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REPORT ON THE PROGRESS IN THE PREPARATION OF PLANS OF ACTION TO
COMBAT DESERTIFICATION

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I. INTRODUCTION

1. Drought and desertification are the most debilitating environmental problems confronting more than two-thirds of the African countries. There are more than 36 desertification prone countries in Africa of which 28 are classified as least developed. More than 200 million people live in these drought stricken areas, of which 10 million have become displaced persons. Thousands of them suffer from famine, malnutrition and diseases.

2. A more serious problem is that tropical deserts experience extremely high temperatures during the day. Average temperatures of 45-55 degree C are not uncommon. Evapotranspiration is high and the air is always thirsty. Unlike temperate deserts, there is no winter. Scientists trained in laboratories located in temperate deserts will still have to carry out the kinds of research activities alluded to above and particularly with regard to selection of sand holding plant species.

3. In order to mitigate the impacts of drought and halt the desertification process, the ECA member States have, since the United Nations Conference on Desertification (UNCOD), 1977 adopted a number of resolutions. In 1984 the Plan of Action for Combating the Impacts of Drought and Desertification was adopted. This formed the basis for the environmental elements of the African Priority Programme for Economic Recovery (APPER) and the United Nations Programme of Action for Africa's Economic Recovery and Development (UN-PAAERD). Some of the measures recommended included the formulation and implementation of a national plan of action to combat desertification and the impacts of drought. Within this context the objectives are to promote the:

- (a) establishment of a central national authority for co-ordination of actions and evaluation of programme activities for combating desertification;
- (b) establishment of national and subregional Early Warning System for drought;
- (c) establishment of regional networks in Africa for joint pilot projects on afforestation including wind breaks green belts and sand dune stabilization;
- (c) promotion of the exchange of information and research methodologies including education and training.

4. Using the information collected by ECA during advisory service missions in selected cases, this report will review activities that have been initiated in the formulation of plans of action to combat desertification. Emphasis will be given to institution building at the national, subregional and regional levels, manpower development, popular participation and inter-country cooperation.

II. REVIEW OF SITUATION IN SELECTED COUNTRIES

A. DJIBOUTI

5. The country has an area of 22,000 km²; it is the smallest country amongst the IGADD member States - the other member States being Ethiopia, Kenya, Somalia, Sudan and Uganda. Djibouti is one of the hottest countries in the world. During the hot season, the temperatures range from 40-45°C while during the cool season the temperatures range from 25-30°C. The country has about 1 million heads of livestock, mainly goats and sheep. The density of livestock population is 45 per km².

Drought and Desertification Control

6. Although there might appear to be no definite plan of action for combating desertification, this activity is a part of life in Djibouti. An inter-ministerial committee report of August 1988 spells out details strategies to mitigate the effects of drought on the rural population. This was prepared by the UNDP office in Djibouti, following a support mission to districts of the Republic. This is an assessment of rural development policy as well as the evaluation of related development programmes. There has been some success over the past few years on the development of agricultural activities that would mitigate food shortfall under these drought-prone conditions. These have included mainly quick maturing market-garden crops at the expense of production of food crops. The result has been the inevitable dependence on the outside market for other food supplies.

7. Livestock raising is also facing great problems and there is a breakdown in pastoralism. It is interesting to note from the report that the breakdown in pastoralism has exacerbated the process of desertification. This may mean that due to profitability of garden crops, pastoralists may have turned to cultivation of fragile lands for production of these garden crops resulting in the intensification of desertification process. It would be logical to argue that the key to a better future in

Djibouti lies in the reorganization of human and material resources rather than the introduction of new technologies. Therefore, the major tasks that lie ahead include fighting poverty and food dependency, as well as combating desertification.

8. Concerning the organization and development of institutions to promote the strategies mentioned in the previous paragraphs, the report recommends that:

- (a) the interministerial committees for planning and drought should be reorganized to make them more efficient;
- (b) the permanent secretariat of those committees should be under the Directorate of Planning;
- (c) preparation and follow-up of the projects should be the responsibility of a Technical Interministerial Subcommittee;
- (d) donors should be closely associated with the work of the committees;
- (e) regional committees should be set up under the direction of the state commissions and the Directorate of Planning.

9. On the question of desertification control, the report recommended that this activity should now enter an active phase including:

- (a) the creation of Forestry Services Department to deal with all aspects of desertification control;
- (b) protection of the remaining groves and wood lands;
- (c) review of proposals made several years ago with a view of implementing them.

10. With regard to agropastoral activities, the report made the following recommendations:

- (a) The livestock Department should address issues other than animal health such as marketing;
- (b) Action in favour of the pastoral areas (water tapping, fodder crops) must be strengthened;
- (c) Pastoral areas should be organized through tribal structures by creating a pastoral environment basing on their previous experiences;
- (d) Preparation of methods for real extension services;
- (e) Efforts should be made to obtain reliable information on human populations as well as that of livestock;
- (f) Preparation by the secretariat of a directory of the on-going projects.

11. The report ends with a proposal for Food for Work Programme whose main components are as follows:

- (i) systematic support to agricultural operations to encourage the participation of the beneficiaries;
- (ii) the local districts to be given resources to carry out programmes initiated by themselves;
- (iii) animal feed assistance to be included in the programmes.

12. It is hoped that the proposed work programme and activities of the Interministerial committee will be adopted and implemented. As the committee responsible for this report was an interministerial one, it would be expected to review all sectors of the economy of the country. Although the development of rural areas requires an integrated approach, it may still be necessary to establish a Ministry or Department of Environment rather than that of forestry, to address adequately the environmental issues identified in this report.

B. MAURITANIA

13. As is the case with Djibouti, combating desertification forms part of the daily activities of the people. A number of dams had been constructed in the country by the Ministry of Rural Development and the local authorities. Rural populations also make their own trenches for harvesting and conserving water run-off. Oases also serve as natural habitats where water run off is collected and conserved for agricultural activities.

14. Forestry services in the country began seriously about 1940. Their main responsibility was surveying the needs of the forestry services in the country. At the time of political independence (1957) surveys of the country's forests was still the major activity. Sand dune fixation was associated with forestry. At that time, afforestation was a fairly hopeless endeavour. To-day the country is divided into 12 regions and 10 of them have full fledged forest officers. There are at least 2-3 forest officers in each of the ten regions. This expansion has taken place since 1982. In fact, forestry services have doubled in the country since that time.

15. The second phase of afforestation programme was launched in 1987. Sixty sites were selected. Implementation of this programme pursued an integrated approach, which included, inter alia, water harvesting, and production of hay for animal feed. A greater responsibility for execution of this programme lay in the hands of the local people. Indeed, greater successes were achieved when a greater responsibility was placed in the hands of the village people. On the question of availability of seedlings for afforestation, it is said that in 1982 there were only four nurseries in the country, while in 1986 there were 56 nurseries. It is probable that there are about 70 nurseries in the whole country now. Regarding sand dune stabilization, the local forest service executed the project. The project was fully staffed for a minimum level of funding. However, when the funding agency (UNDP), dropped the salary component, the project went faltering, as it had now to depend on local forest volunteers.

16. Some of the sites which have received considerable attention are the oases. These have been protected by establishing shelter belts. Attempts to plant trees in valleys with heavy black cotton soils have been unsuccessful because the soils dry up completely during the drought, causing the seedlings to wither away.

17. The second phase of the project is sponsored by UNDP/UNSO. In this phase, there are both national and sub-regional projects. The national projects include protection of the roads from sand dunes encroachment, inventory of natural resources and education. As pointed out earlier, the country is divided into 12 regions. Preparation of at least six regional master plans to combat desertification has been completed (e.g. the Trarza region). However, all the regional plans were expected to be completed by September 1989 in readiness for the round table meeting of the donors. It is estimated that each regional project would cost about US \$ 10 per person per year.

18. With regards to the food situation in the country, productivity for 1989 was relatively good. However, due to the political situation, the yield was unlikely to be as high as it was a year ago. Water harvesting by local peasants had doubled crop production. The country received food aid because of drought. However, famine is usually avoided due to good storage facilities which are situated in strategic places in the country. In addition, the country has not experienced a real famine because of good transport facilities. At the village level farmers are advised to contribute cereals to village "banks" for use during the drought.

19. The practice is that before any desertification control activity is undertaken in an area, social economic studies are carried out. It is on the basis of these studies that a decision is made whether or not to implement an activity. The decision is normally made on the basis of the desire and initiative of the people to launch the project. Once a decision has been made about the viability of the project, the technical personnel then move in to assess the project requirements as well as the techniques to be employed in carrying out the operation. On completion of technical formalities, a contract is then signed by the President of the village committee, the Governor, the Chief and the local forestry officer. The contract embodies the quantitative and qualitative aspects of the job to be carried out. The financial or remuneration process is also spelt out in the contract. In general, the project covers 70% while the community is responsible for 30%. The project's component of 70% is divided into two parts, 40% is given in money form while the 30% is in food form. However, both items (money and food) are only made available on successful completion of the prescribed work.

20. Initially the community may be advanced with 25% in food and money form, however, the disbursement of the balance is made only on successful completion of prescribed work. Each job to be carried out is usually divided into several phases. For example, an area to be afforested may need fencing, preparation of land, raising of seedlings, etc. At each one of these stages, a certain amount of food and cash are disbursed to the community. Indeed, the mode of payment and the stages at which the community should expect payment are carefully explained at the on-set of the activity by the sociologist. The convention has now been set and the people themselves know what to expect from the sponsors of any project.

21. The underlining principle of the development of any project is that it should eventually be self supportive. The question of the reduction or non-provision or what type of incentives has come up a number of times. For example, whether only food should be given to a community and not money. There has been a divergence of opinion; some people in favour and others against. It is to be remembered that the essential needs of the people are plastic bags for raising seedlings, and some means of transportation. It is, therefore, planned to carry out a reduction on incentives in the Trarza region in order to assess the reaction of the peasants.

22. The other problem that the project is encountering relates to follow-up of activities. Extension service in the country is virtually non-existent. The few foresters are too busy trying to assist new farmers, making it impracticable to carry out follow-up activities. There is, therefore, an urgent need to train and equip extension service programme in the country.

23. Because of the large number of people involved in various projects, the chances of one group issuing greater rations to one community than the counterpart are high. This is also being looked into in order to achieve uniformity.

24. Finally, forestry service is not a police force to guard against the destruction of forests. This is a concept which has to be instilled into the forest officers and the general public. By and large, many of the trained forest officers are conscious of this fact, and are endeavouring to steer away from acting as police officers.

25. The movement of sand dunes is a very serious problem in many parts of Nouakchott city where some of them can be as high as ten metres. There are many new and old buildings which are threatened by drifting sand dunes. Indeed, dunes pose the greatest threat to the existence of the city itself. There are many buildings which have never been completed because of invasion of the sites by dunes. Today they stand buried in the seas of sands. Investment ventures into housing and office buildings without understanding the migration of sands could be devastating. Sand dunes in the city are not only a health hazard, but quite often they obstruct highways, sewage systems and other similar facility.

26. Nouakchott is not only faced with the invasion of sand dunes, but has also been invaded by a massive rural exodus of the population. An educated guess placed the population at 600,000 inhabitants, in contrast to 15,000 in 1965 and 500 in 1950. This increased population has also provoked a rapid degradation of the environment. There is a very large population of camels, sheep and goats in the city centre. In fact, Nouakchott is one of the great urban centres for livestock farming.

27. The average rainfall is 50 mm per annum; in 1977 it received only 2mm. The lack of surface water and a drastic decline in underground water level had caused the extinction of large areas of vegetation. The winds are strong; they blow mainly from north and north-east at an average speed of 5.0 m/sec. As if this was not enough, last year, another calamity befell Nouakchott, this time an invasion of swarms of locusts which caused great havoc to the surviving trees.

28. The Nouakchott Green Belt Project (NGBP) was started in 1975 in cooperation with the International Lutheran Federation. Phase I of the project extended from 1975-1981, phase II 1982-1986 and phase III, 1987-1991. By 1991, the cost of the project will have reached US \$ 700,000. The Government of the Netherlands, the WFP and the Lutheran Church for Sweden have also contributed to the project. The main objective of the project is to protect the capital from the invasion of sand hills through the regeneration of natural environment.

29. Phase II of the project is about 2 1/2 km east of the city, where the old Nouakchott city used to be. About 150 ha had been planted with Prosopis juliflora. The objectives are:

- (a) making the population of Nouakchott district fully sensitive to and conscious of the problem at hand;
- (b) growing of plants with the assistance of the people (individual and collective afforestation) and
- (c) educating the people on techniques and methodologies employed in sand dune stabilization.

30. The UNDP/FAO committee further reiterated the need for schools to be strengthened for the production of junior and intermediate categories of staff rather than being up-graded into a University. This should include the training of junior agricultural officers, aimed at the following:

- (i) an integrated approach to agricultural training
- (ii) extensive practical and field work
- (iii) short term visits to rural farming areas
- (iv) developing student research projects and
- (v) field attachment

31. On successful completion of this course, the students would be awarded a certificate in Agriculture. Such students should readily find employment in the ministry of rural development and other related ministries. They should also be able to work as junior agricultural and forest extension officers. Others should be able to find jobs in veterinary clinics as well as assisting veterinary doctors in carrying out their routine diagnostic and curative measures. In many developing countries of Africa where agriculture is the main-stay of economy, such graduates would be employed as "managers" of small scale farms.

Sand dune stabilization: the Nouakchott Green Belt Project (NGP)

(i) Nouakchott's Green Belt Project (NGBP)

32. As already pointed out many buildings in the city of Nouakchott (including some hotels, the sugar refinery) and the airport runway are threatened by sand dunes. The situation appears hopeless at the first sight. Attempts are, however, being made to stabilize these dunes. The NGBP is 14 years old; it has been supported mainly by the Lutheran World Federation WFP. Prosopis juliflora is the main plant species being used to stabilize the dunes. However, mechanical stabilization with fences of Euphorbia balsanifera precedes the plantation of Prosopis seedlings.

33. The area afforested in the city of Nouakchott is like a drop in the ocean. The major obstacle in the establishment of Prosopis is the scanty rainfall. (At least 80mm of rain fall is necessary for the growth of Prosopis). Furthermore, the wind velocity is high, and sometimes it blows from all directions making the sand barrier fences useless. There are also many domestic animals (cattle, camels, goats, donkeys, etc) in the city, and one would imagine that they relish the proteinous leaves of leguminous plants such as Prosopis. The city of Nouakchott, like any other metropolis, belongs to all the inhabitants, however, activities such as sand dune stabilization is nobody's business. Consequently, individuals hired to carry out sand dune stabilization would demand to be remunerated well. Finally, the population of Nouakchott has markedly increased in recent years putting additional pressure on the meagre resources of the city.

34. It is against all these odds, that something must be done in order to halt the advancing sands lest they choke all the facilities and investments of the city.

c. MOROCCO

35. The total area of the Kingdom of Morocco is 710,850 km² of which 62% constitutes desertified land, 16% arid, 15% semi-arid and an equivalent of 7% as subhumid and humid zones. The semi-arid areas receive about 300 mm rainfall per year while the arid zones receive about 100 mm/annum. The natural vegetation follow the climatic zones; the desertified and arid zones consist of scattered vegetation. The semi-arid zones are dominated by herbaceous species and dwarf trees, while the sub-humid zone is characterized by natural vegetation of trees as well as permanent prairies or meadows. The forested area is about (8.97) million ha of which 500,000 ha consist of artificially planted forests.

36. The population of Morocco is approximately 22 million inhabitants of whom 57% are rural. Eighty percent of the rural population obtain their livelihood from agriculture. The mean annual growth rate of the country is about 2.6% while that in the rural areas is 1.4%. The lower rate of population growth in the rural areas is mainly due to mass exodus of the population to the urban centres. Agricultural land is about 7.9 million ha. of which 0.76 million ha are irrigated.

37. Irrigated lands constitute 45% of the total agricultural lands and contribute at least 60% to the total agricultural export earnings. The 7.9 million ha (out of which 0.76 mill. ha. are irrigated) represents the useful agricultural land of the country. The pastures occupy about 21 mi ha. and the forest (including reafforested area) occupy 9.4 mill. ha. The forests and grasslands are meant to protect and preserve the land from soil loss.

38. Some of the factors which contribute to the desertification of Morocco include the following:

- (i) High annual and inter-annual variability in climate including torrential rains;
- (ii) fragility and impoverishment of the soil due to over-utilization;
- (iii) land degradation arising from removal of vegetation by man;
- (iv) high rural population.

39. In the agricultural ecosystems the process of desertification is enhanced by (i) poor farming methods, (ii) salinization due to poor drainage, resulting in the rise of salt water to the surface - especially in irrigated systems.

40. In the pastoral system desertification results from over-grazing due large stock numbers. For forest ecosystems desertification stems from uncontrolled collection of fuelwood by the population neighbouring the forests.

41. Productive cultural land has become a scarce commodity in the country. This has resulted in pressure on forested and grassland areas. Recent studies have revealed that nearly 180,000 ha. of grassland areas have disappeared since 1950 to pave way for agricultural farms. Estimates also suggest that 6,000 ha. of forests are cleared annually in preparation for agricultural land in the Provinces of Al Hoceima, Azizal, Agadir and Taxa.

42. Fuelwood consumption is similar to activities of pastoralism in the sense that both take away from the ecosystem more than the productive capacity of the ecosystem. It has been estimated that nearly 10 million m³ of fuelwood are annually taken away from forests.

43. The grazing lands are diminishing year by year due to (i) their conversion into agricultural lands for cereal production (ii) over-grazing and (iii) fires. It has been estimated that 20,000 to 80,000 ha of grassland are converted to cultivation annually, while fires destroy about 2,700 ha. per year of forests.

44. Soil erosion by water threatens almost the entire of Morocco. Out of 23 million ha of farming and pasture land nearly 12.5 million ha are at risk of being eroded. Approximately two thirds of the farming land require urgent interventions to prevent soil loss. The transport of silt downstream into dams and reservoirs has become so serious that the water holding capacity of these dams has been reduced by 50-60 mill cu metres per annum. In other words, an irrigation potential of approximately 5000-6000 ha/year is lost. In the southern region of the country, siltation is one of the main manifestations of desertification in that many reservoirs are silted only after a short period of 10-15 years.

45. The problem of salinization is common to almost all large scale irrigation schemes. Recent studies show that 37,000 ha out of 414,000 ha are affected by salinization or alkalinisation. In the Ouarzazate and Errachidia provinces alone, it has been estimated that 22,000 ha of irrigated lands and 5 million ha of pasture are salinized.

46. Some of the socio-economic impacts arising from desertification include:

- (i) the reduction of forest and vegetation cover resulting in a reduction of fuelwood and fodder.
- (ii) soil erosion resulting in loss of top soil and soil fertility with a concomitant reduction in crop yields. This forces farmers to look for new farming lands elsewhere.
- (iii) siltation of dams and reservoirs hampers socio-economic developments.

Combating desertification

47. Combating desertification activities in the country is shared between many Government departments. The objectives of desertification control were initially laid down in the Forests Exploitation and Conservation Act of October 1917- which was amended in 1960.

48. There are other legislations pertaining to soil conservation, protection of nature and environmental conservation, as well as conservation of specific plant species. In 1976 a legislation was passed relating to the participation of the public in the development of forest economy.

49. In 1970 the National Plan of Action for Afforestation was adopted in collaboration with FAO. It was envisaged that 66,000 ha of land would be afforested by the year 2000. The target remains valid today. There are 93 tree nurseries scattered all over the country. At the Provincial level the Governor of the Provinces coordinates afforestation activities with other ministries such as Home Affairs and Public Works.

50. Problems associated with soil erosion and the management of water resources have led to the integration of programme activities with a view to protecting against uphill erosion and the safeguarding of the hydro-agricultural works downhill.

51. In 1986, the National Plan of Action to Combat Desertification was undertaken. The plan outlined:

- (a) Coordination of participants in desertification control: Establishment of a permanent committee on desertification control which would be in-charge of policies on water management throughout the country;
- (b) Pastoralism programme;
- (c) Agriculture including resource utilization, research and development;
- (d) Environmental legislation;
- (e) Soil and water conservation.

52. The Government is at the moment trying to maintain the status quo in these drought stricken areas. Attempts have been made to plant xerophytic plant species-mainly Atriplex and Artemisia to reduce soil erosion in these areas. The grazing lands are used communally, however, the livestock are owned individually. In addition, the government has adopted other measures to reduce degradation of the rangelands. Some of the measures include:

- (a) introduction of rotational grazing;
- (b) planting of shrubs and herbs;
- (c) organization of pastoralists into cooperative societies.

53. Although the planting of shrubs and other activities is undertaken by the Govt., the pastoralists pay a small fee for these services. Other plant species which the Govt. has included in its planting programme include Acacias, Medicago, Trifolium etc.

54. The Government has also established a centre for production of rangeland plant material. This centre ensures continuity in the multiplication and production of the material as well as evaluation of the adaptability of the material to various ecological habitats. In addition, the centre serves as a gene-bank for the arid plant material. Finally, this centre also maintains a collection of materials for species from other countries.

55. The Government has been monitoring the changes which are occurring on rangelands including counting the animal species numbers as well as assessment of abundance and vegetation types. As pointed out earlier the germplasm of the several species is being multiplied at the Centre. The Govt. has also been assisting the pastoralists in improvement of the quality of their animals by providing medicines to control the various types of animal diseases. Although some breeding work is going on, the Govt. has had to ensure that the maintenance for the indigenous breeds continues so that it can be used at a later stage. A specific case along the border between Algeria and Morocco is cited, where the inhabitants prefer the Algerian highbreed goats to the Moroccan native ones. The Govt. does not want to completely lose the native stock in favour of the Algerian breed because extinction is irreversible.

56. The Government of Morocco is paying special attention to the problem of desertification control. One of the areas of concentration has been the conservation of natural resources such as soils, vegetation cover and water. In the five year plan (1988-1992), the Govt. is paying particular attention to the following:

- (i) conservation of surface and underground water;

- (ii) conservation of soil using various techniques including cultural practices;
- (iii) combating wind erosion by construction of wind breaks in the affected areas;
- (iv) rehabilitation of salinized and alkalinized soils;
- (v) re-examination and enactment of laws governing the exploitation of agricultural land; and
- (vi) conservation of natural vegetation.

57. On the question of mobilization of water resources, the Government has stopped this because it was building one large dam which would not be completed until the year 2000. The Govt. also hopes to put into operation an additional 500 smaller dams.

58. In order to manage the existing forests well, the Govt. was making efforts to conduct inventories of about 5 million ha. of forests. It was also planned that, in this five year plan, the Govt. would attempt to utilize rationally about 450,000 ha. Regarding the regeneration of natural forests, it was anticipated that about 200 ha would be put under this scheme. In order to alleviate the fuelwood problem, it was envisaged that village plantations would have to be increased to 2000 ha. However, the afforestation programme itself would involve some 80,000 ha within the five years.

59. The other activities envisaged in this five year plan relate to silvicultural studies including research on the production of forage for livestock. It should also be noted that the soil conservation programme includes all aspects of sand dune fixation.

D. MOZAMBIQUE

60. Some of the causes of desertification in Mozambique include the high density of the human population, the non-sustainable use of natural resources (soils, water, forests). Deforestation of catchment areas and overutilization of soils has resulted in the rapid deterioration of land and siltation of some dams and rivers. In the semi-arid areas, livestock, particularly goats, have helped to aggravate the situation by removing vegetation resulting in extensive soil erosion.

61. Salinization problems arise when the volume of water in the Limpopo River recedes the sea water flows backwards. The farmers have in the past, used this salt containing water for irrigation, resulting in salinization of some 2000 ha. After independence, the State took over this land. Adjacent to this land are coastal sand

dunes which are now threatening to engulf the fertile irrigable lands in the Limpopo valley. Casuarinas have been used to stabilize some of the dunes. The project was under the direction of the Provincial Agricultural officer, and due to budget constraints, it has lapsed. The areas where sand dunes had been stabilized are, once again, in danger of reactivation. Moreover, there are relatively few people in the area to participate in the stabilization process.

62. Deforestation in the country is extremely serious in the southern part of the country. Mozambique has been estimated to possess about 19 million hectares of forest. In 1986 it was estimated that 130-150 trucks (8 ton lorries) come to Maputo each day loaded with fuelwood. The need for fuelwood in the urban centres has been exacerbated by the exodus of people from the rural areas due to civil strife.

63. Sand dunes constituted an acute problem south of country. About 2500 hectares of Casuarina plantations have been established to arrest sand dunes. However the current thinking by some ecologists is that attempts should be made to use native species (Acacia, etc) to halt the migration of sand dunes rather than using Casuarinas.

64. In more recent years trials on intercropping of Eucalyptus and crop plants have been carried out with different spacings. These trials will be analyzed next year. Trials using native species have not been done, and it is expected that they will commence next year. Other experiments have aimed at seed production, nursery trials, plant population and agroforestry studies.

65. Maputo receives 600-1000 mm, Beira (Sofala Province) about 1000 mm while Nampula Province gets about 800 mm./annum. More than 60% of the total land is infested with tse-tse flies making livestock industry difficult. There are 3 parks and three national reserves in the country.

66. The country has a number of laboratories for breeding species and soil conservation. The complex includes:

- (i) irrigation scheme training lab.
- (ii) animal husbandry including bee, poultry keeping
- (iii) soil conservation (afforestation)
- (iv) rural development plans for each province
- (v) human nutrition

67. The techniques of sand dune stabilization are well known. They may involve fencing the affected area to exclude grazing followed by mechanical stabilization as suggested above. This may be followed by construction of checkerboards using local materials (stones, clay from a river if available or straw or any plant refuse). In some cases this step is completely omitted so that the mechanical stabilization is followed directly with planting of appropriate species which form micro-fences. In some parts of the world levelling of the dunes precedes the planting of appropriate sand holding species; in other places no levelling is done. In some cases it may be necessary to use living xerophytes to stabilize the sand dunes on the wind-ward side and the apex of the dunes before planting other species.

68. Sand dune stabilization is a demanding process which requires the popular participation. It is hoped that the local people in the vicinity of the dunes will be persuaded and encouraged to participate in this worthwhile endeavour.

69. The objective of irrigation is to combat hunger through the use of river or dam water. This practice is characteristic of drought prone areas or where a farmer does not wish to be wholly dependent on the erratic rainfall. It has been estimated that about 25,000 ha. of land are under irrigation in the Limpopo valley.

70. Although irrigation is vital in the production of food for the ever expanding populations, it can also result in desertification. In general, irrigation farmers tend to use more water than is necessary resulting in the accumulation of various types of salts in the soil. Unless an irrigation scheme is well planned including the drainage of excess water, the problem of salinization is bound to arise at some stage. Because drainage is expensive, it is desirable that it be implemented at the very beginning of the establishment of an irrigation scheme rather than attempting to do it after the soil has become salinized. The drained salt solution could also be evaporated through appropriate structures to yield the common salt.

71. Along the coast of Mozambique, there are also many areas which apparently contain high levels of salts. Efforts are however, underway to afforest such areas using species of Casuarina, Acacia and Prosopis. It is hoped that this activity will be expanded. It is further hoped that plantation of other plant species will be tried in these habitats.

72. It is particularly impressive that the women rather than the men are more involved in afforestation. In order for the rural afforestation programmes to succeed women must be the target. It is the rural women who travel long distances to fetch water. It is the rural women who hoe, plant, weed, harvest, thresh and store the grain. It is the rural women who experience hardships when adverse weather conditions occur. As pointed earlier, women will respond readily to calls to participate in afforestation programmes. More women should, therefore, be trained as extension workers. Women should, therefore, be involved in the planning and implementing of strategies to combat desertification.

73. The two most obvious stumbling blocks to development in the Republic are the civil strife and an acute shortage of trained manpower. With respect to civil strife it will certainly have to come to an end. However, as pointed out earlier problems of land degradation will linger around for a long time to come. There is a need for every primary and secondary school to establish a tree nursery. This should be done in collaboration with the Ministry of Education.

74. The development of primary and secondary school curricular containing a substantial amount of environmental education must be undertaken. The University's in-put into the development of primary and secondary school curricula is essential. This task must not be left for the National Institute for Development of Education. If the University had participated fully in this endeavour, the current high failure rates at the University would not be existing. Preparing of teaching materials including the writing of text books for use in secondary schools should be undertaken seriously by the University staff. But this can only be done if the University Staff are interested and/or involved in the development of secondary school curricula. Generally speaking, many high school pupils prefer to pursue professional programmes at the University rather than pure science or humanities. When stability and peace have arrived in the country, the Deans of the Faculties of Science and Agriculture should travel throughout the country to talk and interest the high school students in these subjects. Finally, the University must endeavour to train and produce more graduates capable of facing the changes that exist in the country.

75. There are many instances where there is duplication of effort. Because of the meager resources of the country, there is an urgent need to establish a central Authority to coordinate actions on desertification control. The Environment Section in the Institute for physical Planning could be strengthened so that it assumes the role of coordination.

D. SOMALIA

76. Although UNSO is in the forefront of most anti-desertification activities in the country, it cannot be depended upon forever. The real strength of a nation lies in its own native scientific community. Sand dune movements constitute a major environmental threat to developmental activities South of Mogadisho. Available satellite imagery information indicates that over 150,000 ha of land to the south of Mogadisho consists of reactivated sand dunes, while 315,000 ha of land to the North of Mogadisho is caused largely by over-use of these habitats by man himself and his livestock. This has been well documented by investigators working on sand dune fixation in the country.

77. Currently there has a concerted effort by several international donor agencies under UNSO to arrest sand dunes in Shallambod, Brava and Adale areas South of Mogadisho. The objectives of the projects include: sand dune fixation and stabilization, forest nursery establishment, selection of appropriate sand holding plant species and the introduction of shelter belts to promote public awareness on the fragility of the environment. The cost of these projects has been estimated to be almost US\$ 2.7 million.

78. Protection of stabilized sand dune areas from human encroachment results in non-reactivation of the dunes. Irrigation of semi-arid lands is one way of combating food shortage in a nation. Somalia is not endowed with many rivers which can be used for extensive irrigation practices. Irrigation is, therefore, carried out on about 100,000 ha of land.

79. Although irrigation may be used to supplement food production from rain-fed agriculture, improper irrigation practices lead to salinization and water logging. Reclamation of salinized soils is an expensive endeavour. In most instances it takes an average of five years for irrigated land to be salinized. When this happens, farmers ironically just move to the next plot to repeat the same operation. Salinized land is, for all practical purposes, desertified land.

80. There are severe soil erosion problems South of Mogadisho city. The gulleys are wide and deep. Deforestation and overgrazing were the main causes of land deterioration thereby accentuating the erosion process. Almost 50% of the land area in the northern part of the country is experiencing acute problem of sheet erosion.

81. The control of soil erosion by building lines of low stone dikes or by construction of gabions in order to slow the run-off requires little technical-know-how. However, manpower is necessary. This is where creation of public awareness and obtaining the participation of the citizens in such activities is crucial.

82. With this background, the Government has decided to formulate a national plan of action to combat desertification and the impacts of drought. The main objectives of the NPAOD are:

- (a) Establishment of a co-ordinating authority for all environmental issues including desertification control;
- (b) Establishment of a mechanism of environmental monitoring and a national environmental data base;
- (c) Strengthening and development of environmental education;
- (d) Strengthening the department of forestry, wildlife and anti-desertification at the National Range Agency (NRA);
- (e) Combating desertification in selected priority areas;
- (f) Development, production and propagation of audio-visual means for environmental education in order to enhance awareness in children and adults of the seriousness of the desertification problem;
- (g) To devise new and appropriate methods for combating desertification in Somalia by conducting baseline studies.

83. The most active institution in environmental matters is the Faculty of Agriculture was established in 1971 under the sponsorship of the Italian Government. There are two options in the Faculty which offer BSc degrees in Agriculture and Botany and Range Science. The latter programme was established in 1983. The total number of students which has graduated from the Faculty since 1975 is 377 of which only 40 pursued the Botany and Range Science option. The major objective in establishing the Botany and Range Science Dept. was to train scientific personnel in range management. Most of the graduates work for NRA and the related departments within the Ministry of Livestock. At the beginning of the course programme, foundation courses are offered jointly to both groups of students but later they branch into their respective disciplines. The Botany and Range Science option is funded by USAID. The funding lapses in June 1988 and the activity would be taken over by World Bank.

84. The Departments are experiencing an acute shortage of lecturers, because those students who were sent to USA for further training for their MSc degrees failed to return to the country. The situation is likely to worsen because the World Bank has made no provision for expatriate lecturers in its commitment.

85. Within this context, the government of Somalia is paying particular attention to the:

- (i) Strengthening of environmental education at primary and secondary school levels through active participation in the Environmental Education Unit of the Curriculum Development Centre;
- (ii) Writing and publishing books to support programmes in environmental education;
- (iii) Production of text books on environmental education for the teacher trainees.

F. SUDAN

86. In Sudan today, desertification is caused by a combination of factors. They include irrational land use such as overgrazing, overcropping, wood cutting and deforestation; lowering of water tables due to increased water use and burning of grass, shrublands and forests. It is important to note that all these destructive activities of man can be prevented and halted resulting in reversal of desertification. Man-induced causes of desertification in Sudan, include (a) mechanized farming (b) bush fires and (c) overgrazing.

87. Approximately half of the Sudan receives less than 400 mm of rainfall per annum. It is, therefore, extremely drought and desertification prone. In 1985, the extent of desertification was estimated to be approximately 26% (or 652,000 km²) of the total land area. The most affected areas are the semi-arid areas (86,000 km²) and the northern fringe of the low rainfall ecological zone (163,600 km²). The true desert (0-75 mm rainfall) is found in the northern part of the country. However, the semi-desert areas (75-300 mm rainfall) occupy the region just below the true desert zone, (Khartoum City is situated in the semi-desert ecological zone). The low-rainfall savannah ecological region (300-800 mm) stretches across the entire country - just below the semidesert zone. The dominant vegetation of the semi-arid zone include semi-desert grassland/shrubland with Acacia mellifera and Commiphora spp. as the main tree species.

88. Desertification control in Sudan is not a new phenomenon. The seriousness and magnitude of desert encroachment in the semi-arid lands of Sudan was recognized in the early 1940s. Indeed, some of the data on the rate of desert advancement cited during the United Nations Conference on Desertification (UNCOD, 1977) arose from measurements carried out in the Sudan. In 1976, a year before the UNCOD meeting in Nairobi, Sudan had produced its own document on

desert encroachment control and rehabilitation. The relevant question to pose now is what programme activities aimed at desertification control have been undertaken in Sudan since mid 1970s, and whether the Sudan people are now more environmentally conscious than they were a decade ago? In general, some visible signs of anti-desertification activities include the establishment of shelter belts, village woodlots and an increase in food self-sufficiency.

89. However, the expansion of herd sizes with the associated problems of overgrazing and the expansion of cropping areas are visible signs of desertification. In the following pages, a number of recommendations have been made specifically on the need to transform completely the national environmental co-ordinating unit (authority) in order to enable it execute its obligations. The authority requires the support of local and international professional staff and hence the need to host a national workshop to discuss freely all matters pertaining to desertification control. More importantly, the authority needs the full support of the policy makers (parliamentarians) and hence the need to hold a leaders' conference. Meanwhile, there is the dire need for the authority, with the support of political leaders, to promote public awareness on sound environmental management of the arid and semiarid ecosystems for sustainable development.

90. As in many countries of the subregion, the progress on participation of the masses in environmental conservation activities continues to be elusive. It is true that pamphlets have been written in local languages on various aspects of environmental management and distributed widely. But common sense suggests that individuals will participate in an activity if the latter has an impact on their way of life. Alternatively, an individual may recognize the danger posed by desertification but he or she becomes acclimatized to it. Environmental managers, political leaders as well as other concerned environmental crusaders should recognize these human tendencies and deal with them cautiously.

91. It is important to recognize the fact that every citizen within the land is a resource user - be he a parliamentarian (policy maker), civil servant (implementer of policy) or a farm or factory worker, an imam, a policy or army officers. Some citizens, especially the parliamentarians and the imams are better placed in society to create public awareness by virtue of their positions than the farm or factory workers. It is, therefore, suggested that the parliamentarians and the imams must play a greater role in mobilizing the masses within their constituencies or mosques for effective participation in environmental management, bearing in mind that the rural people constitute 80% of the total population of Sudan. Policy makers, as well as public servants should not

wait "for trigger events" in order to initiate public awareness on environmental hazards. They should routinely deal with the impacts of environmental stresses rather than reacting to them.

G. ZIMBABWE

92. Zimbabwe is one of the few countries in Africa which have developed and launched National Conservation Strategies (NCS). The objective of the Zimbabwe NCS is to protect the nations life support systems for sustainable development. The successful implementation of the NCS will depend largely on availability of resources as well as development of the necessary infrastructure, and the enforcement of conservation legislations which have been promulgated. The Zimbabwe Government is highly decentralized. There are 8 provinces in the country and each province is divided into several districts. Each district is further divided into wards and the latter into villages. A ward is represented by a Councillor in the rural or urban council. For development purposes, there are village as well as ward development committees. The District Administrator and the Provincial Governor chair the District and the Provincial Councils respectively. Concerning the day to day management of resources at the local level, the department of Natural Resources has stationed the Regional Land Inspector, the District Land Inspector and the Ranger at the Provincial, District and Ward levels respectively.

93. Achievements in the field of environmental conservation and natural resources management include:

- (a) promotion of public awareness on environmental conservation e.g. use of school children to raise tree seedlings for afforestation programmes; community participation in environmental conservation programmes at the ward and village levels.
- (b) ability to produce enough food (e.g. maize) to feed the nation plus surpluses for export.
- (c) working in close collaboration with other SADCC countries resulting in the exchange of information on environmental conservation matters and particularly in the exploitation on a sustainable basis of shared natural resources (e.g. the Zambezi Action Plan).
- (d) working to improve food security sector of the economy through expanded production at the household, national and at the sub-regional levels.

94. In some cases, it may be necessary to carry out pilot studies before solutions can be found. In many other instances, data already available and all that remains is the implementation of programme activities.

III. TRANSBOUNDARY ENVIRONMENTAL ACTIVITIES:

95. In co-operation with IGADD and other agencies in the subregion, it should be possible for ECA to sponsor inter-country study tours within the subregion aimed at observation of successful pilot projects on: (i) alternative energy sources to fuelwood (solar, wind and biogas), (ii) successful research techniques on forestry and soil stabilization for combating desertification, (iii) afforestation and agroforestry techniques with emphasis on selection and proliferation of plant species for rehabilitation of various ecological zones.

96. The IGADD Plan of Action was adopted by the First Summit of Heads of State and Government held in Djibouti in January 1986. This coincided with the launching of IGADD secretariat. However, the 1st Donors Conference was held in March 1987 in Djibouti. The Second Summit of the Heads of State and Government took place in March 1988.

97. The objectives of IGADD include, inter alia, co-ordination of activities of member States; appraisal of the international community of the magnitude of drought and desertification in the sub-region; identification of projects and mobilization of financial and technical resources for the implementation of the projects; assistance to member States in setting up guidelines and action programmes for drought and desertification control; and supplementation of member States efforts in raising public awareness in environmental management and conservation.

98. The strategies and programmes are categorized as follows:

- (a) Emergency measures and short-term programmes for the mobilization, distribution of food aid, provision of health care, provision of survival equipment and materials (blankets, water, etc) and the mobilization of logistic support (e.g. transport).
- (b) Long-term programmes
 - (i) Agricultural development and food production;
 - (ii) Resources development and management;
 - (iii) Development of physical and human infrastructures.

99. The means of implementation of the plan of action have been cited as: training and utilization of human resources, technical resources including research and experimentation, institutional resources legislation measures and economic and financial measures.

100. The sector on desertification control is under the OEC sponsorship. They have drawn up a programme of work for review by member States before implementation. This programme is in its initial stages of formulation and that there was little that could be elaborate upon. Nineteen projects have been submitted to OEC for funding.

101. As part of the plan, it would certainly be desirable to establish one institute for the subregion. There is the need to implement projects on sound scientific principles rather than by trial and error methods. World renowned desert research institutes such as the Institute of Desert Research, Academia Sinica in Lanzhou China, and the Desert Research Institute in Ashkhabad, USSR have spent three decades on selection and improvement of plant species for arid and semi-arid lands. In Eastern Africa farmers and pastoralists are advised to plant, for example, Eucalyptus tree species in nearly every ecological habitat - on desertified lands, in denuded high lands (at timber-line), along the salinized sea-shores, etc. despite the fact that there are more appropriate native species for rehabilitation of these habitats.

102. The objectives of IGADD as described in Part II of the Plan of Action are sound, reasonable and achievable. However, in Part III of the document entitled Strategies and Programmes, IGADD is on record as having pledged that the authority "shall mobilize material, financial and technical assistance for member States for ...". This promise is repeated for nearly all the sectors. For example, it appears in one form or another, under the following sectors: crop production, livestock production, fisheries development, water resources, energy resources development, desertification control and infrastructure development.

103. IGADD's responsibility ought to be foremost to create an atmosphere of confidence and self-reliance amongst the member States rather than promising them funds, materials and others.

104. One of the thorny issues within the sub-region is the use of shared natural resources particularly river waters. Improper irrigation systems up the stream increase salinity of the water down stream. Damming of rivers up stream may regulate and/or reduce the flow of water down stream. This is an area where IGADD should assist member States sharing the same natural resources to establish bilateral agreements so that the resources can be exploited harmoniously.

105. The other areas where co-operation amongst the member States could be implemented include:

- (a) exchange of seed and plant material for rehabilitation of rangelands.
- (b) exchange of information on research techniques on
 - (i) tissue culture techniques for proliferation of selected plant species;
 - (ii) drought resistant crop plants;
 - (iii) soil erosion and desertification control.

106. Another example can be taken from Mozambique and the countries surrounding it. Due to unavailability of resources and personnel, water quality of the country's rivers, dams and lakes were not being monitored. This is a very serious matter bearing in mind that most of the country's rivers originate beyond the borders of Mozambique. This is an area which should be seriously looked into and must commence as soon as the security of the country improves. Also of importance is the need to formulate adopt and enforce sub-regional legislations on shared natural resources (river water, wildlife) through SADC. Because Mozambique is at the receiving end, it ought to be her primary responsibility to initiate dialogue on this matter.

107. Since almost the same arguments can be made for the situation in the CILSS countries of West Africa, serious attention must be directed towards greater subregional collaboration in activities to combat desertification. This is important because desertification is more of a sub-regional problem than just a national one.

108. With this background, regional institutions like the African Centre of Meteorological Applications for Development (ACMAD) can meaningfully be relevant.

109. The objective of ACMAD is to promote the use of meteorological products for agricultural activities in the region. It is expected that the Centre will develop a meteorological user assistance network in Africa, with a view to:

- (a) produce adequate and reliable meteorological and climatological data, forecasts and information with continental coverage needed by the national Meteorological Services (NMSs), as well as by the RMCs and RTHs for the application of meteorology to economic and social development;

- (b) establish a capability for continental analyses of the African climate, its variability and change and the factors affecting such change;
- (c) help strengthen national institutional capabilities and develop manpower capabilities in the application of meteorological and climatological products, by introducing appropriate methodologies and techniques and by assisting in personnel training;
- (d) provide regular climatic and meteorological data and processed products to national and regional institutions, in order to contribute, inter alia, towards:
 - (i) Early warning systems (crops, livestock, forests, locusts, etc.);
 - (ii) Assessment and alleviation of the effects of drought, desertification, floods, tropical cyclones, etc.;
 - (iii) Increase in the quantity and quality of food production;
 - (iv) Promotion of the use of renewable energy sources;
 - (v) Conservation of the environment.
- (e) enhance the application of meteorological research to gain a better understanding of the atmospheric conditions which affect daily activities and the use of results of this research in fields such as agriculture, water resources development, transport, tourism, and the conservation of ecosystems

IV. CONCLUSIONS AND RECOMMENDATIONS

110. The above review reveals that, in the majority of cases combating desertification activities are part of national planning and no specific documented plan can be identified. This is particularly true of countries in the Sudano-Sahelian belt. Furthermore activities are carried out on a departmental basis and there are few national bodies charged with the specific duties of either drawing up a plan or coordinating combating desertification activities. However, activities are increasingly being undertaken to combat desertification and the impacts of drought, particularly at the national and sub-regional levels.

(a) Institutional setting:

111. There the need to strengthen and streamline combating desertification activities both at the national and sub-regional levels. Institutions, where they exist should be supported by governments, particularly the non-governmental institutions and organizations that are either interested or involved in combating desertification activities, including research and training.

(b) Manpower development:

112. Apart from developing all the levels of manpower resources that would be necessary for these activities, popular participation must be encouraged because it maximizes the use of all the human resource base.

(c) Inter-country co-operation:

113. Inter-country co-operation in programme development at the bilateral level should also be encouraged and/or strengthened within the context of existing subregional, governmental and non-governmental organizations.

17. Manpower development;

- Popular participation;
- Inter-country cooperation.