Proc. 3rd All Africa Conf. Anim. Agric. & 11th Conf. Egyptian Soc. Anim. Prod., Alexandria, Egypt, 6-9 November 2000: 61-68

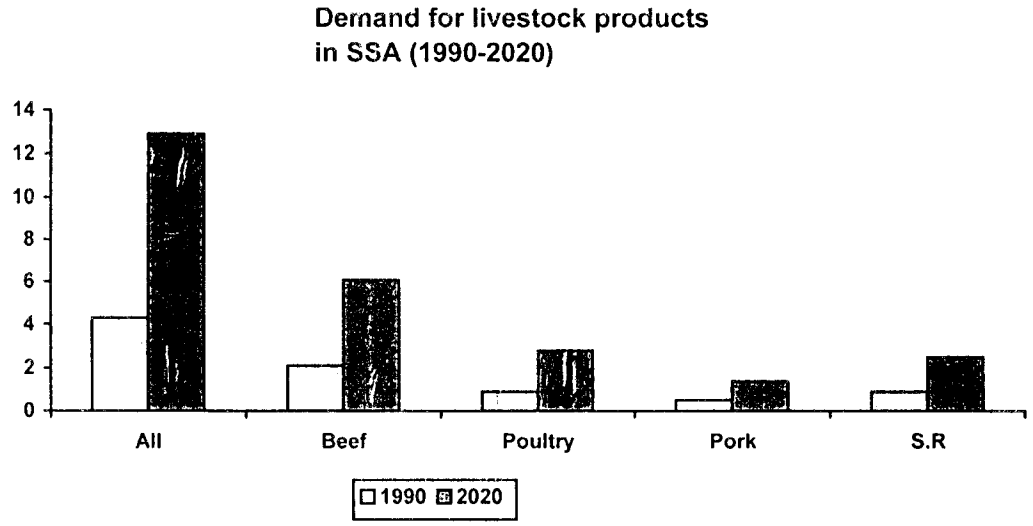
LIVESTOCK AND ENVIRONMENT INTERACTIONS – OUR PROFESSIONAL CHALLENGE

C. de Haan

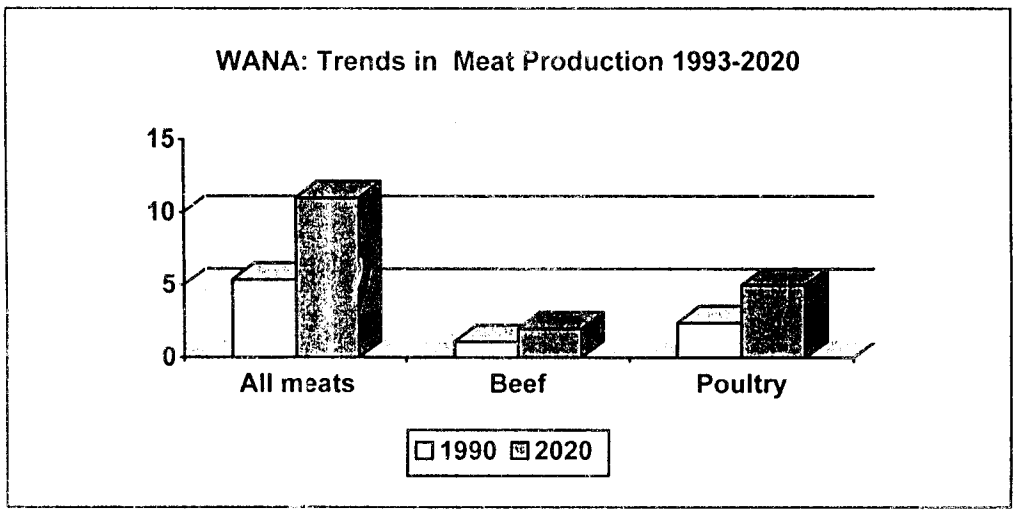
Senior Livestock Advisor World Bank. The views and opinions expressed in this paper are those of the author, and do not necessarily reflect those of the World Bank or its Affiliates

INTRODUCTION AND OVERVIEW OF THE ISSUES

The African livestock sector faces an enormous challenge. Fueled by a growing population, rising incomes and rapid urbanization, the demand for meat and milk is expected to increase strongly. Assuming a 3.3 percent annual per capita income growth, the total demand for meat will increase from the current level of about four million tons to about thirteen million tons per year in 2020 (Delgado *et al.*, 1999). Demand for poultry products will triple from about one million tons now to about three million tons in 2020. At the same time, demand for non-food services of livestock, such as traction, is expected to increase, while the use of livestock as a source of investment and soil fertility maintenance would remain important. Thus, livestock will remain an important factor in food security and poverty alleviation.



The increased demand can be supplied by increasing imports. And, in effect, the most recent trends point into that direction. Sub-saharan Africa has currently a deficit of about 450,000 to 520,000 tons meat and that gap seems to be rising. In effect, Delgado *et al.* (1999) estimate that under high demand scenario, about 3 million tons would be imported. This is not necessary, and may be even less justified in the future. The Uruguay Round of trade liberalization offers new opportunities for SSA, as it would reduce the subsidized exports from the OECD countries. It might open "niche " opportunities for milk production in the highland of East Africa, and meat production in diverse environments such as the Sahelian countries and Eastern and Southern Africa.



However, under current livestock production practices, satisfying those future food needs and capturing eventual new export opportunities, would take a strong toll from Africa's land, water and bio-diversity resources. Some examples:

- Land: While long term data, incorporating the resilience of Africa's eco-systems are not available, serious land degradation is already occurring in the semi-arid and sub-humid areas. For example, the World Bank /FAO (1999) estimates that in SSA, 320 million ha is moderately to excessively degraded. More specifically, long term monitoring of semi-arid rangelands of Mali showed that the area of bare ground increased by at least ten fold over the last three decades (de Haan *et al.*, 1998).
- Water: Ground water levels are falling in many areas of the Sahel. There is chemical pollution because of dip fluid drainage, and sedimentation of rivers and lakes, because of erosion;
- Bio-diversity: Loss of wild bio-diversity is important, for example, in Kenya, it is estimated that over the last three decades, the large mammals living outside the park declined by 30 percent. Concerning domestic livestock breeds, FAO estimates that 27 breeds, out of a genetic pool of 400 African breeds, are in danger of extinction
- Air: Annual burning of sub-humid savannas are an important source of Carbon-dioxide, one of the greenhouse gasses. For example, it is estimated that at least 45 percent of the CO_2 emission from Africa comes from burning savannas and rangelands.

Outline of paper

This paper is prepared against this background. It will first provide more detailed information on future trends in demand for livestock production and its effects on modes of production and the environment. Second, it will describe some general principles affecting livestock-environment interactions, and third make more specific suggestions on policies and technologies, to mitigate the negative and enhance the positive effects. It will end with proposed follow-up actions, especially for the African continent. It is the result of an effort of a group of bi-lateral and multi-lateral development agencies[1], reported in de Haan *et al.* (1998) to: "To protect and enhance natural resources as affected by livestock production and processing while alleviating poverty".

The main messages

The main messages resulting from the analysis, are that with strongly growing demand for meat and milk globally and in SSA, and already heavy pressure on land, water and bio-diversity, there is a clear need to introduce environmentally friendlier technologies for livestock production. A large number of such environmentally friendly technologies is available. However, they will not be adopted, if the policy framework is not conducive to the introduction of these technologies. Because it is not livestock production per se, but human actions and activities, which make livestock behave the way they do.

It is therefore less useful to look only at physical interactions, such as the effect of stocking rate on the vegetation, or the quality of feed on methane emission and global warming. We need to analyze first the forces, which causes the negative and obstructs the positive effects. The key challenge then is to introduce those policies, which correct those forces, and lead to environmentally sustainable development. Some of these forces go beyond the realm of livestock policy, such as population growth and consumption habits. Other are easier to amend, such as subsidies on feed and fertilizer, and inappropriate land tenure rules. They are the main focus of this paper.

Livestock Production Systems as main arena of livestock-environment interactions

Livestock-environment interactions are production systems specific. Production systems are therefore chosen as the main physical arenas to describe livestock-environment interactions. For the purpose of this paper, Africa's livestock production is classified according to three production systems, mainly based on criteria of amount of feed produced within the own system:

---

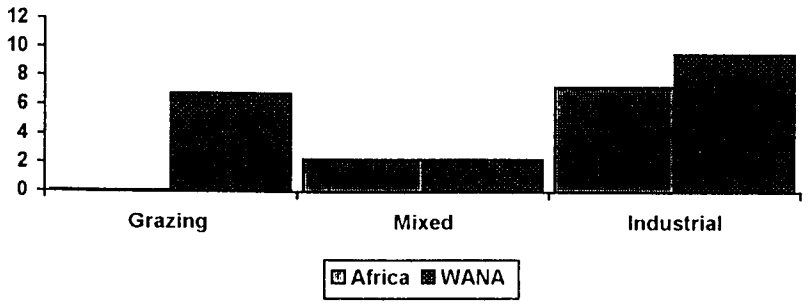
[1] Commission of the European Union, DANIDA of Denmark, FAO, IFAD, la Ministère de la Cooperation of France, GTZ of Germany, Directorate of International Cooperation of the Netherlands, ODA of the United Kingdom, World Bank and USAID.

- grazing systems, where animals get 90 percent of more of their feed from pasture;
- mixed farming systems, where animals get at least 10 percent of their feed from crops and crop residues produced on the own farm; and
- industrial systems, where animals get less than 10 percent of the feed from the own farm.

In Africa, the grazing system produces about half the meat, the mixed system about 40 percent and the industrial system about ten percent. Milk is for more than sixty percent produced by the grazing system in the continent. The remaining milk comes from the mixed system.

Possibilities of expansion of the grazing system seem rather limited. First, past trends clearly show a stagnating area of grazing land of about 850,000 ha in SSA. Crop encroachment and increased urbanization are taking away some of the best grazing lands. Similarly, past trends in meat output by the different systems (Fig. 2) show a very low growth (only 0.1 percent) in the grazing system, for SSA, although a higher growth rate for WANA, caused by an increased input of cereal feed in grazing systems in this region. Both regions show a moderate growth in the mixed system, and a very rapid growth in the industrial system

Fig. 2. Annual growth (%) of SSA and WANA prod. systems (81-93)



The increased demand over the next decades would, first of all, cause that the pressure in all systems will increase. For the grazing system, it is not likely that the productivity would increase very much in the near future. In the arid and semi-arid areas, productivity per ha is already at very high levels. For example, Breman and de Wit, showed that Sahelian pastures under the transhumant system produced two to three more protein per ha, than ranches in Texas or Australia. For the sub-humid areas, there is some growth possible, although unless there is a major breakthrough in the ruminant nutrition which facilitates the breakdown of the high fiber content of the tropical grasses of that region, growth would be slow as well. The focus in these grazing areas would therefore be on preservation of land, vegetation and animal bio-diversity.

For social and food security reasons, it is critical that the mixed farming system would be intensified in Africa. Smallholder and family farms will remain the mainstays of crop and livestock production in the continent, and there is still a strong competition between cereals for feed and food. In addition, there is still land available in Africa. But, the mixed farming system can also not be expected to supply the major part of the increased demand. The growing pressure for economies of scale and increasing market opportunities, also in Africa, would lead in this system to the specialization of production. Most likely, the major growth therefore would continue to come from the industrial system, and mostly from intensive crop-based pig and poultry production, as already shown by the past trends.

Environmental consequences.

The grazing and mixed farming systems are mostly pre-dominant closed systems, where the waste produced is used again within the same system. This means that the producer has a direct incentive to utilize their waste in an environmentally sustainable fashion. Environmental problems occur, when these incentives disappear. This is the case, when the system opens up (or as the economists would say; "when externalities occur") for example, when collective grazing rights deteriorate and communal grazing areas become open access areas. It is also the case, when outside pressures become so strong,

that nutrient input and output flows are not in balance anymore. These pressures can come from a growing population, as the case in Central Africa, where the nutrient outflow is so strong that serious nutrient imbalances occur.

The growing importance of the industrial system, means, in principle, a move to an environmental unfriendly system. The industrial system is an open system, where most of the waste produced in the enterprise can not be used within the same system. Without incentives and regulations, large amounts of waste (the industrial system produces globally about 8 billion ton of waste per year) would be emitted outside the system. Thus, in all production systems, there is a strong need to find appropriate policies, which will lead to environmentally friendlier technologies.

General principles on livestock-environment interactions

First, mitigation of livestock-environment interactions need to be based on local and national decisions and action plans. Blanket approaches to mitigate the negative and enhance the positive effects of livestock are not desirable for two main reasons:

a) the sustainability of livestock production is mainly a result of local resource endowment and prevailing policies and institutions. A thorough understanding of the local situation is therefore required; and

b) even more importantly, certain societies, especially in the developing world, give a higher value to income generation and food security, and lower values to immediate environmental concerns. This must be acknowledged, and any intervention needs therefore to be designed according to prevailing local or national priorities, balancing human needs and environmental concerns.

Second, removing the causes of environmental degradation is often more effective than seeking to control the symptoms. Removing the incentive to cause the problem eliminates the problem once and for all and requires no enforcement supervision. Thus, for nomadic herders in Africa, alternative employment generation, good pricing policies and the transfer of the responsibility for the stewardship of their land, through the reinforcement of their traditional users rights on rangelands in arid and semi-arid grazing systems, is more effective than trying to control, through outside authorities, the animal stocking rate of these lands.

Third, social objectives should not be fulfilled through market mechanisms. A key lesson from the past is that social objectives (i.e. increasing farmers income) should not be coupled to mechanisms, which determine market prices. Within any production system, economic policies and institutions define the relative prices of the inputs, and these relative prices, in turn, induce the type of technology which will be used to produce or process agricultural products. Some examples

- Phasing out subsidies on in-organic fertilizers, such as occurs now in many developing countries, favors the use of compost and manure to maintain soil fertility. In Burkina, market pricing and the devaluation of the CFA, has increased the use of rock-phosphate and manure mix (phosphate composting).
- Input subsidies and price supports in the EU and West Asia have caused the concentration of intensive units around ports and urban areas. Full pricing of the inputs and the outputs, including the environmental costs of those units, would probably lead to a better geographical distribution of intensive production units and the emergence of more sustainable mixed farming systems
- Free water for livestock, has led in many parts of the world to a proliferation of water points, and livestock and human densities (settlements) out of balance with the carrying capacity of the land. Private ownership and
- Free and/or subsidized concentrate for range livestock in North Africa during the drought to support drought affected pastoralists, has had negative effects on the rangelands. Full costs for these inputs, combined with measures to increase offtake, and even with direct monetary support would have been

Fourth, a mixture of policy instruments is almost always required. There are a variety of different instruments available to induce environmentally friendlier technologies. They can be classified in (i) informational; (ii) educational; (iii) price-based; (iv) institutions and property mechanisms; and (v) regulation. In most cases, these measures have to be combined. For example, giving herders a greater

share of the benefits of eco-tourism to conserve wildlife, becomes more effective, if accompanied by education and changes in property rights.

Specific instruments.
Some of the specific aspects of the different policy measures enumerated just above are as follows:

(a) improvement of database for decision making

The first step would be to improve the data base to enable better decision making. There is clearly a need for better information on livestock-environment interactions. Decision making is seriously hampered by poor or incorrect information on the size and direction of livestock-environment interactions. This is one of the main reasons that livestock is so often made the scapegoat of environmental problems. This has serious consequences, and has led to wrong decision making. For example, following the droughts of the seventies, livestock has been fully blamed for "desertification", with concerns of advancing deserts. This has led to considerable investments in arid areas (green belts, etc..). However, the pictures of the different states of the vegetation in the Gourma of Mali (Hiernaux, ILRI), data from NASA-NOAA and our own work (de Haan et al. 1997) show how resilient the arid vegetation is. The real problem is in the semi-arid and sub-humid zones. Better information would have provided better targeted investments.

But also there is little information available on the positive effects of livestock on, for example land and bio-diversity. The multi-donor study has documented a wide variety of cases, where livestock has shown positive effects on land, bio-diversity and reduction in herbicide use. For example, within the framework of the study, it was estimated that US $ 1.2 billion is contributed annually by livestock in replacing in-organic fertilizer and saving non-fossil fuels in irrigated systems of Asia.

Finally, information is definitely lacking on the value of some of the environmental benefits of livestock production. For example, unless we arrive at reasonable estimates on the environmental benefits of breed conservation, it would be difficult to establish the correct breeding and breed conservation policies.

(b) Better education and awareness creation

On the basis of good information, the second step would be to increase the emphasis on education and public awareness. This could include education at all levels. Farmers and especially young farmers education on the possibilities of more sustainable production forms has large pay-offs. For example, the introduction of farm level mineral accounting in the Netherlands, made farmers aware of nutrient loading and led to more targeted and lower fertilizer applications. Primary education inputs into village level natural resource management in Burkina Faso has also shown to be one of the key factors in successful land management activities. Similarly, there is an enormous task of educating policy makers. On the other hand, curbing consumption of animal products, by creating greater awareness for the health effects of meat and milk, as some groups advocate has proven to be ineffective. Finally, there is a strong need for a paradigm shift of the professionals (livestock scientists and development specialists), in particular those that are in the public sector to move the focus of their work, away from the pure production aspects of livestock, to some of the environmental effects of animal agriculture, identifying the technologies that improve the management of livestock-environment interactions. This is a major challenge for the profession

(c) More appropriate institutions and property regimes

The creation of appropriate institutions is the third critical component of any effort to improve the environmental sustainability of livestock production and processing.

This means first, that *clear and enforceable rules for access and ownership* of land, water and bio-diversity need to be established. For example:

- Pastoral development in Africa would be environmentally more sustainable, if access rights to critical dry-season grazing areas, and adequate flexibility and mobility for the pastoralists would be clearly established and enforced to allow them to utilize the highly variable (in time and space) vegetation most efficiently.
- Clear ownership rights on water points would have also reduced the overgrazing and the random and sometimes chaotic settlement, and consequently environmental degradation, around those points in many arid and semi arid areas; and

- Clear ownership rights on bio-diversity (such as wild life) by local communities, and game ranches would help to promote better livestock-wild life associations.

Secondly, decentralized decision making and local empowerment in arriving at sustainable resource use needs to be strengthened. Decisions about local range or water use should not be made in a capital, but by the local community. While experiences with pastoral associations and range management have not always been successful, there are now several examples of pastoral groups, for example in Chad, which show that these groups are mastering the internal discipline to improve the management of their rangelands. Pastoral institution building includes the development of drought preparedness or drought contingency plans. While rangeland degradation occurs especially in times of drought, there is little experience on how to prepare arid and semi-arid production systems to better cope with drought. Possible measures include early warning systems, followed by early off-take and restocking, feed stocks, incentives to promote stratification, and drought insurance schemes (especially covering support to destocking, full insurance for livestock losses would not be viable). All these measures are location specific and knowledge intensive, and need therefore bottom-up approaches and skilled local staff. Capacity building at local level is therefore extremely important.

Thirdly, regulations and institutions to improve the geographical spread of intensive units, to bring livestock more in line with the absorptive capacity of the land need to be established. While not yet as urgent in SSA as, for example in Asia, concentration of intensive poultry production units and peri-urban dairies is already becoming an important issue around some SSA metropolitan areas.

(c) Market pricing for inputs and outputs.

The *introduction of realistic prices for inputs and products* would be a key instrument to induce more intensive and at the same time environmentally friendlier livestock production and processing. Ideally, the prices of meat and milk should reflect all direct and indirect costs that embody the proper valuation of environmental costs and benefits. This report therefore argues, that environmentally the most appropriate balance between the different production systems and human needs is established, if all environmental costs are internalized and environmental benefits are adequately shared. Internalization of environmental costs promotes efficient input use. It therefore reduces the production of waste and saves non-renewable resources, and hence improves the sustainability of production. The use of price and other financial incentives are particularly effective where we have weak institutions to control and regulate waste disposal, such as exists in many developing countries. For the costs side this covers:

- the introduction of market pricing for all inputs for the intensive production systems, such as feed, AI, and veterinary treatments, but also for the more extensive systems, such as communal water and grazing. Some examples:
  - phasing out of subsidies on fuel and machinery would reduce crop encroachment in critical dry-land grazing areas, such as shown in WANA;
  - market pricing of AI would shift the emphasis of using introduced breeds and losing bio-diversity to the use of local breeds;
  - market pricing of veterinary treatments would increase the cash requirements, and improve off-take. It would, for example, also lead to a more rational use of dips;
  - cost recovery for water and grazing, would again increase cash needs of the pastoralists, and would reduce for them the incentives of keeping marginally productive stock, and therefore reduce grazing pressure.
- the abolition of price supports on the one end, and the payment of market prices on the other for meat and milk. In this respect, the reaction of Sahelian pastoralists to the livestock price increase following the recent devaluation of their currency and the reduction of EU dumping was interesting: It caused a strong increase in off-take, and hence a reduction in grazing pressure; and
- introduction of levies and taxation on waste disposal: Acceptance of this "polluter pays" principle is getting more wide-spread (although certainly not yet universal) acceptance. A key issue is the appropriate valuation of these environmental costs. While some information is available on internalizing environmental effects of waste treatment in industrial production units (for example in 6-10 percent for swine production in Malaysia and Singapore respectively and 6 percent for Australian feed lots), these valuations don't cover the other environmental costs of feed production, etc.. Environmental cost valuations of meat and milk produced in grazing or mixed systems are even scarcer.

Even more difficult and controversial is the equitable distribution of environmental benefits, because of the lack of appropriate valuation techniques and the problems of distributing those benefits in an equitable fashion. Sharing of environmental benefits provides a direct interest in preserving that good. One of the most obvious examples of course is the sharing of benefits coming from tourist and other forms of wildlife utilization by the users of the common grazing areas in Africa, where still major issues of valuation (how much) and equity (who) exist. Similarly, over the recent year there has been substantial data showing the increased carbon-sequestration capacity of improved tropical savannas in South America. This could also apply to Africa. Redistributing the benefits of a reduction of global warming (estimated at about US $ 5 per ton CO2 sequestered) would greatly increase the attractiveness of such enterprise. The global environmental facility (GEF) is developing global instruments for this.

Follow-up activities

From the above, a program of follow-up actions to the multi-donor study is evolving. This would include:

- ***Strengthening of data collection and analysis***
  - data-banks combining natural resource, livestock and human trends
  - identification of key indicators;
- ***Strengthen awareness and education and create broader ownership***
  - Development of regionally, easily accessible guidelines to improve the environmental impact of livestock development at community, district and national level (toolboxes)
  - Regional workshops and training activities; and regional and global communication networks
- ***Testing of improved farm models and institutions***, with suggested pilot operations in several fields (wild-life, regional spreading of intensive units, sustainable pastoralism in the arid zones, improved nutrient and energy cycles in mixed systems, etc.)

CONCLUSION

If these policies and institutions would be put in place, it is our vision that:

The *grazing systems* would remain a source of extensively produced animal products, and even of producing organic meat. There is some possibility of intensification in the higher potential areas, and diversification everywhere. Better benefit sharing mechanisms, and stronger institutions would lead to such diversification with tourism, carbon sequestration, etc... In this context, livestock's role can be to protect land and bio-diversity.

The *mixed farming* system would see continued intensification and growth. Small holder and family farms will remain important in SSA, and increasing demand, reduction of input subsidies and increasing restrictions on waste emission would favor mixed farming. Within that system, the phasing out of input subsidies would induce improvements in the nutrient and energy cycle. Livestock's role would be to enhance and substitute natural resources.

In that sense, also the *industrial system* will evolve into a mixed farming system, but seen from a regional perspective. Internalization of the environmental costs and stricter zoning will lead to a blend of resource saving technologies and a better distribution of industrial units, more in line with the absorptive capacity of the land. These new mixed-industrial systems will be based on the absorptive capacity of the land, if nutrient balances are to be maintained and the environment's ability to absorb pollutants is to be respected. The systems purpose must be to produce efficiently at low costs. As in the mixed system, the main focus should be to intensify, but not to concentrate.

If we achieve these developments, we can continue the beneficial character of livestock development, with livestock providing:

- food and nutrition, particularly in view of a large portion of the world's population suffering from hunger and malnutrition
- poverty alleviation, and the opportunities to use livestock for the generation of income of the poor
- health, meaning human health but also animal health where it constitutes a human health hazard
- and the enhancement of the Region's natural resources.

REFERENCES

Breman H. and C.T. de Wit, 1983. Rangeland Productivity in the Sahel. Science, 221 (4618) 1341-47.

Delgado, C,. M. Rosengrant, H. Steinfeld, S. Ehui and C. Courbois. Livestock to 2020. The Next Food Revolution IFPRI Food Agriculture and Environment Discussion Paper 28. Washington D.C.

De Haan, C. H. Steinfeld and H. Blackburn. Livestock and the Environment. Finding a Balance. Brussels. Report of a Study, coordinated by the Food and Agriculture Organization and the World Bank. European Commission, Directorate General for Development

World Bank-FAO, Recapitalization of African Soils, World Bank, Washington D.C.