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AGRICULTURAL POLICIES FOR SUSTAINABLE USE AND MANAGEMENT OF NATURAL RESOURCES IN AFRICA

Table of Contents

	Paragraphs
Introduction	1 - 5
Degradation of Natural Resources in Sub-Saharan Africa	6 - 18
<i>Nature and Extent of Degradation of Land Resource in Semi-Arid Zone</i>	7
<i>Nature and Extent of Degradation of Land Resource in Highlands, Sub-humid and Humid Zones</i>	8 - 9
<i>Nature and Extent of Degradation of Forest and other Vegetation</i>	10
<i>Nature and Extent of Degradation of Water Resources</i>	11 - 12
<i>Root cause of Natural Resource Degradation</i>	13
<i>Information on Natural Resources for Policy Decision-Making</i>	14 - 18
Technologies for Sustainable Use and Management of Natural Resources	19 - 23
Policy Options for Sustainable Use and Management of Natural Resources	24 - 61
<i>Social Stability and Macro-economic Environment</i>	25 - 26
<i>Tenurial Arrangements</i>	27 - 31
<i>Relative Agricultural Commodity Prices</i>	32 - 33

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<i>Fertilizers and other Technology-Carrying Inputs</i>	34 - 40
<i>Livestock Policies</i>	41 - 44
<i>Irrigation Schemes</i>	45 - 47
<i>Aquatic Living Resources Policies</i>	48 - 50
<i>Forestry Policies</i>	51 - 55
<i>Rural Infrastructure and Support Services</i>	56 - 61
Conclusions and Recommendations	62 - 63

Introduction

1. The need to rapidly transform agriculture in Africa is underscored by the fact that Africa's population growth rate of about 3% per year threatens to reduce the availability of natural resources per capita. It is estimated that the availability of agricultural land per capita will reduce from 0.80 ha in 1997 to 0.38 ha in the year 2020. To mitigate serious negative environmental and socio-economic consequences this situation will generate, there is an urgent need for a rapid move of the economy including agriculture into an accelerated growth path in which it should be expected to grow at 8% in real terms by the year 2020 and beyond. Given the dominance of the agricultural sector in Africa (40% of GDP in 1997), it is generally accepted that without significant improvement in the sector's performance, it will be inconceivable for Africa to achieve its growth target.
2. Africa's mission on how to achieve the above policy objectives should consist of a programme which has as its focus, sustainable agriculture and rural development, necessitating structural transformation in order to enhance production, to improve food security, and to reduce poverty. This process should be conceived as a comprehensive development approach where the criteria of efficiency, equity and sustainability are carefully integrated within a coherent and operational framework. The integration of such areas as environment, rural development and structural transformation, population and human settlements, should reflect the interactions of these major areas of concern, as a matrix to promote sustainability.
3. Available evidence pertaining to Sub-Saharan Africa (SSA) suggests that the last three decades have been characterized, among other things, by significant degradation of the natural resource base. Chief among the causes of this unfortunate situation is the serious difficulties policy-makers in most Sub-Saharan countries encounter in designing and implementing policies that could promote a widespread gender-sensitive adoption of agricultural technologies and practices that are not only productivity-improving, but also environmentally sustainable. This situation has resulted in a dismally poor performance of the agricultural sector, the leading contributor to growth of most Sub-Saharan economies. High population growth associated with poor economic performance have exacerbated the extent of degradation of natural resources in the Sub-Saharan region.
4. In a face of rapidly increasing population, the over-exploitation of natural resources in high potential areas and the move into low potential eco-systems could not be avoided. This ever-increasing rate of natural resource degradation poses the problem of vicious circle between increasing population and deepening of poverty. Environmental degradation has even a more deleterious impact on household food security. Women farmers who bear most of the responsibility for feeding their households are unable to produce enough food, as most of them have their farmlands concentrated on degraded areas, compared to their male counterparts.
5. The situation is as damaging to Africa's capacity for self-reliance in poverty reduction as it is serious to its entire economy. Urgent actions are required if the region is to avoid being marginalized from the mainstream of the world economy. The adoption of policies and strategies to enhance a widespread gender-sensitive use of environmentally-friendly agricultural technologies and practices is being considered necessary to address the underlying problems. In this vein, the paper succinctly examines the nature, extent and causes of natural resource degradation in various agro-ecological zones of the Sub-Saharan region, attempts to underline the link between the population factor, agricultural technologies, degradation of natural resources and failure of

domestic policy, and proposes a set of policy measures and actions that could be considered in order to reverse the trend.

Degradation of Natural Resources in Sub-Saharan Africa

6. FAO has partitioned, on the basis of moisture regime and land suitability, the Sub-Saharan region into seven global land classes, corresponding to seven agro-ecological zones. For the purpose at hand, however, these agro-ecological zones can be regrouped into four zones on the basis of their moisture regimes. These are semi-arid, sub-humid, highlands and humid zones¹.

Nature and Extent of Degradation of Land Resource in Semi-Arid Zone

7. In the semi-arid zone of Sub-Saharan Africa, human-induced land degradation is the most important environmental problem. This degradation is primarily due to wind and water erosion, overgrazing and soil tillage for dryland crops which reduce the limited protective vegetal cover. Chemical deterioration, another human-induced soil degradation process, is also prevalent in the semi-arid zone. This process includes nutrient depletion and salinization. Nutrient depletion arises from bush burning and nutrient mining consecutive to cropping and grazing, while soil salinization and acidification are associated with inappropriate exploitation of wetlands and coastal areas, and use of fertilizers and other agricultural chemicals. In addition, desertification process, a particular case of natural resource degradation associated with climatic changes, continues unabated in arid and semi-arid zones. In the Sahel, nutrient depletion affects about 25 million ha of land, compared to 2.0 million ha affected by salinization and 1.2 million ha suffering from acidification. Moreover, it is estimated that about 802.4 million ha or 60% of the total area in Sahel is prone to human-induced degradation, of which 224 million ha are already severely degraded.

Nature and Extent of Degradation of Land Resource in Highlands, Sub-humid and Humid Zones

8. In the highland areas, generally characterized by high population densities, the major land degradation problems are similar. Traditional practices including fallowing, crop rotations and mixtures, manuring, and crop residues, as used at present, can no longer maintain land productivity, implying a decreased soil fertility through nutrient mining and cultivation of more fragile areas. A proper management of these very practices could, nevertheless, contribute substantially to upgrading soil fertility. Expansion of cultivation on fragile lands has several negative environmental effects including, among others, soil acidification decreased forest cover, increased soil erosion. Soil erosion in the highlands is a peculiar problem due to the prevalence of steep slopes. About 2 million ha of cropland in Ethiopian highlands have been degraded irreversibly, of which 80% is due to cropping activities. Annual sediment loss from the highlands has been estimated at 20 mt/ha in Ethiopia.

9. In sub-humid and humid zones, reduced cycles of shifting cultivation is widely practised and constitutes the main cause of deforestation and loss of biodiversity. However, the fallowing of farm-fields for an extended period of time limits, where population densities are still low, the negative environmental impact of this farming system on land resource. Where population densities are relatively high, the shortening of fallow period and cultivation of more marginal areas accelerate the rate of natural resource degradation including land degradation, deforestation and loss of biodiversity.

¹ Dry and moist semi-arid areas sometimes referred respectively to as Sahelian and Sudanian zones form the semi-arid zone. It should be also observed that FAO class of marginally suitable lands and that of naturally flooded lands can be found in semi-arid, sub-humid, highlands and humid zones .

Nature and Extent of Degradation of Forest and other Vegetation

10. Beside the negative impact of agriculture and livestock on these resources, the over-exploitation of the forest resources for wood, fuel and fiber is also a major cause of deforestation and loss of biodiversity throughout the Sub-Saharan region. Forests currently cover about 520 millions ha, or about one-third of the land area of Africa of which 48.3% is located in the humid zone of Central Africa. The rates of deforestation are significant and are as follows:

- The deforestation rates are 297,000 ha per year in West Sahelian Africa and 642,000 ha per year in East Sahelian Africa. Humid West and Central Africa which contain most of the humid and dense forests of the continent (149.8 million and 296.7 million ha respectively) have annual deforestation rates varying from 85,000 ha in Central Africa with the Democratic Republic of Congo (DRC) totalling alone 732,000 ha according to the FAO Forestry Resources Assessment 1980 –90.
- The forests of the Tropical Southern Africa are subject to the highest deforestation rate of 736,000 ha per year mostly located in Tanzania (438,000 ha/year), Zambia (363,000 ha/year), Mozambique (135,000 ha/year) and Angola (174,000 ha/year). Insular Africa, composed of a collection of small islands except Madagascar, contains a great diversity of vegetation and animals. The current deforestation rate is reported to be 89,000 ha per year.

Nature and Extent of Degradation of Water Resources

11. The degradation or pollution of both groundwater and surface water in Sub-Saharan Africa is largely due to agricultural activities. Fertilizers and other agricultural chemicals have been found to pollute water resources and in the process to harm aquatic life. It has also been documented that irrigation, notwithstanding its importance, has major negative environmental effects, resulting from changes in the hydrology and limnology of river basins. Over-extraction of under-ground water can result in lowering of water tables, land subsidence, decreased water quality and saltwater intrusion in coastal areas.

12. With respect to aquatic living resources, overfishing and the use of inappropriate fishing techniques have accelerated the depletion of fish stocks and other aquatic living resources both in inland water bodies and marine waters. In summary, the major processes that lead to natural resource degradation in Sub-Saharan Africa are cropping activities, over-grazing, over-fishing, deforestation and over-exploitation of other vegetations.

Root cause of Natural Resource Degradation

13. Rapidly increasing population pressures on natural resources, which have disrupted the delicate balance between the traditional methods of production and the natural resource base, are the root cause of natural resource degradation throughout Sub-Saharan Africa. While the rapid population growth is the root cause of natural resource degradation in Sub-Saharan Africa, policy failure to address the population issue, to technologically transform agriculture on a sustainable basis and to rationalize the exploitation of forest and other natural resources, should be regarded as the main factor explaining the current high rate of resource degradation in different agro-ecological zones of Sub-Saharan Africa.

Information on Natural Resources for Policy Decision-Making

14. The unregulated exploitation of natural resources, including the proliferation of human settlements in the many areas of Africa increasingly degrades the environment and encroaches on arable lands, forests, and coastal areas, and thus jeopardizes the reproductive capacity of the natural environment. Environmental problems include deforestation, loss of soil fertility and erosion, degradation of coastal areas, and air and water pollution, and in some places, permanent damage to ecosystems. The consequences of over-exploitation and pollution include decreased

agricultural production and fish catches, deleterious effects on human health, and decreased biological diversity.

15. These ecologic and socio-economic impacts raise an urgent need for the establishment of appropriate policies for the sound management and use of natural resources in large parts of Africa, based on cross-sectoral planning. However, the institutional capacity of agencies responsible for the planning and implementation of programmes to regulate the conservation and use of the natural resources of the continent continues to need strengthening in many areas not least of all in the management of information and the appropriate utilisation of it as a decision making tool.

16. In Africa, as in many areas, in order to establish the basis for decision-making for agriculture, forestry and fisheries activities and in particular their contribution to the protection of the natural resource base in a sustainable manner, there is an urgent need for an environmental information system. The diverse type of information to be considered and the volume of data to be handled, as well as the loss of the historical records on land, its utilization and its resources, requires immediate action for developing an environmental management information system, using such technologies as remote sensing technology and Geographic Information Systems (GIS). Although these technologies are correctly perceived as tools to collect, build and update much of the historical data, there exists in many areas a distinct gap between information gathering and information transfer to the users in the country. This information must be made available to decision-makers, planners, scientists, engineers and technologists. This can only be done through the development of suitable technology and transfer programmes which involve not only appropriate equipment, training of staff and establishment of a management structure, but also the identification of a mechanism for both inter-departmental and inter-ministerial co-operation

17. It is evident that many of the constraints to sustainable development in Africa can be alleviated through the increased use of Environmental Information Management Systems-EIS. Planning for sustainable development will require that decision makers in each sector understand how their work affects other sectors. Managing for SD in Africa must encompass all of the social, institutional, economic, and environmental dimensions, thereby requiring information systems that are robust enough to manage an increasing complexity and multiplicity of data.

18. In recent years, the shapers of development philosophy have designed new approaches toward managing environmental information. The identification of demand through needs assessment, new incentives to promote the exchange of environmental information within national networks, the focus on capacity building at all points within the information production chain and advances in information technology (GIS, GPS, etc.) are elements which should increasingly be adopted in development planning.

Technologies for Sustainable Use and Management of Natural Resources

19. The central technological issue for improving agricultural productivity on a sustainable basis in much of sub-Saharan region is how to build up and maintain soil fertility, especially in intensive annual cropping despite the low agricultural incomes and increasing labor constraints. Recent scientific and technological advances by national and international research centers have resulted in the development of very promising technological packages not only for tackling the degradation of farmlands and rangelands in Africa, but also for improving their long-term productive capacity. Technological packages are also available for sustainable exploitation of water bodies, forests and other vegetations.

20. In semi-arid zone, the ecologically sound way of using farmlands is for farmers to adopt techniques and technology-carrying inputs that improve soil fertility, protect soil moisture and prevent soil erosion. These techniques and inputs will provide a suitable milieu that will enable crops to express their potential in terms of biomass production. This will result in both high land

and labor productivities. Sustainable high level of land productivity precludes shifting cultivation and delays the move into marginal areas, while high labor productivity translates into improved rural household income and welfare.

21. However, because of high risk associated with farming in these eco-systems, farmers are reluctant to invest in land conservation and improvement. Since this risk is due to the erratic nature of rainfall, efforts have to be made to develop irrigation and high value crops where possible. A good approach in uncertain climate situations can be the diversification of food crops. These will be a pre-conditions that will allow farmers to consider investing in land conservation and improvement. Where irrigation is not possible, water harvesting is to be encouraged. The integrated nutrient management systems have been developed for these areas. Integrated crop-livestock systems have also been developed for this agro-ecological zone.

22. For highland areas of Sub-Saharan Africa, integrated nutrient management systems as well as integrated crop-livestock systems have been developed to address the problem of natural resource degradation and to improve rural household income on a sustainable basis. For humid and sub-humid zones, alley-farming, an agro-forestry technology alternative to slash-and-burn agriculture, has been developed and tested. Other environmentally-friendly farming systems that have been developed for humid zone include multi-strata systems and improved fallow systems. Technological innovations such as integrated pest management (IPM) to which FAO and IITA have significantly contributed is applicable in all the agro-ecological zones and environmentally-friendly crop varieties developed by various research centers are currently available for adoption.

23. The above farming systems not only conserve and improve long-term productive capacity of land resource, but also constrain the rate of deforestation and destruction of other vegetations, and consequently reduce the extent of loss of biodiversity. It is important to recall that environmentally sound methods of forest exploitation for wood and other products are available and well known. This is also true for fresh water use, and inland and marine fishing. It is the failure, to design and implement appropriate policies with environmental focus, that has been the leading cause, responsible for the rapid rate of natural resource degradation in Sub-Saharan Africa.

Policy Options for Sustainable Use and Management of Natural Resources

24. Progress in achieving sustainable agricultural development depends on the creation of a more favorable environment including political and social stability, a clear and equitable regulatory framework, and an enabling economic framework based on a stable macro-economic environment coupled with appropriate agricultural and other sectoral policies with clear environmental focus. Furthermore a cross-sectoral approach, considering the natural resource base, the social dimension and the technical and economic issues, is required to effectively enhance sustainability.

Social Stability and Macro-economic Environment

25. A fundamental requirement for sustainable development is political and social stability. Environmental degradation often reflects the desperate competition for access to resources under unstable social conditions, and unless these conditions are addressed it will be impossible to make progress towards sustainable development. The importance of a good governance, a pre-requisite for stable political and social climate, cannot be over-emphasized.

26. The centrality of stable and appropriate macro-economic environment is unquestionable. Economic policy reforms of the last two decades have focused on achieving the stability of the macro-economic environment. Both supply and demand management policies were adopted to realign relative prices and incentives and to ensure domestic and external balances. These policy

reforms have had little environmental focus. Shifting cultivation, exploitation of marginal and fragile areas, overfishing, deforestation and nutrient depletion consecutive to overcropping with little use of fertilizers and manure have been unexpectedly promoted. Macro-economic and sectoral policy reforms have to be also reassessed in order to suggest measures and actions required to dampen the magnitude of their negative environmental effects on the economy.

Tenurial Arrangements

27. A broad-based equitable and secure access to natural resources is one of the preconditions for their sustainable use and management of natural resources. This access depends on an appropriate land tenure system that clearly defines the ownership and tenancy rights. Secure access to land and other natural resources by poor segments of the rural population, of which women represent the largest share, has been found to be limited particularly in high potential areas relative to poor and environmentally-fragile areas.

28. Indigenous customary land tenure systems are still prevalent in Sub-Saharan Africa. Strong calls for these systems to be replaced by private land-ownership and title registration programs to provide the security of tenure, assumed to be one of the key conditions for private investment in agriculture are backed by very little practical and empirical evidence. There is, however, evidence that customary tenure rights evolve toward stronger more alienable individual rights as population pressure on land increases, technologies change and agriculture becomes more commercialized. In fact, there is a great danger that individual land titling by the State may encourage large speculative land holdings and rent seeking behavior if not carefully managed and properly controlled.

29. Policy-makers should focus on incremental approaches to change in indigenous land tenure systems rather than to more drastic replacement programs. Programs of compulsory and systematic titling and registration should be considered only in those limited cases where land has become the subject of competition and dispute which the customary tenure systems are unable to cope with, or land is being distributed by the State in connection with projects involving settlement and there is no customary land tenure system. Governments should take all necessary steps to protect the land rights of local communities and encourage continuing evolution of traditional land tenure systems.

30. Furthermore, it is also useful to note that some development projects such as construction of mines, dams, railways, highways and logging roads have led to changes in land use, soil erosion and sedimentation, disruption of hydrological systems, forest fragmentation and other associated consequences. Until recently, these social and environmental costs were rarely taken into account. The capacity for such considerations within national land-use planning institutions is still very weak in many Sub-Saharan countries and needs to be significantly strengthened.

31. Moreover, the management of common properties, e.g. communal rangelands, poses serious institutional problems. Efforts to address these problems could only be expected to bear fruit in the long-run. In the short and medium-terms, these efforts should be directed at educating common property users on the need to preserve the productivity of their resources by avoiding over-exploitation so that their welfare and that of future generations is preserved. Policy actions to ensure the sustainability of common rangelands or individually-owned grazing lands, are described in the section of the paper dealing with livestock policies.

Relative Agricultural Commodity Prices

32. Sustainable technologies are economically attractive only to the extent that the resulting products are remunerative. Some of the main features of structural adjustment programs (SAP), including liberalization and privatization of product and factor markets, exchange and trade policy reforms, and disengagement of the State in production activities and services were intended to let

market forces set the prices of productive inputs as well as those of products and services, among other things². If the prices of most food crops have been liberalized, those of major export crops are still administratively determined and governments continue to extract a significant portion of fiscal revenue through these price manipulations. In predominantly agriculture-based economies, as in most Sub-Saharan countries, taxing the agricultural sector is unavoidable. However other forms of taxation such as land, income and consumption taxes have been found to be superior to taxes through trade, exchange rate, pricing and marketing policies. These types of taxation should be eliminated as they distort the structure of incentives and lead to a misallocation of resources which entails a significant economic cost in terms of lost output and income.

33. In addition, efforts to improve the relative prices of farm products should also concentrate on the rationalization of product and input distribution and marketing channels. This rationalization is made possible through development of rural infrastructure, support services and consistent regulatory framework. These actions will help improve the efficiency of the marketing systems, enabling farmers to get remunerative prices for their produce and to acquire in a cost-effective manner inputs and other services. This will result in increased relative prices of farm products. Increasing relative prices will stimulate farmers to make investments in land and other natural resource improvement and conservation techniques.

Fertilizers and other Technology-Carrying Inputs

34. It is generally agreed that the level of use of fertilizers and other improved inputs would have to increase from the present low levels if agriculture is to sustainably meet the challenges of increasing population pressure, low-productivity, expansion of agricultural activity on marginal lands, and soil degradation. Although input subsidies have been often advocated to facilitate the intensification needed to ensure sustainability, the general experience with subsidy programs in Sub-Saharan Africa is that they have been inefficient. The subsidies have often not reached the intended farmers and the programs have mainly encouraged rent-seeking behavior. On the other hand, subsidy removals have reduced fertilizer and other input supply in the countries, and this situation has had negative impact on productivity through reduced input use. It has also induced area expansion to maintain production which tends to promote land degradation, as farmlands are mined and the move into fragile eco-systems. Thus, the effect of subsidy withdrawal is mixed.

35. However, intensification of agricultural production is possible without input subsidization. Input cost at the farm level could be significantly reduced by more efficient procurement and distribution and reduction or total elimination of levies and surcharges imposed on agricultural inputs to raise fiscal revenue. The development of rural infrastructure and support services leading to more efficient marketing systems will further render the need for input subsidy unjustified, as inputs are delivered at the farmgate in a more cost-effective manner and farm products are sold at competitive prices.

36. Since most African countries do not produce fertilizer, another step in reducing the cost of fertilizer to farmers should be to reduce the cost and improve the operational efficiency of its importation through such activities as: (1) removal of all import tariffs and duties, (2) regional cooperation to combine orders for countries in the sub-region and so reduce costs due to the economies of scale associated with bulk purchasing and boost regional integration; (3) changing the type of fertilizer to higher-nutrient types; (4) helping to negotiate better conditions of purchase for importers; (5) arranging for or guaranteeing cheaper external loans for importers, and (6) helping importers obtain cheaper supplies by improving their access to better fertilizer market information .

²This is not to imply that SAP policies have had an environmental focus. In fact, the assessment of these policies has shown that overall they have had a negative impact on natural resource base (shifting cultivation, land and soil degradation due to nutrient mining, logging and over-exploitation of other vegetation and over-fishing have been unexpectedly promoted).

Other factors such as increased efficiency of fertilizer use in integrated nutrient management systems described earlier, and increased access to credit discussed later, will also facilitate fertilizer use.

37. Increased attention should be given to the possibility of locally producing organic fertilizers or adopting cropping patterns which retain soil moisture and increase soil fertility.

38. Regarding seed industry, it should be noted that this industry goes through a four-stage life cycle of development. During the first stage, farmers save their own seed and exchange seed with a few other farmers. The second or emergence stage is marked by increased specialization, greater division of labor, emergence of a scientific community and specialized seed industry. In the third or growth stage customers become more knowledgeable and experienced and there is more demand and market penetration. In the fourth or maturity phase, knowledge is widely diffused, customers are influenced by suppliers reputations, and production technology is sophisticated.

39. Government policies, foreign investments and donor programs must be designed to fit the particular seed life cycle stage of a country. In the fourth phase seed industries are dominated by the private sector which can be responsible for most of the research to produce new varieties, while government run programs may be most efficient in developing markets in stage 2. In stage 3, effective partnerships between the private sector and government may be the most appropriate strategy. Governments in sub-Saharan Africa should carefully determine where they are and support the necessary mix of government run and private enterprises.

40. The situation is most critical for root and tuber crops and tree germplasm. Thus, there is a need in many countries to establish seed orchards and to train communities on proper techniques for seed collection and orchard establishment. The process of decentralization and privatization of germplasm production and delivery is more critical when large quantity of planting materials is required per ha of land. As shown in a study in Uganda, private sector nurseries are quite adept at discovering and using cost-effective innovations. The successful innovative programs being funded by IFAD in Nigeria and Ghana for root and tuber crops multiplication could be extended elsewhere.

Livestock Policies

41. Improved management, accessibility and utilization of water and pasture resources are the key to ensuring sustainability of livestock resources in the dry semi-arid (Sahel) areas. Effective management of forage resources requires community involvement, through livestock farmers' participation, in the design and management of watering holds and stock routes through cropped lands, and in promoting effective destocking through increased offtake herd productivity and better livestock market links, information, phased sales and improved culling appropriate policies.

42. In the wet semi-arid (Sudanian) and sub-humid areas, the need and opportunity exist to intensify mixed farming and crop-livestock interactions in order to improve bioenergetic efficiency through: (1) enhancement of feed resources by developing high-yielding legumes and other forages and improving the quality and utilization of crop residues; (2) increasing animal resistance to disease and access by producers to health services; (3) improving the productivity of local livestock breeds; (4) promoting improved animal husbandry through expanded dissemination of technological interventions; and (5) developing effective input and support services, infrastructure and institutions.

43. In the more southern areas, opportunities exist to exploit demand and market linkages with the more populated humid and coastal zones through specialized cattle and small ruminant fattening activities. To achieve these potential requires continuation of the reforms underway in Sahelian countries involving: increasing cost recovery for animal health services, liberalizing veterinary services, promoting pastoral associations, and reorganizing public services. However, small-

holders will only invest in improving their breeds and practices if efficient market systems of their livestock products exist .

44. The technological thrust for developing sustainable livestock in highlands centers around small-holder integrated crop-livestock systems, including dairy and small ruminants, supported by adequate animal health care, forage and feed production, and processing. Development of small-holder dairy depends on low cost milk collection and marketing, private sector participation, and incentive and support systems.

Irrigation Schemes

45. The current emphasis on macro-economic policy reforms has several important implications for irrigation. The recognition of the value of water and the high cost of turning a water source into a service delivered to a farm make the water sector a prime target for further policy reforms. Given water's scarcity and its value to cities and industry, the water sub-sector will be less dominated by irrigation and its multi-purpose uses will be more widely acknowledged. Irrigation sector consumes large quantities of capital and foreign exchange and ties up scarce skilled personnel. The process of irrigation policy formulation, and appraisal needs to include groups that are representative of political, technical, managerial and (most important) water user associations.

46. While appropriate policies and regulations are necessary for improved water productivity, a variety of additional water saving measures are required in the irrigation sector including taking advantage of the scientific, engineering and technological advances in soils, plants and irrigation. Administrative and managerial reforms to improve efficiency, decentralization of public irrigation agencies and a reliance on farmer owned and farmer operated irrigation infrastructure.

47. In this connection, Governments should adopt indirect investment strategy in which they make resources available to farmers in the form of grants, loans and technical expertise to implement small-scale irrigation projects. For water demand management, governments should put in place water use laws that devolve water rights from centralized agencies to farmers and other water use associations, establish a properly managed system of tradable water rights in order to provide incentives for water users to take account of external costs imposed by their water use and to discourage the degradation of water resources.

Aquatic Living Resources Policies

48. To enhance an efficient and sustainable exploitation of fish and other aquatic living resources, designing proper fisheries management frameworks is an urgent priority in most Sub-Saharan countries. The lack of integration of policies between and within sectors, and between the different levels of government and the need for a systematic involvement of stock-holders in sectoral policy-making are important issues, especially for resolving competing water uses.

49. Given the importance of shared stocks and the number of large river basins, strengthened regional collaboration is required. To date, regional cooperation is too much limited to research and the exchange of information. There is a need to promote wider multi-disciplinary and river basin management approaches for fisheries development. In the past, major regional projects took account of this aspect; however, in recent years, growing emphasis on bilateral funding has meant that this kind of intervention has received less support.

50. Another important issue is the heavy reliance on external assistance for aquaculture development and research projects in Sub-Saharan Africa. Project achievements have generally been short-lived and unsustainable partly because of insufficient duration, weak institutional implementing context, changing priorities of donors and governments, and limited follow-up capabilities. Sub-Saharan African countries should increase the level of domestic funding allocated

to promotion of aquaculture development as this is an area of inland fisheries which still has scope for sustainable increase in supplies.

Forestry Policies

51. A widespread adoption of sustainable farming systems in various agro-ecological zones will have a positive impact on forests and other vegetations, as a result of reduced rate of deforestation and destruction of other vegetations. In general national forest programmes should be made to be holistic, intersectoral, interactive and consistent with national and local policies and strategies. They should involve all stake-holders, promote secure land tenure, and integrate sustainable use and conservation of forest and other biological resources. Capacity building, better coordination among various stakeholders, collaboration with indigenous people and communities who have traditional right are essential to develop and maintain .

52. As a first step to avoiding the over-exploitation of timber resources is to give forest products their true social value by evaluating the externalized costs, social and ecological costs of timber and non-timber forest products. Tax and other incentives policies which have been identified as important factors in encouraging destructive logging on some countries should be eliminated. Stumpage fees in Sub-Saharan Africa seldom cover the costs of replacing the volume removed. These fees should be reassessed accordingly to enable reforestation. The Government should develop an incentive system that enhances private sector's participation in tree planting, reforestation and rehabilitation of degraded marginal areas.

53. The society as a whole should be prepared, through government to cover the costs of these services if they are rendered on publicly owned lands. For privately owned lands, taxation and other incentive measures are to be developed to encourage and sometimes to force owners to reforest and rehabilitate their lands. This incentive system has to take into account the longer payback period associated with tree planting. Credit under very soft terms is essential for meeting the demand of these types of investments. Governments and donor communities need to provide assistance in this regard.

54. For fuelwood, the imposition of stumpage fees to rationalize the exploitation of these products should be considered only where there is no longer much open-access wood resources, and in such cases transferring land tenure to local communities, e.g. through community forest programs, should be the mechanisms for collecting such fees. Where open access wood resources are available, the implementation of stumpage fee policy presents severe administrative, institutional, logistical and political problems, and hence should not be considered. The same approach to reforestation and rehabilitation of timber resources including agroforestry should also be considered for fuelwood.

55. Furthermore, government should encourage the production and use of more efficient stoves in order to reduce the demand for fuelwood. In fact, Africa's population is relying more than ever on fuelwood to meet its domestic needs. About 88% of 570 million m³ of roundwood produced in 1994 was used as fuelwood. This calls for an upgrading of these biomass resources and for a transition towards sources of energy both conventional, such as gas, kerosene and electricity, and renewable, such as solar, wind and other biomass. The need to conserve forests and other vegetations requires that the design of agricultural and energy policies also takes into account environmental concerns relating to land, water, and forest resources.

Rural Infrastructure and Support Services

56. In much of rural Africa, access to market is a severe constraint for most farmers as a result of inadequate development of feeder roads. These transport constraints are often combined with inadequate on-farm storage, drying and processing facilities resulting in high post-harvest

losses. Improvement in rural infrastructure will have significant impact on poverty reduction through higher farm profitability and increased prospects for adoption of sustainable technologies, as improved rural roads reduce transport costs, increases access to markets and market information and lowers post-harvest losses and enable farmers reap remunerative prices for their produce.

57. All stages of the food chain, land preparation, irrigation, fertilizing, harvesting, processing, conservation and transport require one form of energy or another. In many African countries only meagre amounts of conventional or renewable energies are available, and policies and investments are still to be established and promoted.

58. To ensure sustainable and accelerated agricultural growth, credit is a necessary condition. Without it, recommended inputs required to support technological transformation of agricultural sector cannot be acquired on a sustainable basis by the majority of farmers. Lack of credit also creates a disincentive for the private sector to enter the industry, since they normally rely more heavily on credit even for seed money to enter new areas of business. Credit is essential in areas where soil amendments, seeds, tree stocks, tools and other purchased inputs are needed to initiate land rehabilitation and the conversion of destructive shifting cultivation to more stable systems .

59. Micro-credit arrangements being experimented within many Sub-Saharan countries, drawing from the experiences of such innovative programs as the highly successful Grameen Bank in Bangladesh, need to be expanded. To be successful such institutions will need access to substantial lines of credit from government treasuries and donors. The key is to support private sector initiatives with significant local grassroots participation, and not to set up state run credit institutions which have not been very successful in the past.

60. New partnership must be formed among farmers, private sector, non-governmental organizations and national and international institutions to address the broad needs for research and development and for knowledge transfer of the more complex integrated natural resource use systems. One of the key elements is strengthening of the NARS in order to make them more client responsible and to develop their capacity for policy and economic analysis. Many of these national agricultural research centers (NARS) still face constraints due to human resource problems, shortage of funding and problems of management and coordination of research programs. Governments should increase their investments in the NARS. The share of NARS' budget spent on natural resource management issues needs to be increased. Areas deserving particular attention are forestry, agro-forestry and soil and water degradation.

61. Finally, effective extension, information and communication are essential to getting farmers to become aware of, and adopt, improved technologies and to improve their level of knowledge. It is imperative for governments to examine ways and means of getting farmers, private sector, non-governmental organizations, and farmers associations to be involved alongside with public agencies in supporting and providing extension, information and communication services. Governments are to invest in these services by improving their human resources, logistic and institutional capacity.

Conclusions and Recommendations

62. Rapid population growth coupled with serious difficulties policy-makers encounter in designing and implementing policies that could promote a widespread gender-sensitive adoption of agricultural technologies and practices that are not only productivity-improving, but also environmentally sustainable, explain the current high rate of natural resource degradation in the region. Some of the public policy options policy-makers in Sub-Saharan Africa need to seriously consider in an effort to achieve a broad-based gender-sensitive agricultural growth and development, while preserving the natural resource base and improving its long-term productive capacity include the following:

- Create political and social institutions which promote good governance; develop a broad partnership in the area of natural resource use and management.
 - Design and implement macro-economic and sectoral policy reforms and cross-sectoral approaches with a clear environmental focus; and encourage the development of rural infrastructure and support services;
 - Develop a national environmental policy mechanism based on a cross-sectoral analysis and monitoring at sectoral activities;
 - Promote the establishment and use, as a decision making tool, modern environmental information systems;
 - Explore incremental approaches to change in indigenous land tenure systems; enact laws that specify tenancy rights and ensure security even under customary land tenure systems; and develop national land-use planning institution and capacity;
 - Encourage improved relative agricultural commodity prices through liberalization and privatization of product and factor markets, development of rural infrastructure and support services;
 - Encourage increased use of fertilizers and other technology-carrying inputs through improvement of input procurement and delivery systems, and development of rural infrastructure and support services;
 - Encourage the assessment and utilization of organic fertilizer and other locally available techniques;
 - Find out a proper division of labor between the private sector, farmers and government in seed industry and in the production and distribution of other planting materials;
 - Promote energy inputs, both conventional and renewable, to enhance productivity of the food chain;
 - Promote community involvement in the management of livestock resources; improve animal husbandry and privatize veterinary services; and encourage destocking through education and better market links and information.
 - Adopt a participatory approach to irrigation policy formulation and appraisal and encourage the development of farmers-owned and operated irrigation infrastructure;
 - Design proper fisheries management framework and strengthening regional cooperation;
 - Promote private sector and private individuals' participation in timber and fuelwood planting; privatize the reforestation services, reassess stumpage fees, and facilitate access to soft credit schemes for tree and fuelwood planting, reforestation and rehabilitation of degraded areas;
63. In a few words, governments have to create a new partnership of shared responsibilities and mutual assistance among all the stakeholders concerned by agricultural development and thus the sustainability of natural resources.