nature reserves and a recent interest in “integrated livestock wildlife management projects” (Doetinchem and Crepin, 2004).

4. Impacts

The declining mobility, is leading Sub-Saharan African pastoralists in a downward cycle of environmental degradation, poverty and increased food aid dependency.

4.1. Environmental Degradation

Overgrazing and land degradation occurs when livestock is forced to stay in a restricted area, but “tracking” of climatic and landscape variability allows mobile pastoral systems to avoid both overgrazing and under-grazing (Niamir-Fuller, 2000). Land degradation from overgrazing under mobile pastoralism is often temporary. The grasses and other annual plants of these areas are extremely resilient, and one good rainfall year can restore such annual vegetation. Less information exists on under-grazing of rangelands abandoned because of settlement elsewhere. In northeastern Senegal, under-grazing resulted in lower palatability of primary productivity, lower phosphorus content of topsoil, lower herbaceous density, and lower biomass production (Niamir-Fuller, 2000). In semi-arid and adjacent sub-humid regions, land degradation is clearly linked to settlement and the combined effect of growing human populations and uncoordinated different land uses. For example in West Africa, uncontrolled expansion of low input cropping systems, accompanied by uncontrolled bush fires, wood fuel collection and increasing numbers of sedentary livestock inducing severe land degradation of both crop and rangelands (Leloup, 1994). Overgrazing has long been considered the primary cause of desertification in Africa. However, recent work has clearly demonstrated the human influence on land degradation through fuel wood collection and crop farming in marginal areas (UNEP, 2000).

4.2. Shifting Herd Ownership

Absentee investors/owners are increasingly contracting pastoralists to herd their livestock, while often putting restriction to livestock movements to facilitate control. For example, absentee livestock owners are estimated to own 50 percent of the Sahelian livestock (Fafchamps et al. 1996);

4.3. Declining Herd Production

Per capita ownership of livestock is declining significantly and for many pastoralist families is now below the minimum subsistence level. In addition, production per livestock unit is declining. For example over the period 1975-1995, beef production per animal declined slightly (from 135 kg/head to 129 kg/head) (Ehui et al. 2002). No data are available on milk production, but similar trends can be expected. As a result pastoralists have to abandon their mobile lifestyle and settle;

4.4. Growing Poverty

Standards of living are falling among the approximate twenty million mobile pastoralists in Africa, often resulting in settlement and the need to rely on alternative income sources, such as cropping and hired labor, out-migration towards urban centers or, ultimately food aid (Niamir-Fuller, 2000). Privatization of rangelands by “white minorities” and “national elites” is severely impacting the situation of the pastoralists in both Eastern and Southern Africa (e.g. Mkutu 2004, Cullis and Watson 2004); and

4.5. Increased Relief Dependency

Frequent and/or almost permanent relief interventions, in human food aid and feed supplements for livestock are the result (Pratt et al. 1997, Morton 2001). For example, in the Horn of Africa, pastoralists represent usually the part of the national populations most food aid dependent.

5. Rationale for Investment

Investing in mobile pastoral development would be based on the following rationale and address the following aspects of general interest to economic development of the arid and semi-arid areas of SSA:

5.1. Maintaining Efficient Natural Resource Use in Arid and Semi-arid Areas

The multi-functionality of pastoral systems, such as the supply of live animals, milk, meat, manure, hides, transport and/or animal traction makes SSA's mobile pastoralist more productive - in terms of animal protein produced per acreage – than the US and Australian livestock systems under similar ecological environments (Bremen and de Wit, 1983, de Ridder and Wagenaar, 1984). Fodder supply is achieved by minimal labor and low economic cost, the chance of disease transmission between animals is low, and access to various markets and social communities and gatherings is easy (Niamir-Fuller, 2000). Rather than a backward antiquated system, mobile pastoralism can be an efficient and sustainable system. Improving natural rangelands in arid and semi-arid regions would also improve the world's carbon storage capacity, biodiversity, and water quality;

5.2. Support Important Sub-regional and National Economies

Arid and semi-arid lands represent about two-third of Africa's total land area of nearly 30 million square kilometers (UNEP, 2000), hosting about 189 million people². The semi-arid and arid areas in the Horn make up 70 percent of the total land area, which provide an average of 20 to 30 percent of GDP, with substantial sub-regional trade (Little 1996). Also in West Africa, the pastoral sector contributes between 10-20 percent of total GDP in Mauritania, Mali and Niger, and there is active trade between those countries. Pastoral development could therefore be an important force in regional development;

5.3. Reduce Poverty

Support to mobile pastoralists would be of immediate benefit to the approximately 30 million pastoral peoples living in the arid areas (ILRI, 2002), covering some of the most deprived populations in the region, often remaining far removed- geographically, linguistically, culturally, academically and economically from those who run the country (Pratt and others 1997).

5.4. Reduce Social Conflicts

Mobile pastoralists are more than most other groups involved and/or impacted by enduring social tensions often resulting from competition over natural resource uses. Such cases concern both transnational and national situations such as in Senegal/Mauritania, Cote d'Ivoire, Burkina Faso, Kenya/Somalia, Tanzania, Benin, Sudan (e.g. van Driel 2001, Shazali and Ahmed, 1999). Pastoral development could therefore prevent some of the conflict or post conflict social upheaval and deprivation.

5.5. Enhance Food Security

Enhancing the condition and availability of natural rangelands and water resources³ for pastoral production would simultaneously improve wild food availability, provide critical micro-nutrients, and diversify regional rural economies. Moreover, increasing the area and condition of rangelands adjacent to cropping areas, would favor the sustainability and productivity of the cropping systems through reduced soil erosion because of increased water retention capacity of the rangelands and through increased availability of animal manure per cropping area unit. Finally, mixed crop-rangeland systems would reduce the impact of food crop failure induced by drought, crop specific pests and/or diseases and thus contribute to the livelihood of the 180 million people in SSA, which are food insecure (Ehui et al. 2002).

6. The Road Ahead: Policy Options and Recommendations

The above description shows that misunderstanding, lack of knowledge and neglect of the effectiveness and needs of mobile pastoral systems in arid and semi-arid areas rather than changing environmental conditions and/or inherent malfunction of pastoral systems explain the increasing degradation and downward poverty cycle. On the other hand, sufficient evidence is available showing the potentials of mobile pastoralism to contribute to the sustainability of large arid and semi-arid areas, and eventual to regional economic development. The following section details the major policy options, their sequencing and describes the major trade-offs issues with other potential investments.

6.1. Defining the Overall Vision and Development Thrusts

At the national level, an in-depth discussion on the overall policy focus for pastoral development, to define the vision for the sector over the next decade is a first priority.

The key trade-offs decisions to be made include identifying:

a. The relative weight to be given to measures to promote out-migration versus investment in the pastoral areas, and within the pastoral area on productivity increase

³ Natural rangelands and water resources contribute also to many more aspects of interest to economic and social development such as biomass fuels, human and veterinary health care products, shelter materials, water transport, cultural values and sometimes eco-tourism.

versus sustainable natural resource management. The current and expected “human carrying capacity” of these areas will be the main factor on which to base such decision.

b. The relative weight to be given to the development of the high potential, low lying areas for arable farming vs. protection of those areas for dry season grazing to support mobile pastoralism. Planning should not just base decisions on the narrow focus of an immediate yield increase, when an area of land is converted from grazing to crops, but look at the wider importance that such potential arable land might have for the viability of the entire pastoral systems, in preventing conflicts and reducing food aid dependency.

All stakeholders have to be associated with the definition of such a long-term vision, and the following direct steps would be required:

a. Broad-based Consultations

Awareness raising of all policy makers through broad-based workshops on national, sub-regional and regional level is required to define the long-term vision and the required steps to implement such vision. Timing, (i.e. letting it dovetail with the preparation of major policy papers, such as the Poverty Reduction Strategy Papers (PRSPs) and donor assistance strategies) and broad-based ownership, (i.e. involving also infrastructure and social service departments) would be essential, because of the crosscutting nature of the issues;

b. Strengthening Pastoral Associations

Adequate representation of pastoralists in defining a long-term vision and the subsequent follow-up will be critical. A lot of progress has been made, as shown in Kenya (see box), and several West African countries. Improved pastoral representation can be achieved by the pro-active strengthening of partnerships with existing pastoralist organizations. While increased pastoral representation might still be politically sensitive in some countries, as history has shown, there are significant negative trade-offs by ignoring the pastoral voice.

Empowerment and pastoral investment in Kenya: It pays to be represented

In **Kenya**, the Pastoral Forum (the national association of nomadic livestock keepers), through a pastoralist thematic group, has been actively involved in the formulation of the Initial Poverty Reduction Strategy Paper (IPRSP) and PRSP in Kenya. Through intensive lobbying, the development of the arid and semi-arid lands became a special theme. As a result, the special needs for pro-poor investment in the pastoral areas was clearly integrated in the Kenya’s IPRSP and is now translated in support for the second phase of the World Bank funded Arid Land Natural Resource Management project, as well as the identification and prioritization of larger roads and infrastructure not covered under the credit. Source: World Bank; Directions in Development (2005)

c. Updating the Vision

As many gaps in knowledge remain on a country by country base of the specific situation of mobile pastoralism on the various issues identified in this paper (e.g. total number of pastoralists and their livestock, importance of absentee owners, benefits and costs to national economy, physical constraints to mobility, policies constraining mobility,

existing and lost key grazing and water areas, pastoral organizations, communication means and locations, supply of social and livestock services models, relief dependency, climatic patterns etc.). Research activities could be supported to fill these gaps in close collaboration with pastoralists. Meanwhile, adequate indicators to monitor the situation of mobile pastoralism and its role in larger economies need to be defined and subsequently long term measurement arranged.

6.2. Defining the Incentive Policies

Incentive policies, using public funds, need to address the negative social and environmental externalities, and protect the sector to unfair competition. The pastoralists normally would carry those costs of their direct own benefit (private goods). Regarding protection of mobile pastoral systems, this would imply considering the options for the following incentives:

a. Overall Incentive Framework

For the overall incentive framework the options would include the provision of cheap food for urban areas, versus sustainable social development of the marginal, poor, rural areas. Allowing the import of subsidized meat and the subsidization of crop inputs or outputs would decrease meat and cereal prices but cause further encroachment of arable farming in marginal pastoral areas, and restrict mobility. The introduction of countervailing import tariffs on meat to protect domestic pastoral production would be justified

b. Payment for Services

For the payment for services, charges for water would improve the sustainability of water infrastructure, and hence cause a better spatial distribution of livestock over the arid rangelands. Experience has shown that pastoralists are willing to pay.

c. Provision of Subsidized Livestock Feed

The provision of subsidized livestock feed through import or aid, while socially and politically often desirable, tends to cause declining mobility and increasing density of livestock in the distribution areas. They also tend to induce long term dependency and abuse of the system, while often reaching only the more sedentary and wealthy livestock owners (Hazell, 2000).

d. Payment for Environmental Services

Regarding payment for environmental services, sharing of environmental benefits from sustainable range management (eco-tourism, carbon sequestration) is another policy option. This would include trading-off investments in conservation of national parks, which restrict livestock movements with investments into in-situ conservation in a production environment, which promotes mobility. Win-win solutions seem to be possible here, as experience is accumulating, for example in East and Central Africa, which shows positive reactions of pastoral groups to community planning of wildlife livestock grazing areas and payment for wildlife conservation.

6.3. Defining Resource Access Policies

The development of appropriate legislation, ensuring access and user rights (not necessarily property rights) to critical grazing and water resources, to limit encroachment of other uses and users (e.g. cropping, ranching), integrate various natural resources uses and users, and in some areas, reclaim some of the lost key grazing and water resources for pastoral use is critical, and, although highly sensitive, absolutely essential for environmentally and socially sustainable development of these areas. Where increased cropping and declining stock numbers have made the long migration impossible, shorter treks, with a closer integration of crops and livestock is probably the best strategy, with community institutions facilitating and enforcing contracts between the different land uses and users.

6.4. Defining Investments

The main investments to maintain mobile pastoral production concern infrastructure and services, as summarized below.

a. Infrastructure

Infrastructure needs concern mostly water, networks of pathways through crop areas, markets and mobile communication and weather forecasting equipment to manage drought. Sustainability of these investments is a major issue, and needs to be addressed through clear agreements with pastoral users on cost sharing and maintenance responsibilities.

b. Services

Service needs concern the technical services, such as veterinary care, and livestock marketing information, but cover also adapted social services, such as health care and education. Investments include the equipment and training needs to replace the current static service models for human and animal health and education with mobile service models. Major strategic decisions are required in education on the curriculum (focus on pastoral indigenous knowledge, versus more formal teaching, language) and “training the trainer” programs (Kratli, 2001). In health the major strategic decision concerns the combination of human and animal basic health care system, which is often debated, has many synergies, but is rarely implemented.

c. Research

Research should contribute to the monitoring activities mentioned above and assess the lessons learned available in the literature regarding various attempt to improve the situation (e.g. water use fees, grazing fees, livestock corridors, integrated livestock-wildlife management, integrated livestock-forest management, grazing reserves) while attempting to produce “out of the box” new incentives to be tested.

6.5. Partnerships and Knowledge Sharing

Coordination and knowledge sharing among entities or programs on national and (sub) regional level of interest to pastoral development in SSA will be an important asset. The Alive program, which brings together stakeholders at the international level, such as OIE and FAO, at the regional level, such as the African Union, and ILRI, the Regional Economic Commissions, governments, producer organizations and NGOs, with its website, can take that role.

7. LITERATURE

Blench, R. and Z. Marriage (1999) *Drought and Livestock in Semi-Arid Africa and Southwest Asia*. Working Paper 117, Overseas Development Institute, London.

Behnke, R.H., Scoones I, and C.Kerven (Eds) (1993) *Range ecology at Dis-equilibrium*. Overseas Development Institute, London.

Breman, H and C.T. de Wit (1983). *Rangeland Productivity in the Sahel*. Science 221 (4618).

Cullis, A. and C. Watson (2004) *Winners and Losers: Privatising the Commons in Botswana*. International Institute for Environment and Development (IIED) & Resource Conflict Institute (RECONCILE)

De Haan, C. (1994) *An Overview of the World Bank's Involment in Pastoral Development*. Pastoral Development Network. Paper No. 36b. London: Overseas Development Institute.

De Haan, C., Schillhorn van Veen, T., Brandenburg, B., Gauthier, J., Le Gall, F., Mearns, R. and M. Siméon (2001) *Livestock Development. Implications for Rural Poverty, the Environment, and Global Food Security*. The World Bank, Washington D.C.

Delgado, C., Rosegrant, M. Steinfeld, H. Ehui, S. and C. Courbois (1999). *Livestock to 2020. The Next Food Revolution*. IFPRI, FAO, ILRI.

De Ridder, N. and K.T. Wagenaar (1984) *A Comparison between the Productivity of Traditional Livestock Systems and Ranching in Eastern Botswana*. International Livestock Center for Africa, Addis-Ababa, ILCA newsletter 3(3):5-7.

Doetinchem, N and C. Crepin (2004). *Integrated Livestock-Wildlife Management, Agriculture Investment Note, Agriculture Investment Source Book, Module 05*, The World Bank.

Dia, M. (1996) *Africa's Management in the 1990s and Beyond. Reconciling Indigenous and Transplanted Institutions*. Directions in Development. The World Bank, Washington DC.

- Ehui, S., Benin, S., William, T. and S. Meijer (2002) Food Security in Sub-Saharan Africa to 2020. Socio-economics and Policy Research Working Paper 49, International Livestock Research Institute, Nairobi, Kenya.
- Fafchamps, M., Udry, U. and K. Czukas (1998) Drought and Savings in West Africa: Are Livestock a Buffer Stock? , Journal of Development Economics 55(2): 273-305.
- Hazell, P. (2000) Public Policy and Drought Management in Agropastoral Systems. In McCarthy et al. 2000.
- Kirk, M. (2000) The Context for Livestock and Crop-Livestock Development in Africa: The Evolving Role of the State in Influencing Property Rights over Grazing Resources in Sub-Saharan Africa. In McCarthy et al. 2000.
- Kratli S (2001). Education Provision to Pastoralists, Working Paper, IDS University of Sussex UK
- Larsen, K. and M. Hassan (2003) Sedentarisation of Nomadic People: The case of the Hawawir in Um Jawasir, Northern Sudan. Dryland Coordination Group Report No.24. Norway.
- Leloup, S. (1994) Multiple Use of Rangelands within Agropastoral Systems in Southern Mali, PhD Thesis Wageningen.
- Little, Peter D. (1996) Cross-border Cattle Trade and Food Security in the Kenya/Somalia Borderlands, Institute for Development Anthropology: Binghamton.
- Mkutu, K. (2004) Pastoralism and conflict in the Horn of Africa. Africa Peace Forum/Saferworld/University of Bradford.
- Morton, J. Ed (2001) Pastoralism, Drought and Planning. Lessons from Northern Kenya and Elsewhere. Natural Resources Institute, DFID, University of Greenwich.
- Niamir-Fuller (2000) Managing Mobility in African Rangelands. In McCarthy et al. 2000.
- McCarthy, N., Swallow, B., Kirk, M. and P. Hazell (eds). (2000). Property Rights, Risks, and Livestock Development in Africa. International Food Policy Research Institute, Washington , D.C. / International Livestock Research Institute, Nairobi, Kenya
- Pratt, D.J., Le Gall, F. and de Haan, C. (1997). Investing in Pastoralism Sustainable Natural Resource use in Arid Africa and the Middle East. World Bank Technical Paper No. 365.
- Savory, A. (1988) Holistic Resources Management. Island Press. Washington DC.
- Shazali, S. and A.G. M. Ahmed (1999) Pastoral Land Tenure and Agricultural Expansion: Sudan and the Horn of Africa. Paper presented at DFID workshop in Land Rights and Sustainable Development in SSA, Berkshire, UK.
- Swallow, B. and N. McCarthy (2000) Property Rights, Risk, and Livestock Development in Africa: Issues and Project Approach. In McCarthy et al. 2000.

8. Thornton (PK), R.L.Kruska, N.Henninger, P.M.Kristjanson, R.S.Reid, F.Atieno, A.N.Odero and T.Ndegwa (2002), Mapping poverty and livestock in the developing world ILRI, Nairobi

UNEP (2000) Global Environment Outlook 2000

Van Driel, A. (2001). Sharing a Valley. The changing relations between agriculturalists and pastoralists in the Niger Valley of Benin. African Studies Centre, Leiden.

Veenendaal, E. and J.B. Opschoor (1986) Botswana's Beef Exports to the EEC: Economic Development at the Expense of a Deteriorating Environment. Institute for Environmental Studies, Free University, Amsterdam.