

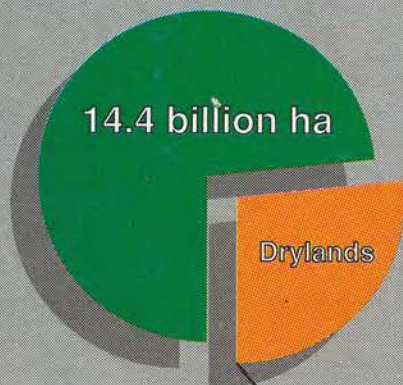
Desertification Control Bulletin

A Bulletin of World Events in the
Control of Desertification, Restoration
of Degraded Lands and Reforestation

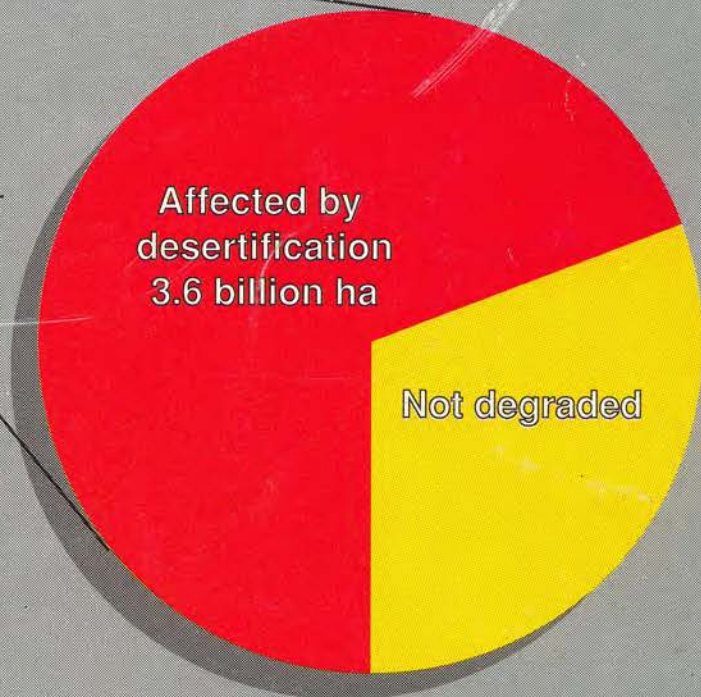
Number 20, 1991

Desertification — a global threat

World Land Surface



Drylands
5.2 billion ha



**The well-being
and future of
900,000,000 people at risk!**



Desertification Control Bulletin

United Nations Environment Programme

Number 20, 1991



In the Sahel, overexploitation of inherently fragile resources and prolonged dry years since the 1960s have resulted in vast areas of desertified land. Photo: UNESCO/FAPIS project

UNEP Governing Council Decision 16/22 - Desertification		3
A New Assessment of the World Status of Desertification	<i>H. Dregne, M. Kassas, B. Rosanov</i>	6
Desertification and Drought: An Ecological and Economic Analysis	<i>M. Kassas, Y. Ahmad, B. Rosanov</i>	19
External Evaluation of the Plan of Action to Combat Desertification	<i>Editor: A Buonajuti</i>	30
Regional Activities in Africa		34
News from UNEP		47
News of Interest		56

The United Nations Conference on Desertification (UNCOD) was held in Nairobi from 29 August to 9 September 1977. This was the first worldwide effort initiated to consider the global problem and responsibilities posed by the spreading menace of desertification. 95 States, 50 United Nations offices and bodies, 8 intergovernmental organisations and 65 non-governmental organisations participated. The United Nations Conference on Desertification prepared and adopted a worldwide Plan of Action to Combat Desertification (PACD) with 28 specific recommendations. The PACD was approved by the United Nations General Assembly at its 27th session on 19 December 1977.

Recommendation 23 of the PACD invited all relevant United Nations bodies to support, in their respective fields, international action to combat desertification and to make appropriate provisions and allocations in their programmes. Recommendation 27 gave the responsibility for following up and coordinating the implementation of the PACD to the United Nations Environment Programme (UNEP) with its Governing Council (GC) and Administrative Committee on Co-ordination (ACC).

Immediately after approval of the PACD, the Desertification Unit was established within UNEP to assist the Executive Director and ACC in carrying out their tasks to implement it.

In 1985 the Desertification Control Programme Activity Centre (DC/PAC) was created on the basis of the Desertification Unit by UNEP's Executive Director with approval from the Governing Council. DC/PAC is a semi-autonomous office with increased flexibility to respond to the demands of following up and implementing the PACD.

One of the main functions required by the PACD from the Desertification Unit is to prepare, compile, edit and publish at six-monthly intervals a bulletin to disseminate information on, and knowledge of, desertification problems and to present news on the programmes, activities and achievements in the implementation of the PACD around the world. Articles published in *Desertification Control Bulletin* do not imply expression of any opinion on the part of UNEP concerning the legal status of any country, territory, city or area, or its authorities, or concerning the delimitation of its frontiers or boundaries.

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Cover

Photographs

The Editor of *Desertification Control Bulletin* is seeking photographs for consideration as bulletin covers. All submissions should be addressed to the editor at the above address.

Technical requirements

Photographs must be colour transparencies of subjects related directly to desertification, land, animals, human beings, structures affected by desertification, control of desertification, reclamation of desertified lands, etc. Submissions must be of high quality to be enlarged to accommodate a square 18 cm x 18 cm.

Captions

A brief caption must accompany each photograph giving a description of the subject, place and country, date of photograph and name and address of photographer.

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It is assumed that all submissions are the original of the photographer and all the rights are owned by the photographer. *Desertification Control Bulletin* gives full credit to

photographers for the covers selected but does not provide remuneration.

Articles

Desertification Control Bulletin invites articles from the world's scientists and specialists interested in the problems arising from or associated with the spread of desertification.

Audience

The bulletin addresses a large audience which includes decision makers, planners, administrators, specialists and technicians of countries facing desertification problems, as well as all others interested in arresting the spread of desertification.

Language

The bulletin is published in English. All manuscripts for publication must be in English.

Manuscript preparation

Manuscripts should be clearly typewritten with double spacing and wide margins, on one side of the page only. The title of the manuscript, with the author's name and address, should be given in the upper half of the first page and the number of words in the main text should appear in the upper right corner. Subsequent pages should have only the author's name in the upper right hand corner. Users of word-processors are welcome to submit their articles on diskette in MS-DOS format, indicating the programme used.

Metric system

All measurements should be in the metric system.

Tables

Each table should be typed on a separate page, should have a title and should be numbered to correspond to its point in the text. Only essential tables should be included and all should be identified as to source.

Illustrations and photographs

Line drawings of any kind should each be on a separate page drawn in black china ink and double or larger than the size to appear in the bulletin. They should never be pasted in the text. They should be as clear and as simple as possible.

Photographs in the bulletin are printed black and white. For satisfactory results, high quality black and white prints 18 cm x 24 cm (8 in x 10 in) on glossy paper are essential. Dia-positive slides of high quality may be accepted; however, their quality when printed black and white in the bulletin cannot be guaranteed.

All line drawings and photographs should be numbered in one sequence to correspond to their point of reference in the text, and their descriptions should be listed on a separate page.

Footnotes and references

Footnotes and references should be listed on separate pages at the end of the manuscript. Footnotes should be kept to an absolute minimum. References should be strictly relevant to the article and should also be kept to a minimum. The style of references should follow the format common for scientific and technical publications; the last name(s) of the author(s) (each), followed by his/her initials, year of publication, title, publisher (or journal), serial number and number of pages.

Other requirements

Desertification Control Bulletin publishes original articles which have not appeared in other publications. However, reprints providing the possibility of exchange of views and developments of basic importance in desertification control among the developing regions of the world, or translations from languages of limited audiences, are not ruled out. Short reviews introducing recently published books in the subjects relevant to desertification and of interest to the readers of the bulletin are also accepted. Medium-length articles of about 3,000 words are preferred. A nominal fee is paid for articles accepted for publication and 25 reprints are provided to the authors.

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**Editorial Board of
Desertification Control
Bulletin**

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UNEP Governing Council Decision 16/22 - Desertification

A. Implementation of the Plan of Action to Combat Desertification

The Governing Council,

Recalling General Assembly resolutions 32/169 and 32/172 of 19 December 1977, 33/89 of 15 December 1978, 34/184 of 18 December 1979, 35/73 of 5 December 1980, 36/190 of 17 December 1981, 37/147 of 17 December 1982 and 37/218 of 20 December 1982, 38/160 of 9 December 1983, 39/168A of 17 December 1984, 40/198A of 17 December 1985, S-13/2 of 1 June 1986, 42/189A of 11 December 1987 and 44/172A of 19 December 1989,

Recalling also its decisions 9/22 of 26 May 1981, section VII of its decision 10/14 of 31 May 1982, section VII of its decision 11/7 of 24 May 1983, and its decisions 12/10 of 28 May 1984, 14/15A of 18 June 1987 and 15/23A of 25 May 1989,

Having considered the report of the Executive Director on the implementation in 1989 and 1990 of the Plan of Action to Combat Desertification (UNEP/GC.16/11),

Having also considered those parts of the 1989 and 1990 reports of the Administrative Committee on Coordination dealing with the coordination and follow-up of the implementation of the Plan of Action to Combat Desertification (UNEP/GC.16/16),

Reaffirming its conviction that the Plan of Action to Combat Desertification is an

appropriate instrument to assist Governments in developing national programmes for arresting the process of desertification,

Also reaffirming its conviction that combating desertification at the national level:

- (a) Should involve the traditional systems used by local people to promote popular participation in programmes of desertification control;
- (b) Requires the establishment of effective institutional machinery for integrating desertification control programmes into overall national development plans and priorities,

Taking note of the report of the Consultative Group for Desertification Control on the work of its seventh session (DESCON 7-7) and, in particular, its paragraph 22 (xii), which states that participants expressed a strong desire for the Consultative Group to contribute to the preparatory process for the United Nations Conference on Environment and Development and that it was suggested that, for this purpose, the eighth session of the Consultative Group, in 1991, would be of a special character and attract a large number of countries and organisations,

- 1 *Takes note* of the report of the Executive Director on the implementation in 1989 and 1990 of the Plan of Action to Combat Desertification;
- 2 *Authorizes* the Executive Director to submit his report, on behalf of the council, through the Economic and

Social Council, to the General Assembly at its forty-sixth session;

- 3 *Encourages* the ongoing efforts to compile a global assessment of desertification and to carry out mapping of thematic indicators of desertification at the global, regional and national levels;
- 4 *Takes note* of the action taken by the Inter-Agency Working Group on Desertification to mobilize technical resources to assist States members of the Southern African Development Coordination Conference to develop and implement national programmes to combat desertification and to encourage reporting on activities of member organizations relevant to the implementation of the Plan of Action to Combat Desertification;
- 5 *Invites* donor Governments, inter-governmental bodies, including aid agencies and non-governmental organisations, to accord high priority in their bilateral and multilateral assistance activities to national programmes for combating desertification and for the rehabilitation of degraded land resources and to take into account the promotion of long-term ecological and social rehabilitation programmes in areas prone to desertification;
- 6 *Emphasizes* the importance of further steps to improve international

coordination between agencies within or outside the United Nations system involved in combating desertification;

- 7 *Requests* the Executive Director to assist, within available financial resources, countries prone to desertification, at their request, in developing programmes for combating desertification within their development plans;
- 8 *Also requests* the Executive Director to intensify his efforts to contribute fully to the preparations for the United Nations Conference on Environment and Development in the area of implementing the Plan of Action to Combat Desertification and to report on his efforts to the Preparatory Committee for the conference through, inter alia, the drafting of a consolidated report to be made available to the Committee at its fourth session and giving a progress report to the Preparatory Committee at its third session, since the committee has decided to have a full discussion of the issue of desertification at that session;
- 9 *Authorizes* the Executive Director to convene the eighth session of the Consultative Group for Desertification as a session of a special character devoted to a review of the draft consolidated report on the implementation of the Plan of Action to

Combat Desertification before the report is made available to the Preparatory Committee and to invite all interested Governments, donor agencies and intergovernmental agencies to that session.

B. Financing and other measures in support of the Plan of Action to Combat Desertification

The Governing Council,

Recalling General Assembly resolution 34/184 of 18 December 1979, 36/191 of 17 December 1981, 37/220 of 20 December 1982, 42/189C of 11 December 1987 and 44/172A of 19 December 1989,

Recalling also its decisions 13/30A of 23 May 1985, 14/15D of 18 June 1987 and 15/23B of 25 May 1989,

Having considered the report of the Executive Director on the Consultative Group for Desertification Control (UNEP/GC.16/16 section III),

- 1 *Recommends* that, pending action by the General Assembly on the recommendations of the United Nations Conference on Environment and Development, the mandate of the Consultative Group for Desertification Control should be changed to concentrate on information exchange and coordination,

reviewing the status of the Plan of Action to Combat Desertification and exchanging information on scientific research in this field, national programmes and the implementation of the Plan of Action to Combat Desertification, and advising on further action against desertification;

- 2 *Invites* the international community to pledge voluntary contributions to local, national and regional mechanisms for financing the implementation of the Plan of Action to Combat Desertification;
- 3 *Further invites* the international community to create the necessary economic and financial conditions that would enable countries prone to desertification to appropriate part of their resources to combat desertification;
- 4 *Requests* the Executive Director to expedite the studies requested by the General Assembly of the Secretary-General, with the assistance of the Executive Director, on the financing of the Plan of Action to Combat Desertification and other aspects of supporting it.

C. Implementation in the Sudano-Sahelian region of the Plan of Action to Combat Desertification

The Governing Council,

Recalling General Assembly resolution 32/170 of 19 December 1977, 33/88 of 15 December 1978, 34/187 of 18 December 1979, 35/72 of 5 December 1980, 36/190 of 17 December 1981, 37/216 of 20 December 1982, 38/164 of 19 December 1983, 39/168B and 39/206 of 17 December 1984, 40/198B of 17 December 1985, S-13/2 of June 1986, 42/189B of 11 December 1987 and 44/172B of 19 December 1989,

Recalling also its decisions 13/30B of 23 May 1985, 14/15B of 18 June 1987 and 15/23B of 25 May 1989,

Having considered the report of the Executive Director on the implementation in 1989 and 1990 of the Plan of Action to Combat Desertification and, in particular,



Desertification control programmes will work best if they are implemented as part and parcel of national development plans. Photo: UNEP/Harvest of Dust



Combating desertification at the national level should promote popular participation in programmes of desertification control. Photo: Dan Stiles

the section on the implementation of the Plan of Action in the Sudano-Sahelian region (UNEP/GC.16/16 section IV),

- 1 *Commends* the United Nations Sudano-Sahelian Office on the steps it has taken, on behalf of the United Nations Environment Programme, towards the implementation of the Plan of Action in twenty-two countries of the Sudano-Sahelian region, in particular in the areas of natural resources management and sustainable development;
- 2 *Requests* the United Nations Sudano-Sahelian Office to strengthen its actions at the national level to assist Governments in the region in developing national plans of action to combat desertification and in incorporating them into national plans for sustainable development, developing or strengthening relevant institutions, implementing replicable integrated projects and ensuring that not only the symptoms but also the causes of desertification are addressed, using available financial resources effectively by avoiding duplication of activities and coordinating the anti-desertification activities undertaken

by the international community in the region;

- 3 *Urges* the United Nations Sudano-Sahelian Office to contribute fully to the preparation of the United Nations Conference on Environment and Development and, in particular, to the comprehensive report on desertification for the Conference;
- 4 *Authorizes* the Executive Director to continue support to the Office as a joint venture with the United Nations Development Programme;
- 5 *Invites* the Executive Director and the Administrator of the United Nations Development Programme to intensify efforts to mobilize resources for continued assistance to the countries served by the Office in combating desertification.

D. External evaluation of the Plan of Action to Combat Desertification

The Governing Council,

Recalling its decision 15/23A of 25 May 1989,

- 1 *Takes note* of the report of the Executive Director on the findings and recommendations of the external evaluation of the Plan of Action to Combat Desertification (UNEP/GC.16/16/Add.1),
- 2 *Underlines* the need for further refinement of the definition of the concept of desertification, taking into account recent findings about the influence of climate fluctuations and about the resilience of soils;
- 3 *Requests* the Executive Director to forward the approved findings and recommendations of the evaluation report along with the present decision to the Preparatory Committee for the 1992 United Nations Conference on Environment and Development at its third substantive session, in August 1991;
- 4 *Also requests* the Executive Director to take into account, when revising the existing recommendations of the Plan of Action to Combat Desertification, the approved findings and recommendations of the

evaluation report and of the present decision and to include the revised recommendations in the Council's report to the United Nations Conference on Environment and Development on the status of desertification and implementation of the Plan of Action.

E. Implementation of the General Assembly resolution 44/172A

The Governing Council,

- 1 *Requests* the Executive Director to expedite the comprehensive implementation of General Assembly resolution 44/172A of 19 December 1989, in which the Assembly requested the Secretary-General of the United Nations, in cooperation with the Executive Director, to prepare, inter alia, a report containing financial and technical expert studies on ways and means to combat effectively desertification, and a general evaluation of the progress achieved in implementing the Plan of Action to Combat Desertification, together with contributions from the Consultative Group for Desertification Control, for presentation to the Preparatory Committee for the United Nations Conference on Environment and Development at its fourth session, and giving a progress report to the Preparatory Committee at its third session, since the Committee has decided to have a full discussion of the issue of desertification at that time;
- 2 *Further requests* the Executive Director to undertake the appropriate measures, within available resources, to strengthen the Desertification Programme Activity Centre to enable it to discharge effectively its responsibilities.

*8th meeting
31 May 1991*

A New Assessment of the World Status of Desertification

By H. Dregne

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Introduction

A new assessment of the world status of desertification was undertaken by the United Nations Environment Programme (UNEP) in 1990-1991. The aim was to provide reliable and consistent data on the present situation and recent changes in the world's drylands for the United Nations Conference on Environment and Development (UNCED), or *Earth Summit*, to be held from 1-12 June 1992 in Brazil.

Two previous global assessments of the status of desertification had already been carried out: the first in 1976-1977 for the United Nations Conference on Desertification (UNCOD, 1977); and the second in 1983-1984 for UNEP Governing

Council's 12th Session which evaluated progress in the implementation of the United Nations Plan of Action to Combat Desertification (PACD). The PACD was adopted in 1977 by UNCOD and endorsed by the UN General Assembly.

Results of Past Assessments

It was accepted by UNCOD (1977) that *desertification is the diminution or destruction of the biological potential of land, and can lead ultimately to desert-like conditions*. At the time of UNCOD it was found that, within the drylands, the area affected at least moderately by desertification comprised some 3.97 billion ha, or 75.1% of total drylands, excluding hyper-arid deserts, and that the process seriously threatened the well-being and future of peoples in more than 100 countries in different parts of the world. Population in areas that had recently undergone severe desertification and directly affected was estimated at 78.5 million. Annual loss of productive capacity of land due to desertification (income foregone) was globally estimated at US \$26 billion. A twenty-year world-wide programme to arrest further desertification required funding of about US \$4.5 billion annually or US \$90 billion in total.

The 1984 assessment confirmed the scale and urgency of the desertification problem as presented to UNCOD and addressed by the PACD. Desertification had

continued to spread and intensify despite efforts undertaken since 1977 which were too modest to be effective. Land continued to be irretrievably lost through desertification or degraded to desert-like conditions at a rate of 6 million ha annually; land reduced to zero or negative net economic productivity was showing an increase of up to 21 million ha annually. Areas affected by at least moderate desertification comprised 3,100 million ha of rangelands (80% of their total area in drylands), 335 million ha of rainfed croplands (60% of their total area in drylands), and 40 million ha of irrigated croplands (30% of their total area in drylands) - in all, up to 3,475 million ha (or 70% of total area of drylands). Rural populations in areas severely affected by desertification numbered 135 million.

Recently, desertification has become one of the most serious environmental and socio-economic problems of the world, as was stressed in the report of the United Nations Commission on Environment and Development (*Our Common Future*, 1988).

The Concept of Desertification

At the start of this new assessment it was recognized that the existing definition of desertification as adopted by UNCOD in 1977 was not sufficiently operative and grossly inadequate for purposes of quantitative assessment. Two studies were commissioned

by UNEP to clarify the issue: the first was *A Review of UNEP's Definition of Desertification and its Programmatic Implications* by Professor Richard S. Odingo of the University of Nairobi, Kenya; and the second was *An Assessment of Global Desertification: Status and Methodologies* by Professor Boris G. Rozanov of Moscow State University, USSR.

After considering these studies as well as other relevant material, the Ad-Hoc Consultative Meeting on the Assessment of Desertification convened by UNEP from 15 to 17 February 1990 in Nairobi, adopted a new working definition of desertification which was taken as a basis for the compilation of the *World Atlas of Thematic Indicators of Desertification* (Edward Arnold, 1992) and for this present assessment.

However, while data were being collected for this assessment, it became evident that a further refinement of the definition and concept of desertification was required. The new definition was finally adopted by the Third Meeting of the Technical Advisory Group on Desertification Assessment and Mapping convened in Nairobi by UNEP from 5 to 7 June 1991. After extensive consultations with relevant United Nations agencies, including the UN Food and Agriculture Organisation, UN Educational, Scientific and Cultural Organisation and the World Meteorological Organisation, and with individual scientific experts in this area, the meeting elaborated a new definition:

Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting mainly from adverse human impact.

Land in this context includes soil and local water resources, land surface and natural vegetation or crops. Degradation implies reduction of resource potential by one or a combination of processes acting on the land. These processes include water erosion, wind erosion and sedimentation by those agents, long term reduction in the amount or diversity of natural vegetation, or decrease of crop yield where relevant, and salinization and sodication of soils.

The new definition recognizes that although the main cause of desertification is adverse human impact, the impact of natural climatic conditions, particularly recurrent droughts, on desertification may play a role under certain circumstances.

In the past there has been some confusion between the two different processes, the one called *desertification* and the other called *expansion and contraction of the desert*. It is important to recognize that desertification is a distinct process of land degradation throughout the drylands and must therefore be distinguished from the quite separate phenomenon of observed cyclic oscillations of vegetation productivity that occur at desert fringes. It is these oscillations in vegetation productivity, often sparked by climate fluctuations, that give the impression that the desert is expanding or contracting, as revealed by satellite data. But this is not *desertification*.

The most obvious symptoms of both the process of desertification and its results relate to a reduction of biological and economic productivity, value of land, and to pollution of water and air. In other words:

- * reduction of yield or crop failure in irrigated or rainfed farmland;
- * reduction of perennial biomass produced by rangeland and consequent depletion of food available to livestock;
- * reduction of available woody biomass and consequent extension of the distance to sources of fuelwood or building material;
- * reduction of available water due to decrease of river flow or groundwater resources;
- * encroachment of sand that may overwhelm productive land, settlements or infrastructures;
- * increasing flooding, sedimentation of water bodies, water and air pollution;
- * disruption to human life due to deterioration of life-support systems; need for affected society to ask for outside help (relief aid) or to seek haven elsewhere (migrating environmental refugees).

The causes of these various forms of ecological degradation and corresponding socio-economic disruptions relate to a combination of:

- * human exploitation that oversteps the natural carrying capacity of the land resource system and sometimes under-exploitation and abandonment of land due to the migration of people;
- * the inherent ecological fragility of

the resource system; and

- * adverse climatic conditions, including severe recurrent droughts in particular.

High degrees of land degradation play a large part in increasing the susceptibility of farming systems to the shocks of drought, as was so clearly seen in the Sudano-Sahelian region of Africa during the last decades.

Excessive human pressures on natural resource systems relate to:

- * increase of population and escalation of human needs;
- * socio-political processes that bring pressures on rural communities to orient their production towards national and international markets;
- * socio-economic processes that reduce the market value of rural products and escalate the prices of rural people's needs;
- * processes of national development, especially programmes for expansion of farmlands for production of cash crops, that exacerbate conflicts over land and water use and often reduce areas available to marginalized communities. The overriding socio-economic issue in desertification is the imbalances of power and access to strategic resources between different groups in society.

Desertification is a very distinctive global environmental and socio-economic problem requiring the special attention of the world community. It is different to the phenomenon of land degradation in other, more humid areas of the world because it proceeds under very harsh climatic conditions and acts adversely on what are already very limited natural resources, ie, soil, water and vegetation. Naturally, there are extents and degrees of desertification but, if the process is not arrested, it is merely a question of time before the land inevitably becomes degraded and abandoned.

Socio-economically, desertification:

- * constitutes the main cause and mechanism of global loss of productive land resources and thus reduces the world capability of providing sufficient food and shelter to growing populations, thus contributing to the spread of poverty and hunger;
- * causes economic instability and

political unrest in areas affected as people struggle to survive with scarce land and water resources and are often forced to migrate in search of relief and refuge;

- * brings pressures on the economy and stability of societies immediately outside areas affected by desertification through escalating the need for food aid and contributing to the influx of environmental refugees, etc;
- * prevents the achievement of sustainable development in countries and regions affected and, therefore, in the world as a whole;
- * directly threatens the health and nutrition status of populations affected, particularly children.

Environmentally, desertification:

- * is one element of planetary environmental degradation that contributes to climate change, water, air and soil pollution, deforestation and soil loss;
- * contributes to the loss of global biological diversity, particularly in areas which are the centre of origin of the major crop species of the world, such as wheat, barley, sorghum, maize, etc;
- * contributes to the planet's loss of biomass and bioproductivity and to the exhaustion of the global humus reserve, thus disrupting normal global bio-geochemical turnover and reducing the global carbon dioxide sink in particular;
- * contributes to global climate change by increasing land surface albedo, increasing the potential and decreasing the actual evapotranspiration rate, changing the ground surface energy budget and adjoining air temperature, and adding dust and carbon dioxide to the atmosphere.

Definition of World Drylands

Once the latest definition of desertification was established in June 1991 (see above) a world map of drylands was prepared at UNEP by the Global Environment Monitoring System (GEMS), Global Resource Information Database (GRID) and Desertification Control Programme Activity



Stabilizing sand dunes is costly, particularly for poor developing countries that are dependent on their drylands resources base. But the social and humanitarian value of this and other desertification control measures is immense.

Centre (DC/PAC). The basis for this map was climatic data sets supplied by the University of East Anglia for the period of 1951-1980 (for aridity zoning) and the *Times Atlas of the World*, 1985 (for regional boundaries). This map will be published in the *World Atlas of Thematic Indicators of Desertification* (Edward Arnold, 1992).

Aridity zones (figure 1) were defined in accordance with their physical parameters using the following precipitation over potential evapotranspiration ratios (calculated by adapted Thornthwaite formula as opposed to the Penman formula used in 1977):

	Aridity Index
Hyper-arid	< 0.05
Arid	0.05-0.20
Semi-arid	0.21-0.50
Dry sub-humid	0.51-0.65
Moist sub-humid & humid	> 0.65

Estimates of the total area of the world drylands made in 1977, 1984 and 1991 were obtained using slightly different methodologies and different climatic data sets and therefore they should not be compared as a time-sequence. The latest (1991) data sets are regarded as more precise since they

were based on time-dependent climatic data selected with most rigorous criteria from a larger number of observation stations. Nevertheless, all the data shown here should be regarded as approximate only, with a degree of accuracy $\pm 10\%$ being restricted by the scale of assessment. This accuracy also relates to the previous assessments.

Because of this approximation, it follows that any accurate measurement of the changes in areas of lands affected by desertification during 1977-1991 at global or continental scales is presently impossible as the observed changes will fall within the range of standard error. However, estimates of changes and trends are possible for certain key areas where more precise data are available as a result of recent detailed assessment at national or local level.

According to the data in table 1 (page 6), the driest continent of the world is Australia which has 75% of its area as drylands; then follow Africa (66%) and Asia (46%). In Europe, North and South Americas, the drylands comprise about one third of their respective areas. In absolute figures, however, the largest drylands occur in Africa and Asia - totalling about 64% of the world's drylands. The total area of drylands constitutes about 6.1 billion ha or 41% of the total land area of the world, among which nearly

Table 1: World drylands in millions of hectares (UNEP/GRID, 1991)

	Africa	Asia	Australia	Europe	North America	South America	World Total	%
Hyper-arid	672	277	0	0	3	26	978	16
Arid	504	626	303	11	82	45	1,571	26
Semi-arid	514	693	309	105	419	265	2,305	37
Dry sub-humid	269	353	51	184	232	207	1,296	21
Total	1,959	1,949	663	300	736	543	6,150	100
% world total	32	32	11	5	12	8	100	
% total global land area	13.1	13.0	4.4	2.0	4.9	3.6	41.0	
% continent area	66	46	75	32	34	31	41	

0.9 billion ha or about 6.6% are hyper-arid deserts and nearly 5.2 billion ha or 34.4% are arid, semi-arid and dry sub-humid drylands which are inhabited and exploited for their admittedly limited but important biological productivity.

Figure 2 shows additional characteristics of the world's drylands and the ratios between different aridity zones within each of the continents. In Africa, hyper-arid and arid zones dominate the drylands; in Europe, North and South Americas semi-arid and dry sub-humid zones prevail.

Desertification in Drylands

Two global data sets showing different aspects of desertification were obtained in the course of the present assessment.

The first data set was produced in the International Center for Arid and Semi-Arid Land Studies (ICASALS) of Texas Technical University, USA, on the basis of available country statistics with reference to major land uses in drylands. It shows various forms of *land degradation* in drylands delineated in previous assessments with a correction for subdividing the sub-humid zone into two parts, *dry* and *moist*.

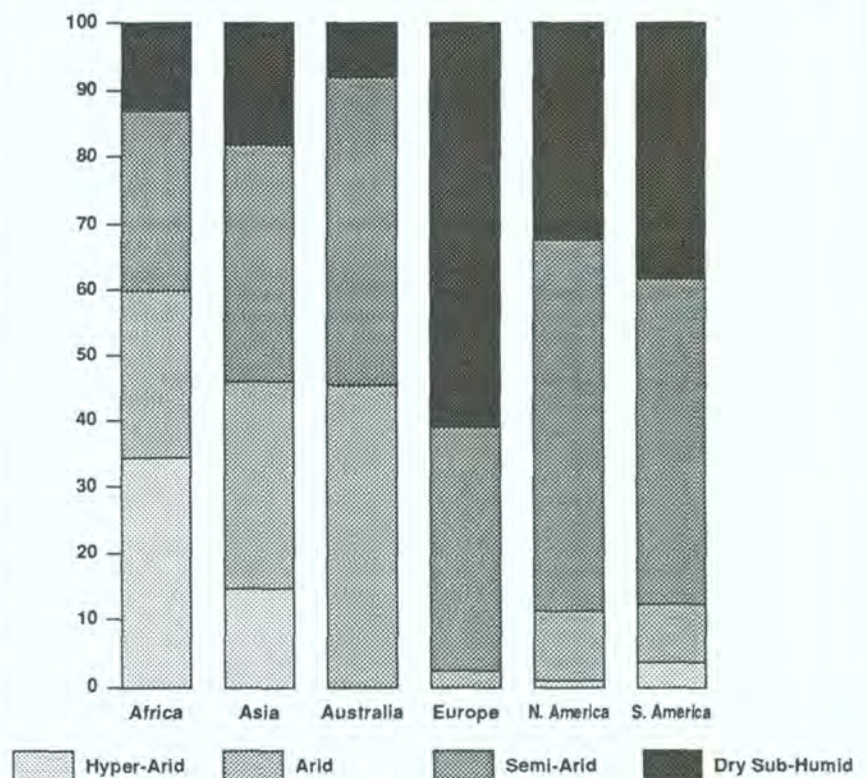
The second data set related to *soil degradation* within drylands of the world delineated by UNEP aridity zones. It is based on the World Map of the Status of Human Induced Soil Degradation (GLASOD) prepared by the International Soil Reference and Information Center (ISRIC) in

Wageningen, the Netherlands and UNEP in 1990 at an average scale of 1:10,000,000. Due to scale limitations, this map shows the situation by continents only, with no relation to major land-use systems.

The two data sets are different, although interrelated: they can be compared at a global and continental level but they should not be directly compared at a country level.

The major difference between the global figures for degraded areas within the drylands can be attributed to extensive rangeland areas with significant vegetation degradation but no recorded soil degradation, eg, all extensive areas of rangelands in Australia or the Aral-Caspian Basin of the USSR. These rangeland areas are included in the figures of *land degradation* but not in

Figure 2: World drylands (%) - 6,115 million hectares



the figures pertaining to *soil degradation*, ie, they have been treated as non-degraded stable lands in the GLASOD assessment.

Reconciliation of these two data sets of global figures provides the following picture of the status of desertification in the world: (table right)

The breakdown of degraded areas indicates that some 2.6 billion hectares, mainly in rangelands, suffer from degradation processes not recorded in the data compilation carried out in the framework of GLASOD. Additionally some 1 billion ha also suffer from soil degradation, making a total area of drylands affected by degradation at present as nearly 3.6 billion ha or about 70% of total drylands.

Desertification manifests itself as land degradation in major land use systems such as irrigated and rainfed croplands and rangelands within the above defined drylands of the world, excluding hyper-arid deserts where this process does not occur. Tables 2, 3 and 4 show how desertification affects these major land use systems.

The largest areas of degraded irrigated lands are situated in the drylands of Asia, followed by North America, Europe, Africa, South America and Australia in descending order. This order almost fully coincides with a sequence of percentages of the areas that are at least moderately affected.

About 43 million ha of irrigated lands or 30% of their total area in the world's drylands (145 million ha) are affected by various

	Million hectares	% of total drylands
1 Degraded irrigated lands	43	0.8
2 Degraded rainfed croplands	216	4.1
3 Degraded rangelands (soil and vegetation degradation)	777	14.6
1+2+3 = GLASOD (ie, drylands with human-induced soil degradation)	1,036	19.5
4 GLASOD (ie, drylands with human-induced soil degradation)	1,036	19.5
5 Degraded rangelands (vegetation degradation <i>without</i> recorded soil degradation)	2,556	50.0
4+5 = Total degraded drylands	3,592	69.5
6 Total degraded drylands	3,592	69.5
7 Non-degraded drylands	1,580	30.5
6+7 = Total area of drylands excluding hyper-arid deserts*	5,172	100%

* *Hyper arid deserts are excluded from further consideration as not being subject to desertification*

processes of degradation, mainly waterlogging, salinization and alkalization. This is an increase of some 3 million ha (about 7.5%) in comparison with the assessment in 1984 but this falls within the range of $\pm 10\%$ accuracy. It would be safer to assume that the situation

did not change appreciably during this period and remained unsatisfactory with a tendency to get worse.

Irrigated lands in drylands constitute nearly 62% of the total irrigated area of the world (240 million ha). Soil scientists have established that the world is now losing,

Table 2: Extent of desertification/land degradation in irrigated areas within the drylands of the world, by continents (Dregne, 1991)

Continent	Total Irrigated Land	Desertified ('000 ha)				Total (> moderate)	% > moderate
		Slight-none	Moderate	Severe	Very severe		
Africa	10,424	8,522	1,779	122	1	1,902	18
Asia	92,021	60,208	24,335	5,788	1,690	31,813	35
Australia	1,870	1,620	100	130	20	250	13
Europe	11,898	1,993	1,340	460	105	1,905	16
N. America	20,867	15,007	4,930	730	200	5,860	28
S. America	8,415	6,998	1,047	310	60	1,417	17
Total	145,495	102,348	33,531	7,540	2,076	43,147	30

Table 3: Extent of desertification/land degradation in rainfed croplands within the drylands of the world, by continents (Dregne, 1991)

Continent	Total rainfed cropland	Desertified ('000 ha)					Total (> moderate)	% > moderate
		Slight - none	Moderate	Severe	Very severe			
Africa	79,822	30,959	43,187	5,153	523	48,863	61	
Asia	218,174	95,890	100,638	18,578	3,068	122,284	56	
Australia	42,120	27,800	13,900	400	20	14,320	34	
Europe	22,106	10,252	8,538	3,227	89	11,854	54	
N. America	74,169	62,558	10,770	721	120	11,611	16	
S. America	21,346	14,711	5,950	561	124	6,635	31	
Total	457,737	242,170	182,983	28,640	3,944	215,567	47	

annually, about 1.5 million ha of irrigated lands due to various processes of soil degradation, mostly salinization, and this mainly in drylands. It would thus be safe to assume that about 1.0-1.3 million ha of irrigated land are currently lost every year throughout the world drylands. This loss is compensated for by involving the best rainfed croplands and rangelands in irrigation and consequently the area of rainfed croplands and rangelands decreases accordingly.

Nearly 216 million ha of rainfed croplands or about 47% of their total area in the world drylands (457 million ha) are affected by various processes of degrada-

tion, mainly water and wind erosion of the soil, depletion of nutrients and physical deterioration. This shows some decrease in comparison with the 1984 assessment.

Rainfed croplands in drylands constitute nearly 36% of the total area of rainfed croplands in the world (out of 1,260 million hectares). It was estimated that the world is losing annually about 7-8 million ha due to various processes of soil degradation, mainly erosion and urbanization, and more than half of this is in the drylands. Therefore, it follows that about 3.5-4.0 million ha of rainfed croplands are currently lost every year throughout the world's drylands. This

is being compensated for by involving the best rangelands in cultivation. But this means that the area of available rangeland decreases accordingly.

The largest area of degraded rangelands occurs in Asia, followed by Africa. The percentage of degraded rangelands is similar in both these continents and in Europe and the Americas. The figures for Australia seem to be underestimated but this has to be studied further as earlier published figures also showed about two thirds of the rangelands as being affected by degradation.

Table 4: Extent of desertification/land degradation in rangelands within the drylands of the world, by continents (Dregne, 1991)

Continent	Total rainfed cropland	Desertified ('000 ha)					Total (> moderate)	% > moderate
		Slight - none	Moderate	Severe	Very severe			
Africa	1,342,345	347,265	273,615	716,210	5,255	995,080	74	
Asia	1,571,240	383,630	485,221	691,602	10,787	1,187,610	76	
Australia	657,223	295,873	277,040	55,310	29,000	361,350	55	
Europe	111,570	31,053	27,372	51,937	1,208	80,517	72	
N. America	483,141	71,987	116,102	284,858	10,194	411,154	85	
S. America	380,901	93,147	88,007	184,431	15,316	287,754	76	
Total	4,546,420	1,222,955	1,267,357	1,984,348	71,760	3,323,465	73	



Cattle grazing has impoverished the cover of high grass which once restrained water run-off on the slopes of the Wukari Valley, Nigeria. As a result, deep ravines have been hollowed out on the hillside.

About 3,333 million ha of rangeland or nearly 73% of its total area in the world's drylands (4,556 million ha) are affected by degradation, mainly by degradation of vegetation which on some 777 million ha is accompanied by soil degradation, mainly erosion. This shows an increase of some 233 million ha (about 7.5%) in comparison with the 1984 assessment. This falls within the range of $\pm 10\%$ accuracy. As in the case of irrigated lands, it would be safer to assume that the situation did not change appreciably during this period and remained very unsatisfactory with a tendency to get worse.

There are no reliable data on actual losses of rangelands and their conversion into agricultural land, wasteland, badland, desert or urban lands. However, if the above estimates of losses of agricultural lands and compensation for this through using better rangelands are correct, then it follows that annual losses of the rangelands

within the drylands are around 4.5-5.8 million ha and even more if so far unaccounted sand encroachment, urbanization, etc. is to be considered.

Seventy per cent of all agriculturally-used drylands are affected to some degree by various forms of land degradation. This is mostly by degradation of natural vegetation, partly accompanied by serious deterioration of soil. It would appear that the situation is better in Australia (53.6% degraded) and Europe (64.8% degraded) than elsewhere in the world. But the situation in Australia could be underestimated. The worst degradation is in North America (74.1% degraded) and Africa (73% degraded) although the problem is not much less serious in South America (72.2% degraded) and Asia (69.7% degraded).

A comparison of total estimates for the areas affected by desertification shows an increase from 3,475 million ha in 1984 to 3,592 million ha in 1991, ie, 117 million ha

or 3.4%. This increase falls within the range of $\pm 10\%$ accuracy and thus should not be considered as a proven change. The conclusion is that the situation remains the same and very unsatisfactory.

Despite the inaccuracy of available data, the present assessment shows very dramatically that about 70% of the world's drylands are affected by desertification or various forms of land degradation. It is difficult at this stage to make definite predictions for future trends but the process, if unabated, may lead to very serious socio-political and economic consequences for the world, particularly in developing countries. 18 industrialized or oil-producing countries out of the 99 countries affected are believed to be able to cope with the problem and may combat the desertification of some 1.5 billion ha of their territories. For the 81 developing countries with 2.1 billion ha of land affected by desertification the problem cannot be solved

Table 5: Global status of desertification/land degradation in agriculturally used drylands

Continent	Irrigated Lands			Rainfed Cropland			Rangeland			Total Agriculturally Used Drylands		
	Total	Degraded	%	Total	Degraded	%	Total	Degraded	%	Total	Degraded	%
	m.ha	m.ha	%	m.ha	m.ha	%	m.ha	m.ha	%	m.ha	m.ha	%
Africa	10.42	1.90	18	79.82	48.86	61	1,342.35	995.08	74	1,432.59	1,045.84	73.0
Asia	92.02	31.81	35	218.17	122.28	56	1,571.24	1,187.61	76	1,881.43	1,311.70	69.7
Australia	1.87	0.25	13	42.12	14.32	34	657.22	361.35	55	701.21	375.92	53.6
Europe	11.90	1.91	16	22.11	11.85	54	111.57	80.52	72	145.58	94.28	64.8
N. America	20.87	5.86	28	74.17	11.61	16	483.14	411.15	85	578.18	428.62	74.1
S. America	8.42	1.42	17	21.35	6.64	31	390.90	297.75	76	420.67	305.81	72.7
Total	145.50	43.15	30	457.74	215.56	47	4,556.42	3,333.46	73	5,159.66	3,562.17	69.0

without major external assistance through international partnership.

Desertification Rate

Apart from the figures in tables 2-4 for land losses of irrigated land, rainfed cropland and rangeland there are no reliable global data on the present rate of desertification. However, certain local studies provide more detailed additional information in this respect.

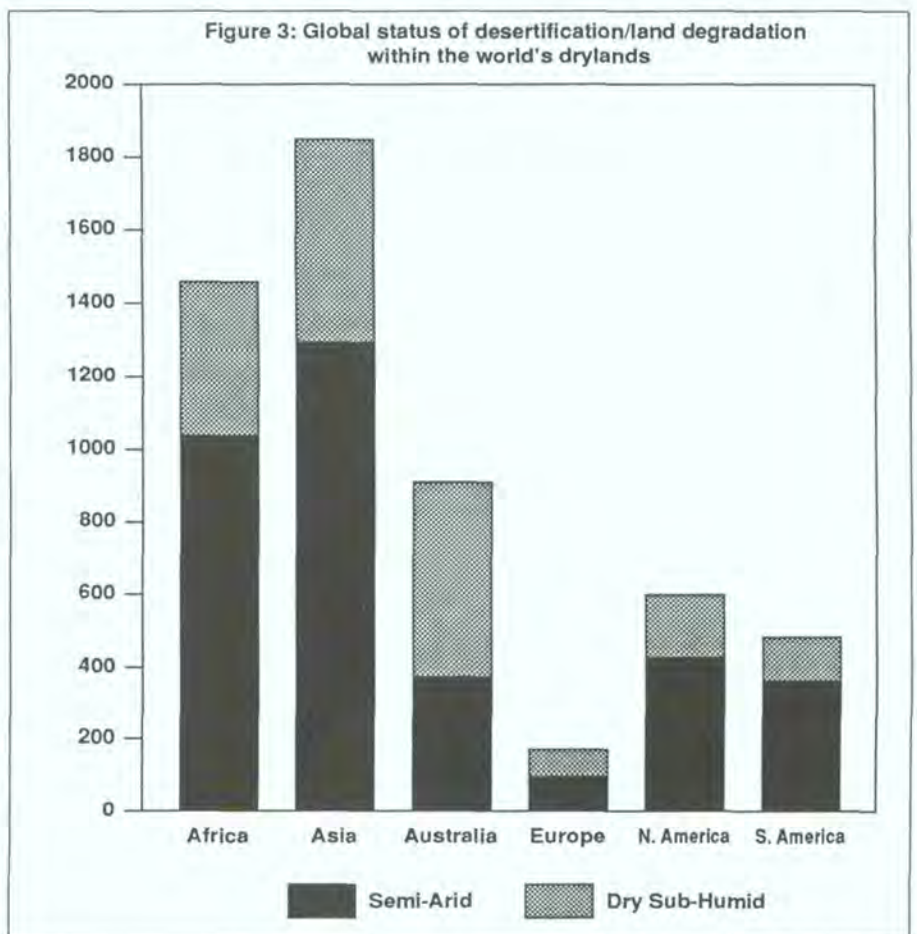
Kenya

In the Baringo study area of 360,000 ha, situated in a transitional zone with annual precipitation of nearly 600 mm rising to 1,900 mm in the surrounding mountains, and mostly used as rangeland with some irrigated agriculture, the following changes were observed from 1950 to 1981:

	% of total area
Areas improved to better vegetation class	11.0
Areas degraded to worse vegetation class	14.0
Expansion of agricultural area	5.3

Calculations give the rate of vegetation degradation as 1,626 ha per year, which gives the annual desertification rate of 0.6%.

In the Marsabit study area of 1,400,000 ha, situated in a more dry zone with annual precipitation of less than 250 mm rising to 800 mm in the surrounding mountains, and mostly used under extensive pastoralism with some mixed farming, the changes during 1956-1972 were:



	% of total area
Areas improved to better vegetation class	0.0
Areas degraded to worse vegetation class	20.5
Areas mainly unchanged	79.5
Expansion of agricultural area	0.0

Calculations give the rate of vegetation degradation as 17,937 ha per year, or an annual desertification rate of 1.3%.

Mali

In three study areas of Mali, the following soil losses were observed within the last

30 to 35 years: (table right)

This study gives an average annual soil loss rate of 0.1% but does not provide any data on vegetation degradation and thus does not give a full picture of desertification.

Tunisia

The following changes in Tunisia were noted in the areas of different land uses: (table right)

Calculations give the average annual loss of productive land by desertification as around 10,000 ha within this last century. Thus an average annual desertification rate of 10% is characteristic of the desert fringes of Tunisia.

China

Certain studies conducted by Chinese scientific institutions show the present rate of desertification expansion on the fringes of the desert as being around 210,000 ha per year. Given that China has approximately 33.4 million ha of desertification-prone lands, this means a present average annual desertification rate of 0.6%.

However, some local studies even showed that the present annual rate of desertification was 1.3% in Kangbao County north of Beijing in Hebei Province, while in Fengning County it was 1.6%.

USSR

The annual desertification rate in certain districts of Kalmykia north-west of the Caspian Sea was recently estimated as high as 10%; in other areas it varied between 1.5%-5.4%.

The desert growth around the drying Aral Sea was estimated at about 100,000 ha per year during the last 25 years, which gives an average annual desertification rate of 4%. With the same annual rate of about 4%, desertification is expanding on the adjoining rangelands, greatly reducing their productivity.

Syria

An area of some 500,000 ha in the Anti-Lebanon Range north of Damascus was studied recently to assess the changes in land and land-use patterns from 1958 to 1982. It was found that the area of rocky shrub land and bare skeletal land has increased from 50,000 ha or 10% to 80,000 ha or 16%. This gives a present average annual

Mali

	Nara	Mourdiah	Yanfolila
Total area, ha	60,241	69,622	67,888
Annual precipitation, mm	400	800	1,200
Annual soil loss, ha	16.5	143	8
Annual soil loss, %	0.03	0.2	0.01

Tunisia

	Year		Balance
	1880	1980	
Per '000 ha			
Cereals cultivation	400	2,000	+ 1,600
Trees cultivation	200	1,600	+ 1,400
Total cultivated land (cereals + trees)	600	3,600	+ 3,000
Grazing land	10,000	6,000	- 4,000
Loss of productive land to desert (grazing land - cultivated land)			1,000

rate of desertification of 0.25% for this area.

Yemen

Existing statistics show that the average annual rate of cultivated land abandonment due to soil degradation has increased from 0.6% in 1970-1980 to about 7.0% in 1980-1984.

Sahel

According to a recent (1989) publication (*Le Sahel en Lutte contre la Désertification: Leçons d'Expériences*) of the results of a co-operative study in the western part of the Sudano-Sahelian region conducted jointly by Comité Inter-Etats de Lutte Contre la Sécheresse au Sahel (CILSS) and Programme Allemand CILSS (PAC), in the southern parts of Mauritania, Mali and Niger between 1961 and 1987, the desertification rate was around 2 million ha per year.

The national case studies show very large variations in the annual rate of desertification in different parts of the world, ranging from 0.1% to 10.0% (ie, a hundred times greater in some areas). The main conclusion is: the more arid an area, the higher its rate of desertification. If we assume, on the basis of the above case

studies, that the annual rate of desertification is about 10% in arid lands, 1% in semi-arid lands and 0.1% in dry sub-humid lands, then calculations for the present annual increase in lands affected by desertification will be: 156.9 million ha in arid areas, 23.05 million ha in semi-arid areas and 1.3 million ha in dry sub-humid areas, making a total of 181.2 million ha throughout the drylands of the world. This will give an average rate of current desertification progress of 3.5% per year. Further studies on the basis of the global monitoring system are needed to obtain more precise data.

Desertification costs: damage and rehabilitation

There is no methodology to estimate accurately the total economic loss due to desertification as there are too many unaccountable losses involved, particularly off-site and social losses. Direct on-site losses can be calculated more or less reliably taking into account an estimated loss in productive capacity (income foregone) due to land degradation in different land use systems. This can roughly be calculated based on the experiences of several countries with

varying economic situations.

In 1977, UNCOD calculated that the process of desertification made a significant contribution to land degradation throughout the drylands of the world and that the subsequent losses in productive capacity (income foregone) amounted to nearly US \$26 billion per year. It was further estimated in 1980 that the cost of not stopping land degradation in drylands over the next 20 years was around US \$520 billion, excluding the price of suffering of the millions of affected people.

The following basic figures for the average yearly income foregone due to desertification were assumed for the present assessment, at 1990 prices:

US \$250 per hectare of irrigated land at least moderately degraded;

US \$38 per hectare of rainfed cropland at least moderately degraded;

US \$7 per hectare of rangeland at least moderately degraded.

Based on these figures and taking into account the total areas affected by degradation in each of the land use categories (see table 5) table 6 shows the annual average income foregone due to land degradation:

Naturally, this global direct annual loss (income foregone) of US \$42.3 billion is a very rough average estimate as the actual figures vary greatly from country to country and from continent to continent. This figure just gives an idea of the magnitude of the loss involved. It also shows that the cost of inaction over the next 20 years will be around US \$850 billion as compared with the earlier estimate of US \$520 billion.

However, the inter-continental comparison gives an idea of the differences between various regions of the world. The major loss appears to occur in Asia since this is the largest area affected; then follows Africa; Europe appears to lose the least amount.

With regard to different land use systems, the major loss occurs due to degradation of global rangeland because of the enormously large area which is affected. Global losses in irrigated land and rainfed cropland are more or less the same. However, large differences exist between continents and, of course, between individual countries.

If the 1980 figure is taken as the lowest estimate and the 1991 figure as the highest, both being rather conservative, then the calculations show that global inability to

Table 6: Annual average income foregone (in millions of US\$)

Continent	Irrigated land	Rainfed cropland	Rangeland	Total
Africa	475	1,855	6,966	9,296
Asia	7,953	4,647	8,313	20,913
Australia	63	544	2,529	3,136
Europe	474	450	564	1,488
N. America	1,465	441	2,878	4,784
S. America	355	252	2,084	2,691
Total	10,785	8,189	23,234	42,308

combat desertification during the fourteen years from 1978 to 1991 has already cost the world some US \$300-600 billion in income foregone alone.

Presently, there is not even a rough estimate available of off-site indirect economic losses due to desertification. Some studies suggest that it might be 2-3 or even up to 10 times higher than the direct on-site losses. This question should be more extensively studied and, of course, site-specifically, since the differences between various ecological and socio-economic situations throughout the world do not permit any generalization in this respect.

Action to combat desertification is inseparable from action to develop resources and management in drylands. Schemes that aim to arrest degradation of rangelands, rainfed and irrigated croplands, to stabilize sand dunes, establish large-scale green belts, introduce soil and water conservation systems in resource management, or to reclaim new areas for productive use are apt to be costly. In the majority of developing countries that are fully or partly dependent on their dryland resource base and have accumulated problems of poverty and underdevelopment, costs will be higher. In terms of market values rehabilitation projects are generally non-competitive, especially when compared with prevalent rates of interest. Investments in land rehabilitation projects commonly do not pay well financially, but their social and humanitarian values as a means of ensuring food security and participation in production are immense.

It is assumed that it is worth rehabilitating all degraded irrigated land (43 million ha). However, only 70% of affected rainfed

cropland (151 million ha), and only 50% of desertified rangeland (1,667 million ha out of 3,333 million ha) can justify the cost of rehabilitation. This is because the remaining land in both categories is in areas too dry for good yields, or has soils too sandy and shallow, and is therefore only marginally productive.

It is further assumed that drylands that are not affected or only slightly affected by desertification would require measures directed to prevent land degradation and sustain the land's productivity. Moderately affected land would require certain additional corrective measures, such as provision of adequate drainage in irrigated croplands. Drylands which are severely or very severely degraded need serious efforts for their rehabilitation and return to productive use. In different land use systems the costs of preventative, corrective and rehabilitation measures will be quite different, as will the costs in different ecological and socio-economic situations in various countries of the world.

Table 7 shows the global average indicative figures for the costs of direct anti-desertification measures in different land use systems and for various degrees of land degradation. These figures were obtained on the basis of an analysis of large numbers of relevant projects in different parts of the world.

Taking into account the above costs (table 7) and the relevant figures for the world status of desertification (table 5), costs of direct anti-desertification measures, which should be considered as showing only an order of magnitude for the world as a whole, are shown in table 8.

Compared with the 1980s estimate of US \$90 billion, or US \$4.5 billion a year for a 20-year programme, the present estimate of US \$171-363 billion, or US \$8.6-18.2 billion per year for corrective and rehabilitation measures in drylands affected by desertification at least moderately is three to four times higher. This is due to more accurate land degradation assessments in 1991 and the increase in world prices and costs of land reclamation. No similar comparison can be made for the cost of preventative measures in drylands as it was not calculated in the 1980 studies.

The global indicative sums and averages for anti-desertification measures over a 20-year period are compared in table 9.

From table 9, the following simple cost/benefit ratios can be calculated: 1:2.5 for irrigated croplands, 1:1.5 for rainfed croplands, 1:3.5 for rangelands, and 1:2.5 for the whole anti-desertification campaign in the drylands. It would be misleading, however, to use these figures as accurate guiding points for an economic evaluation of the Plan of Action to Combat Desertification (PACD) because the time profiles of costs and benefits are different. This is because anti-desertification programmes have a long gestation period and benefits do not appear until many years after. Therefore the above global calculations provide only a general picture of the order of magnitude: accurate economic cost/benefit analyses should be made site-specific on a country-by-country basis in order to obtain meaningful operational estimates.

The global costs of direct preventative, corrective and rehabilitation anti-desertification measures should be divided between the 18 industrialized and other countries which need no financial assistance and the 81 developing countries which need external assistance to implement their programmes to combat desertification (see table 10).

The majority of developing countries affected by desertification are the poorest countries in the world, including those that are least developed with very weak economies and are overburdened with persistent poverty and growing foreign debts. It may thus be assumed that, in order to implement anti-desertification preventative, corrective and rehabilitation measures in 81 developing countries at a total cost of US \$119-292 billion within 20 years, some 50% of the

Table 7: Global average indicative figures for the costs of direct anti-desertification measures in different land use systems*

Degree of land degradation	US \$ per ha Irrigated lands	US \$ per ha Rainfed croplands	US \$ per ha Rangelands
Slight to none	100-300	50-150	5-15
Moderate	500-1,500	100-300	10-30
Severe	2,000-4,000	500-1,500	40-60
Very severe	3,000-5,000	2,000-4,000	3-7

* Measures do not include insurance against recurrent drought. The range of cost for each land use system is mostly determined by the specificity of local natural and socio-economic conditions at the site of every particular project and not by the fact that it is implemented either in a developed or in a developing country or in any specific continent; there are certain extremely low and extremely high costs in some instances throughout the world but they are excluded from these global average ranges.

Table 8: Global costs of direct anti-desertification measures (billions of US \$)

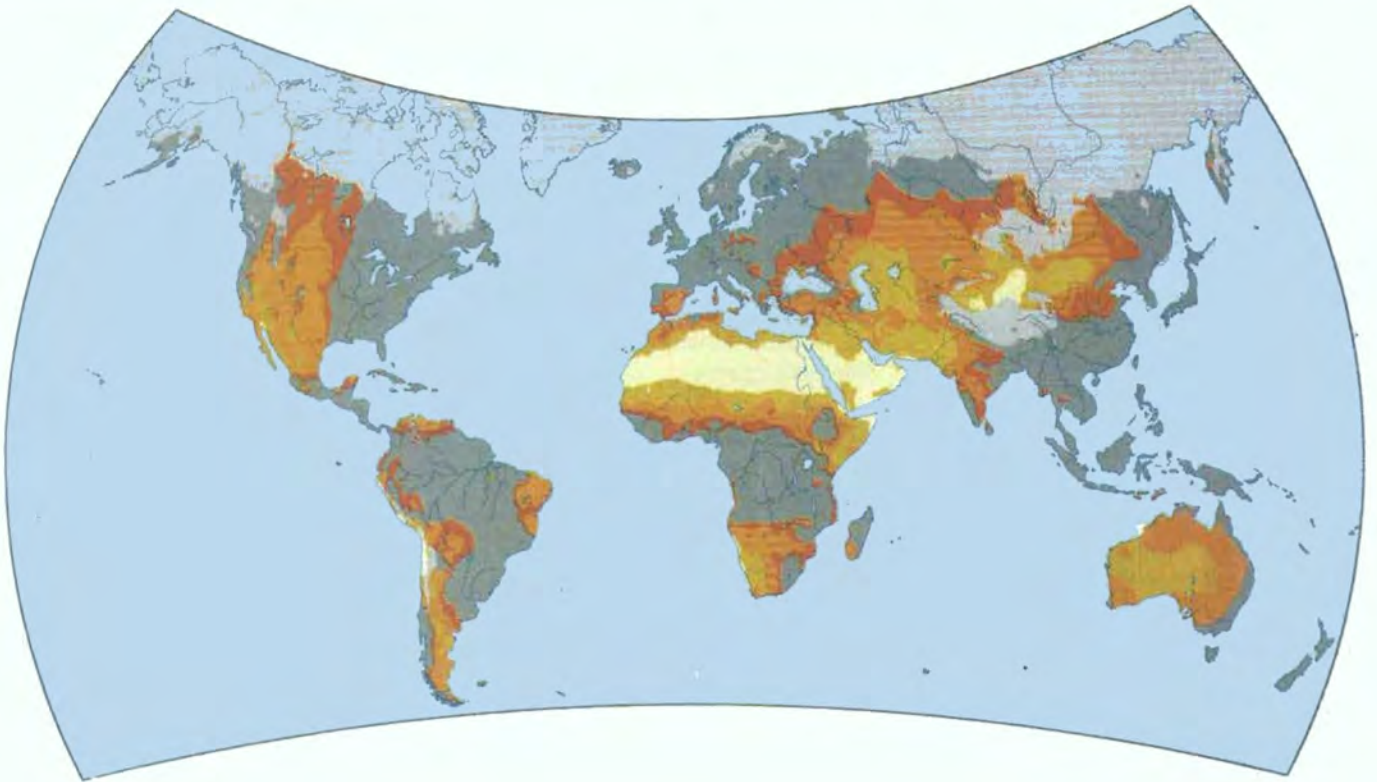
	Preventive measures	Corrective measures	Rehabilitation measures	Total
Irrigated lands	10-31	17-50	21-41	48-122
Rainfed croplands	12-36	18-55	22-59	53-150
Rangelands	6-18	13-38	80-120	99-176
Total drylands	28-85	48-143	123-220	200-448
Per one year for a 20-year programme	1.4-4.2	2.4-7.2	6.2-11.0	10-22.4

Table 9: Comparison of global indicative sums and averages (in billion US \$) for annual losses and prevention/correction/rehabilitation costs

	Annual income foregone due to desertification	Annual cost of pre- ventive measures	Annual cost of corrective measures	Annual cost of rehabili- tation measures	Total annual cost of all measures
Irrigated lands	10.8	0.5-1.6	0.9-2.5	1.1-3.0	2.4-6.1
Rainfed croplands	8.2	0.6-1.8	0.9-2.8	1.1-3.0	2.7-7.5
Rangelands	23.3	0.3-0.9	0.7-1.9	2.0-6.0	5.0-8.8
Total drylands	42.3	1.4-4.2	2.4-7.2	6.2-11.0	10.0-22.4

cost could at least be covered by the countries themselves while the other 50% needs to be provided through external assistance. Naturally, there will be a great difference between individual countries in this

respect: some will require only 10% external assistance, while others might demand almost 90%. Table 11 gives a summary of these calculations on a yearly basis.



The people most directly affected by desertification are usually among the poorest and least educated with limited access to power. Unable to survive with scarce land and water resources, they are often forced to migrate in search of relief and refuge. But the influx of these environmental refugees can put enormous pressure on the economy and stability of societies immediately outside the area of desertification, exacerbating political differences and leading in some cases to civil strife.

Table 11 indicates only the costs of direct anti-desertification measures (preventative, corrective and rehabilitative). Support measures were not costed because of great differences between the countries concerned. These costs are to be borne almost totally by the countries themselves as they concern the appropriate administrative, legislative, economic and policy adjustments as well as education, training and extension. In any case, it is advisable to bear in mind that the total cost of combating desertification, including the cost of full implementation of the recommendations of the PACD and to ensure sustainable development of drylands will be several times higher than the above figures of direct costs. The ratios between direct and indirect costs vary from 1:4 to 1:10 and are more or less common in the implementation of the majority of World Bank, International Fund for Agricultural Development (IFAD) or UN Food and Agriculture Organisation large-scale projects concerned with land development and rehabilitation.

Conclusion

The global assessment carried out by UNEP in 1990-1991 shows that desertification continues to spread and intensify despite efforts undertaken during 14 years of implementing the PACD since DESCON. The inevitable conclusion is that the efforts were too modest and grossly inadequate to be effective. There is no evidence that the situation has improved appreciably anywhere in the world although there is some local success in rehabilitating degraded land and protecting it from further deterioration. It means that the world community has to intensify its efforts to stop desertification and to reclaim desertified lands for productive utilization.

Table 10: Estimated global costs of direct preventative, corrective and rehabilitation anti-desertification measures over a 20-year period

	Preventative measures Billion US\$	Corrective measures Billion US\$	Rehabilitation measures Billion US\$	Total cost Billion US\$
Irrigated lands - total	10-31	17-50	21-41	48-122
industrialized countries	4-13	7-20	7-14	20-40
developing countries	6-18	10-30	14-27	28-82
Rainfed croplands - total	12-36	18-55	22-59	52-150
industrialized countries	5-14	7-24	8-18	20-34
developing countries	7-22	11-31	14-41	32-116
Rangelands - total	6-18	13-38	80-120	99-176
industrialized countries	3-9	6-14	33-48	39-82
developing countries	3-9	7-24	47-72	60-94
World drylands - total	28-85	48-143	123-220	199-448
industrialized countries	12-36	20-58	48-80	80-156
developing countries	16-49	28-85	75-140	119-292

Table 11: Annual cost of preventative, corrective and rehabilitation measures for developing and industrialized countries

	Preventative measures Billion US\$	Corrective measures Billion US\$	Rehabilitation measures Billion US\$	Total Billion US\$
Total global cost	1.4-4.2	2.4-7.2	6.2-11.0	10.0-22.4
Cost to 18 countries not requiring external assistance	0.6-1.8	1.0-3.0	2.4-3.0	4.0-7.8
Cost to 81 countries requiring external assistance	0.8-2.4	1.4-4.2	3.8-8.0	6.0-14.6

Desertification and Drought: An Ecological and Economic Analysis

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Worldwide Manifestations

Desertification is a noticeable environmental menace in the drylands of the world which make up around 40% of the land surface. It manifests itself in different forms and causes varied degrees of damage. We shall consider a number of examples based on recent surveys before we present an ecological and economic analysis of the problem. The examples show the very different facets of ecological degradation that are grouped under the term *desertification*.

USA

A report on *Desertification of the United States* by the Council of Environmental Quality (Sheridan, 1981) surveys various

forms of degradation of land and water resources in the so-called Arid West which at present accounts for about 20% of the national total of agricultural output. The report concludes: *Desertification in the arid United States is flagrant. Groundwater supplies beneath vast stretches of land are dropping precipitously. Whole river systems have dried up; others are choked with sediment washed from denuded land. Hundreds of thousands of acres of previously irrigated croplands have been abandoned to wind and weeds. Salts are building up steadily in some of the nation's most productive irrigated soils. Several million acres of natural grassland are, as a result of cultivation or overgrazing, eroding at unnaturally high rates. Soils from the Great Plains are ending up in the Atlantic Ocean. All total, about 225 million acres of land in the United States are undergoing severe desertification.*

As for the future, the report notes that: *The long-term prospects for increased production for US arid land agriculture look unpromising. The rich San Joaquin Valley is already losing about 14,000 acres of prime farmland per year to urbanization and could eventually lose 2 million acres to salinization. Increased salinity of the Colorado River could limit crop output in such highly productive areas as the Imperial Valley. Economic projections in Arizona indicate a major shrinkage in cropland acreage over the next 30 years. On the High Plains of Texas, crop production is*

expected to decline between 1985 and 2000 because of the depletion of the Ogallala Aquifer. And, certainly, the end is in sight for irrigation-dependent increased grain yields from western Kansas and Nebraska as their water tables continue to drop.

USSR

Rozanov (1990) reviewed the extensive surveys of desertification in various parts of arid and semi-arid territories in the USSR. In Kalmykia region shifting sands covered 500,000 ha in 1989. The main cause is the overstocking of pastures of low carrying capacity. In arid Turkmenia, the largest land resources are pastures. Thousands of tube wells (water points) were constructed between 1981 and 1986. A survey in 1988 showed that circles of land around 3,500 wells were completely devegetated (each circle 1.5-2 km in diameter) resulting from overgrazing, trampling and fuel gathering. Almost 1 million ha had been lost and some 2.7 million ha of pasture required rehabilitation. The second problem in Turkmenia is soil salinization and waterlogging. Aerial surveys showed 10.7 million ha of waterlogged lands on the sides of the Karakum canal.

Kharin *et al* (1988) provide the following estimates of desertification affected territories in the USSR Middle Asia region (*Survey of the Plains of Turkmenia, Uzbekistan and Southern Kazakhstan*, 1988):

	million ha
degradation of vegetation	
by overgrazing	66.4
degradation of vegetation	
by undergrazing	0.4
partial desertification	
around wells	10.2
wind erosion	5.9
salinization of irrigated lands	2.1
technogenic desertification	11.6
salinization caused by	
sea level drop	9.5
water erosion	1.2
Total	107.3

The area affected represents about 60% of the territories surveyed; almost all the remaining 40% is true desert.

China

Extensive studies on desertification were carried out in China (Zhu Zhenda *et al*, 1988). A desertification map of China at a scale of 1:4 million is being published and several experimental maps (larger scale) are available. According to these studies, 334,000 km² are already desertified. Shifting sand is a prominent issue: 42.2% of desertified land is classified as sandy steppe and 52.3% as re-activated sand dunes and shifting sands.

The Chinese studies classify the causes of desertification as follows:

over-cultivation of	
marginal steppe land	25.4%
collection of fuelwood	31.8%
sand dune encroachment	5.3%
misuse of water resources,	
destruction of vegetation,	
technical problems	37.5%

India

ICAR/CAZRI (1988) assesses that out of a total area of 231,000 km² of Western Rajasthan:

desertified area	9,290 km ²	4.35%
at high risk	135,292 km ²	63.26%
at medium risk	67,400 km ²	31.51%
at slight risk	1,900 km ²	0.80%

Singh (1989) estimates that out of the total area of India (328.6 million ha), about 53% of land is subject to various forms of land degradation:



In Sudan nearly 97 million hectares of rangelands have been affected by desertification. Photo: UNEP/Dan Stiles

	million ha
areas subject to water erosion	111.3
areas subject to wind erosion	38.7
areas degraded	
through:	
waterlogging	6.0
alkalinization	2.5
salinization	5.5
ravines & gullies	3.97
shifting cultivation	4.36
ravine processes	
& torrent	2.73
Total area (53%)	175.06

Africa

The desertification menace to the continent of Africa is well known. The prolonged drought that brought catastrophic losses of land and livestock resources during 1968-1986 induced the UN General Assembly, the UN system of agencies and programmes and the international community to mobilize considerable resources of relief and assistance to aid the bedeviled continent.

National surveys show widespread land degradation. In Sudan, desertification affects 1.6 million ha of irrigated farmlands (94.1% of total), 8.8 million ha of rainfed croplands (82.2% of total), and nearly 97 million ha of rangelands. In the northern and north-eastern regions of Nigeria, 12.5 million ha are subject to ecological degradation. A recent study in six countries of Southern Africa (Darkoh, 1989) showed a highly significant increase in desertification since 1977 in Lesotho. The increase in

Botswana, Madagascar, Tanzania, Zambia and Zimbabwe was less severe, but it was noted.

Australia

Surveys of land degradation in Australia (Wood, 1983; Chartres, 1987) divide the continent into a non-arid part (annual rainfall more than 500 mm) and an arid part (annual rainfall less than 500 mm). In the non-arid part (total area 1.8 million km²), 757,000 km² (42%) show degradation due to:

	km ²
water soil erosion	577,000
wind soil erosion	55,000
vegetation degradation	92,000
salinization of soil	19,000
other forms	14,000

55% of the non-arid lands show no recognizable degradation.

In the arid part (total area 3.35 million km²) 55% show degradation (desertification) manifested as:

	km ²
vegetation degradation	
(little soil erosion)	950,000
vegetation degradation	
(some soil erosion)	467,000
vegetation degradation	
(substantial	
or severe soil erosion)	432,000
salinization	1,000

Ecological Analysis: The Processes and Results of Desertification

As with other forms of habitat degradation, desertification may be studied and monitored as a process of ecological retrogression with a sequence of phases, or be described and recorded as the cumulative result (manifestation) of the process. Whether we consider the process or its manifestation, the most pertinent symptoms relate to reduction of economic productivity and hence depreciation of the market-value of land. Manifestations include:

- * reduction or failure of yield in irrigated or rainfed farmland;
- * reduction of biomass produced by rangeland and consequent depletion of feed material available to livestock;
- * reduction of available wood biomass, and consequent extension of the distance to be travelled to obtain fuelwood;
- * reduction of available water due to subsidence of river flow or groundwater resources;
- * encroachment of sand bodies that may overwhelm productive land, settlements or infrastructures;
- * disruption to society due to deterioration of life-support systems and the society's consequent need for outside help (relief aid) or for its people to seek haven elsewhere (environmental refugees).

The symptoms of this ecological degradation are varied. Deterioration of irrigated farmland is often related to the build-up of the water table near the soil surface (waterlogging), primarily due to an imbalance between irrigation and drainage systems. Salinization, which builds layers of salt-rich crusts at soil sub-surface or surface, may result from waterlogging, low-quality irrigation water or intrusion of subsurface saltwater. Other chemical changes, such as alkalinization, may follow. Deterioration of rainfed farmland is often manifested as soil erosion, loss of organic matter and nutrients, compaction and crust formation, and extensive invasion of weeds including noxious parasites, etc.

Symptoms of degradation of rangelands



In the USSR Middle Asia region around 2 million hectares of irrigated land has been affected by salinization and another 9.5 million hectares has been salinized as a result of the drop in sea level. Photo: WHO/Novosti

include: reduction of bioproductivity, invasion of (ie, replacement by) non-palatable species including succulents and thorn-bushes, soil erosion, poorer livestock, etc.

Similar degradation may occur in all climatic zones of the world but the result is not the same for every zone. In the drylands the final stage is a desert-like landscape; in regions of wetter climate the ecological degradation of, for example, oak forests in southern Europe, may result in scrublands of the *maquis* and *garrigue* types; in tropical woodlands ecological degradation may end in a savanna-like grassland. We noted

in the aforementioned survey of land degradation in Australia that land degradation in non-arid areas was mostly manifested as soil erosion, whereas in arid areas degradation affected vegetation with or without soil erosion.

Causes

The causes of these various forms of ecological degradation relate to a combination of excessive human exploitation that oversteps the natural carrying capacity of the land resource system and the inherent

ecological fragility of the land resource system. This exploitation is in the form of three principal land use operations in drylands: irrigated farming, rainfed agriculture and pastoralism. Other vegetation-related uses include wood cutting, collecting special plants for their medicinal and other uses, etc. To these we may add hunting game animals, etc.

Excessive human pressures on resource ecosystems relate to the:

- * increase in human numbers and escalation of human needs;
- * socio-political processes that bring pressures on rural communities for orienting their production towards national and international markets;
- * socio-economic processes that reduce the market value of rural products and escalate the prices of goods needed by rural people; and
- * processes of national development, especially programmes for farmland expansion for production of cash crops, that exacerbate conflicts over land and water use and often reduce areas available to marginalised communities.

Definitions of Desertification

Odingo (1990) and Rozanov (1990) reviewed various literal definitions of the term *desertification*. A Consultative Meeting on the Assessment of Desertification (UNEP, Nairobi, February 1990) adopted the following definition:

Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from adverse human impact.

Webb (1987) quotes the following definition of land degradation:

land degradation is a change in the state of the terrestrial component of global ecosystems that threatens human welfare now and/or in the future.

Land degradation/desertification is a broader concept than soil degradation since it deals with the whole ecosystem in which soil is just one of the components. In many instances of desertification (eg, reduction of range productivity due to invasion of thornbush, a widespread form of range degradation in USA, South Africa and Australia), degradation of vegetation may not be associated with soil degradation.

Desertification is often confused with drought. Although they are both prevalent in drylands and appear to cause similar sorts of damage, they are two entirely distinct phenomena. Desertification is a process of ecological degradation of dryland resource systems that is slow and insidious. It is caused by a combination of the inherent ecological fragility of the land and water resources that form the life-support systems of dryland societies, and the subsequent pressure put on these resources through overuse by these societies. Like other forms of degradation, desertification is induced by mismanagement so better control of land and water resources is one of the most effective corrective measures.

Recurrent drought is one of the causes of the inherent fragility of the resource system. But drought is a natural hazard caused by rainfall failure which is itself a characteristic of dryland climate. Incidences of drought are irregular and unpredictable and the damage caused is sudden and often dramatic. This means that drought should be managed like other recurrent hazards of nature - by instituting insurance mechanisms which would enable societies and their resource base to survive spells of drought.

We shall refer to cases of management of drought and of management of desertification to show their differences.

Impacts of Desertification

Like all major ecological changes, desertification may have impacts at three levels: on-site, off-site and global.

On-site impacts relate to changes in:

- * plant growth (reduction of standing biomass, replacement changes, reduction of primary productivity, extermination of certain species or populations, etc);
- * animal life (reduction of populations of wild animals including soil fauna, degradation of livestock, etc); and
- * surface deposits (soil erosion, loss of organic matter, salinization, crusting, etc).

These changes often cause changes to the microclimate and add to the dust load of the atmosphere.

Societies dependent on land productivity are hard-hit as their life-support sys-

tem deteriorates. They may, under fortunate conditions, change to some other life-support system - as did the coastal land pastoralists in Somalia who became fishermen, or the nomads of Eastern Sudan who settled in the Khashm-el-Girba irrigation scheme. But it is far more likely that they will move to new territories or to relief camps.

Off-site impacts are many and varied, including:

- * Surface deposits that are transported through water and wind erosion and pile sediments on downstream sites of productive lands, roads, railways and water reservoirs;
- * Suspended particulates (dust) that affect the health of livestock and people and reduce visibility; and
- * Salinized surfaces of deserted irrigated fields become sources of salt particles and may be wind-carried to other productive farmlands.

Dregne (1991) quotes one study on wind erosion in the State of New Mexico (USA) that concluded: *off-site costs were about 45 times greater than on-site costs.*

Another off-site impact is the forced movement of people who have to leave the land because their life-support system has deteriorated. These *environmental refugees* bring menacing pressures to their host-sites. This is currently one of the very serious environmental hazards on the African continent and is one of the causes of political strife.

On a global scale the impacts of desertification relate to its effects on world food-producing capacity, world bio-diversity and world climate. The loss or reduction in productivity of extensive areas would entail reduction in the world's food-producing potential and create food deficits in menaced regions with subsequent impacts on world food reserves and food trade.

Desertification entails the destruction of vegetation and diminution of many plants and animal populations. It is an effective cause of loss of species. Many crops (wheat, barley, sorghum, millet, etc) and fodder species that form the backbone of world agriculture and pasture husbandry, have their origins in arid and semi-arid territories (Vavilov, 1949; Barigozzi, 1986). Hundreds of wild plant species native to arid lands are sources of valuable medicinal



Developing countries need external assistance if local populations are to assimilate available technology and apply it to their own situations. Photo: UNEP/Tibor Farkas

materials (UNESCO, 1960). Loss of populations of these plants and their wild relatives would represent loss of valuable and irreplaceable genetic materials. The impact of desertification on loss of germplasm resources may be, from an economic point of view, no less severe than the impact of deforestation.

The impact of desertification on climate is varied. First, deserts and desertified territories are sources of atmospheric dust that could act to modify the scattering and absorption of solar radiation in the atmosphere. Its effect on temperature would depend on the altitude at which it is borne. The climatic impact of suspended particulate substances in the atmosphere may be no less than that of many other pollutants (greenhouse gases).

The impact of impoverishment of plant cover on the ground surface energy budget and the adjoining air temperature has been the subject of many studies (Jackson and

Idso, 1975; Balling, 1988, 1991; Schlesinger *et al*, 1990, etc). Two processes are involved: increased surface albedo and reduced removal of soil moisture by evapotranspiration. Balling's (1991) measurements show a perceptible increase in ground surface temperature and in near-surface atmospheric temperature as a consequence of desertification. Regional and global impacts are discussed by Schlesinger *et al* (1990).

The extensive areas of non and low-productive drylands (natural deserts and desertified lands, as well as other drylands, covering around 40% of the world land area) have little part in the global sinks of carbon dioxide. With the exception of hyper arid deserts they represent space available for programmes of afforestation and other forms of plant growth. The greening of these areas would enhance the global sinks for greenhouse gases.

Management of Desertification and Drought

Kassas (1988) describes briefly two case studies from USA and Syria to illustrate the management processes that are likely to succeed in addressing desertification (over-exploitation of the resources of a fragile system) and drought (natural recurrent hazard).

The USA Case Study - a desertification management package

The history of USA arid and semi-arid lands (Logan, 1961; National Science Foundation, 1977; Warrick *et al*, 1975) may be briefly described as follows. In the early 1930s the Great Plains region of western

North America was menaced by drought. It became an extensive dust bowl; villages were overwhelmed by sand encroachment and deserted farms and ranches became common sights. Drought recurred in the 1950s but passed almost unnoticed (National Academy of Sciences, 1976). This raises two questions: What land-use practices prior to the 1930s caused the system to be so fragile and so seriously damaged by the 1930s drought? And what happened during 1930-1950 that enabled the system to withstand drought with little damage?

It would be an oversimplification to argue (Malin, 1950) that the dust bowl was essentially the work of nature, caused by conditions of severe drought. It was: *the use and misuse of the lands and waters; current uses and factors promoting unwise uses; undesirable tendencies in land use and tenure; destructive effects on physical, vegetal, social systems; and even attitudes of mind contributing to misuse* (*The Future of the Great Plains*, 1936; cited in White, 1986), that left the resource ecosystem vulnerable to the destructive impacts of drought. How?

In the late 1860s an influx of settlers, chiefly graziers, flowed westward to these poorly administered territories. For some 50 years they practiced open ranging and during this long period of unrestricted grazing the rangelands were subject to overstocking and little management. At the same time, uncontrolled intensive rainfed agricultural practices left the land open to wind and water erosion. By the 1930s the area was so vulnerable that it soon became a dust bowl.

What happened in these territories between 1930 and 1950 provides an example of a package of corrective measures which can be briefly summarized as follows:

* *Federal land policy.* A national conference on land use established the National Land-use Planning Committee of the National Resources Board. The committee estimated that more than 6.5 million acres of the Great Plains had to be returned to grass and that some 16,000 farmers should be relocated. The kind of project envisaged included the Southern Otero Project, where 15,500 sheep grazed on pastures sufficient for only 4,000 head.

Policy-makers were determined that the carrying capacity should not jeopardize the grass during drought (Hurt, 1986).

* *The Taylor Grazing Act of 1934.* This Act set in operation the recommendations made by the John Wesley Powell Commission (1879) 55 years earlier. It extended the area of a homestead unit and established federal control over numbers of animals and over land use according to land suitability. Under what became the Bureau of Land Management, measures of soil conservation and balance with carrying capacity were implemented. In 1934 the first national survey was made to assess the severity of the erosion problem in the United States. In 1935 legislation established the Soil Conservation Service, a federal agency, as a part of the Department of Agriculture.

* *Federal financial support.* Federal monies were set aside for ecological restoration efforts, programmes of farm price support, rural relief and public works. The programme was designed to promote extensive adoption of conservation measures by land owners on a cost-sharing basis with government, whereby the government may pay as much as 80 per cent of the cost of some measures (Warrick *et al*, 1975). More than \$2 billion was spent by New Deal agencies in the 1930s to keep the plains farmers in business (Worster, 1986). In the years 1935-1975 some \$15 billion of federal funds were spent on conservation, rehabilitation and subsidies.

* *Transportation.* The railway lines were extended into the arid lands and the highways and trucks followed. These provided a means to transport livestock from summer ranges to winter ranges and to markets. The cross-country transhumance became mechanized.

* *Cattle breeds.* The hardy longhorn cattle that were well adapted to long-distance travel were gradually replaced by less hardy but better quality breeds such as Hereford, Brahman and Shorthorn.

* *Fencing.* The widespread use of cattle fencing allowed ecologically-sound range management, including deferred grazing and rotation grazing.

* *Water availability.* Mechanical innovations provided improved well-pumps and well-drilling equipment that allowed tapping of aquifers at great depth. Stock watering facilities, miles of pipelines and large storage tanks became common features.

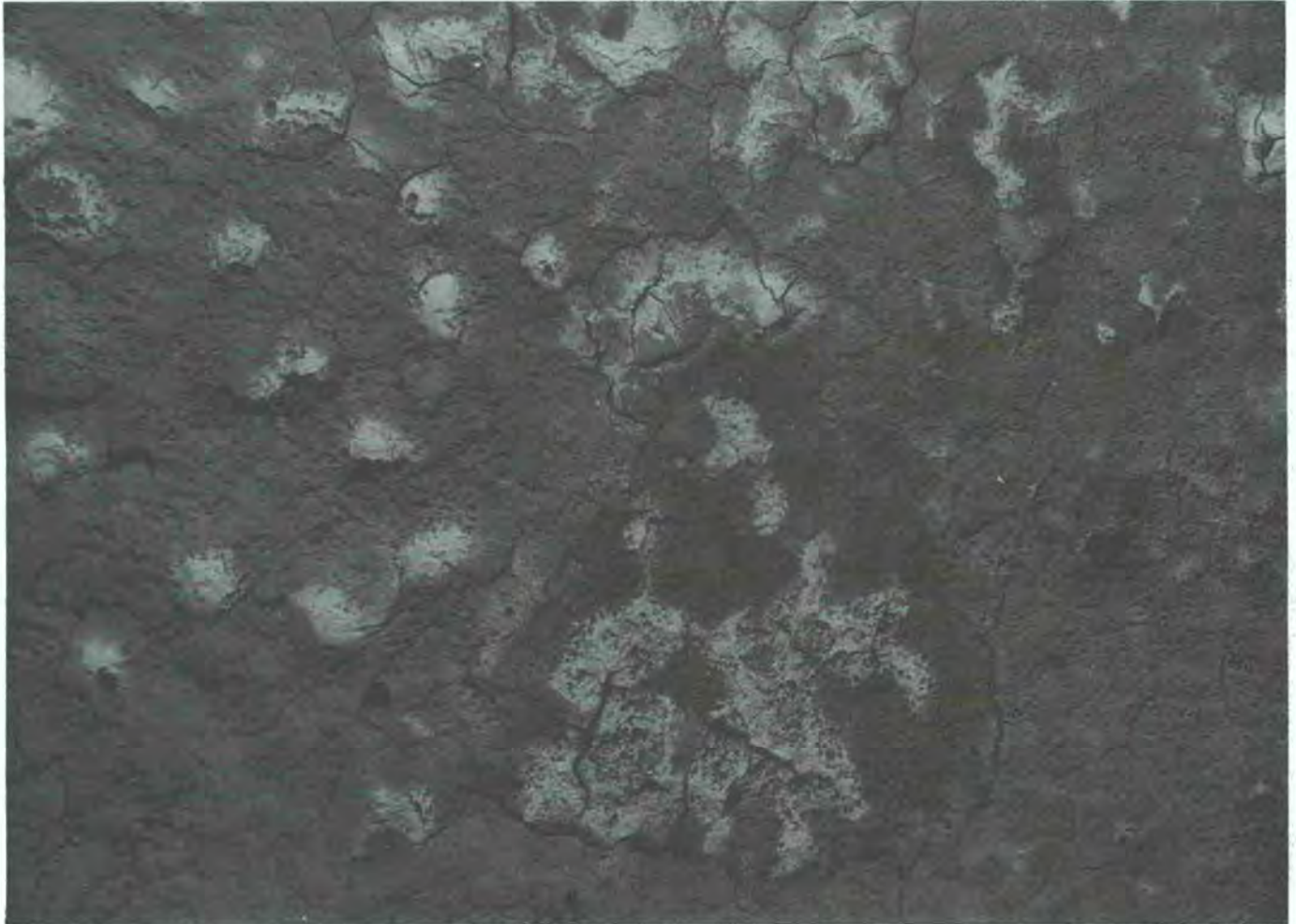
* *Water management.* Large-scale water-management projects included the establishment of several dams (eg, Grand Coulee, Boulder and Shasta). These provided irrigation for extensive farmlands and allowed for production of fodder and feed materials under irrigation. Irrigated farmland became an integrated part of the livestock-range industry.

* *Ecology.* New sciences of applied ecology (soil conservation, range management, etc) were developed and, through effective extension services, farmers and graziers were provided with advice and vocational training.

This management packet is a combination of: government control (legal instruments), government assistance (including federal funds) and guidance (land-use policies), national development schemes (railways, roads, reservoirs), advancements in science and technology and its application, development of natural resources within the framework of an ecologically-sound land use policy, and integration of various uses. Together the actions provided for the sustainable use of land resources, promoted the capacity of the resource ecosystem to withstand the inevitable spells of drought and ensured positive participation of local people. But some fear that the efficacy of this operation has recently been relaxed and that a future drought may cause serious damage (Crosson & Stout, 1983).

The Syria Case Study - management of drought

Syria is a Mediterranean basin country with a total area of 185,400 km². Rainfall is plentiful in the coastal belt (600-1,000 mm



Salt-rich crusts which build up at soil sub-surface or surface level are the result of water logging, low quality irrigation water, or intrusion of sub-surface saltwater. Salts are building up steadily in some of the USA's most productive irrigated soils. The rich San Joaquin Valley could eventually lose 2 million acres to salinization. Photo: FAO

per year) and the western highlands (more than 1,000 mm per year), but is much lower in the inland expanses toward the Turkish, Iraqi and Jordanian borders. The semi-arid territories (100-400 mm of rainfall per year) covers some 90 per cent (167,000 km²) of the country. Traditionally, land use was based on common land that was open for free grazing of flocks, mainly sheep.

A series of drought years between 1956-1965 caused the loss of close to 50 per cent of the total sheep population (Draz, 1978; Syrian government, 1977). The following are numbers of sheep in Syria for those 10 years:

1956	5,042,000	1961	2,901,000
1957	5,466,000	1962	3,223,000
1958	5,912,000	1963	3,926,000
1959	4,751,000	1964	4,753,000
1960	3,649,000	1965	5,373,000

In lean and subsequent years, relief and aid were provided by international organizations (mainly the Food and Agriculture Organisation and the World Food Programme and bilateral assistance). But it became evident that there was a need for a new approach with a national programme that went beyond relief and aimed to restructure the society-land relationship.

Ecological surveys recognized a traditional system of *hema* (areas where grazing and cutting were controlled - Draz, 1965, 1969; Klemme, 1965). In this system, grass cutting was permitted by licence during specified periods; grazing was prohibited or, if allowed, the number of animals was controlled; land was reserved for beekeeping, military camels and horses during periods of inactivity, and for pilgrims to leave their animals while on the *hajji*. This system was widespread throughout the

Arabian Peninsula but was abandoned in recent decades.

The new approach depended on a combination of reintroducing the *hema* reserve system, re-formulating claimed grazing rights of bedouin tribes under the control of bedouin cooperatives, and ecologically-sound and socially accepted management operations. During 1967-1980 the following operations were achieved:

- * *Hema cooperatives*. The first range cooperative was established in 1968. By 1979 there were 22 sheep and range cooperatives and 10 dairy cooperatives with *hema* areas totaling 1.5 million ha.
- * *Sheep fattening cooperatives*. By 1980 there were 54 sheep fattening cooperatives, supported by a network of feed warehouses which made feed available during drought.

- * *Cooperative feed warehouses.* Total capacity of these warehouses was 180,000 metric tons.
- * *National Feed Revolving Fund (NFRF).* This is the credit mechanism for supporting the whole operation. The fund received initial support from the government and some international sources: *(It has now (1978) grown to around US \$4.5 million, mostly revolving in support of various activities...NFRF makes available to members of project cooperatives short-term loans for feed purchases and long-term loans for the construction of feed warehouses... World Bank Loan Agreement with the Syrian government where US \$11.5 million loan and collected interest rates, would go back to the NFRF for the following year's operation. (Draz, 1978)*
- * *Government centres.* The government established a network of eight experimental, training and demonstration centres of range management and sheep husbandry on 120,000 ha of rangeland. Experiments included range improvement (schemes such as reseeding and plantation of palatable shrubs); training of staff; extension services; and programmes for selecting and breeding sheep stock.
- * *Restoration of water cisterns.* Cisterns are underground chambers, dating from Roman times, which were designed to collect and store run-off water. Most of the Syrian cisterns had silted up during centuries of neglect; 2,000 were cleared and restored.

With this packet of measures the Syrian steppe rangelands, their livestock and their pastoralist communities are better able to withstand spells of drought. The essence of management here is insurance against natural hazard.

Common Elements

The issues involved in these two cases are different: in the USA, the aim was to reclaim devastated territories and re-establish a system of sustainable development for land and water resources; in Syria, the aim was to provide a system of insurance that would enable the people, their live-

stock and their land to withstand the hazards of drought and/or rainfall failure.

However, although the aims were different, three equally important elements were common to both solutions:

- * application of new/appropriate technologies,
- * availability of additional funds,
- * societal and managerial re-structuring.

Two factors ensured success to the two endeavours: political will as shown by both governments and positive public participation by the communities concerned. Wide-ranging and effective extension services are essential for the latter.

An Economic Analysis: general considerations

Whether considered in their local (national) dimension or in their world-wide extent, the drylands (territories in the arid, semi-arid and dry-subhumid regions of the world) present a number of general features:

- * they comprise more than 40% of the land surface of our planet;
- * they comprise areas that are extremely arid (little or no rainfall) and broader areas with low (insufficient for permanent farming) rainfall which is often un-reliable;
- * they have considerable resources of oil, minerals, etc;
- * their climate is dry, sunny and warm; extensive drylands are coastal lands;
- * they have land space available for non-agricultural uses (settlements, industrial centres and energy parks, etc).

Sustainable development of the resources of the drylands needs to encompass three considerations:

- * conservation of productive land (farmlands, pasturelands, etc) in order to prevent its ecological deterioration. This may also include mechanisms for insurance against recurrent drought;
- * reclamation of desertified territories, ie, lands that were once productive but have now become non-productive;
- * development of *all* dryland resources for agricultural and non-agricultural uses.

Sustainable development that integrates

these three considerations will also set the drylands and their inhabitants on a par with other, more fortunate, parts of the country. Development of the drier parts of USA during recent decades (eg, the State of Arizona) proved that there are many lessons to be learned, particularly with regard to non-agricultural use of land resources.

Land use world-wide comprises two principal categories: agricultural use and non-agricultural use. The latter seems economically remunerative: urban, industrial, recreation, resorts, oil and mining centres, etc. But agricultural use has become less and less economically viable. We may note that in the fertile lands of Western Europe, where highly productive technologies and management are used, agriculture has remained dependent on economic subsidies throughout recent decades.

Agricultural uses of land, including programmes of desertification control and reclamation of desertified land, cannot be expected to be economically remunerative in the short term. But in terms of stability and security for the immediately-affected population, and the effects on regional security, world climate and biodiversity, the social dividends resulting from agricultural land use are surely positive.

However, actions to combat desertification and to develop dryland resources are still considered part of national responsibilities, even though governments in developing countries prone to desertification do not seem capable of giving dryland programmes high priority in development expenditure budgets. The reasons behind this are complex. Desertification reflects not only the inherent fragility of particular land resource systems but is also indicative of the pressures generated by growing populations, the increasing need for food and agricultural produce, economic growth, demands of trade and external debt, macro economic policies to support State objectives and the myriad of other by-products generated by the development process. Although domestic and external financing is made available for development, the same attention and urgency is not paid to the *effects* of development.

The escalating pressures of high population growth rates and increasing needs of individuals put pressure on land and government resources. Since the people most affected by desertification are typically the

poor and marginalised populations with limited access to political power, governments in developing countries have tended to magnify the costs of anti-desertification projects and to under-value their benefits and so these projects have been given low priority. Cash-flow problems at local level have further meant that many governments have been reluctant to initiate long-gestation, anti-desertification projects which may, at the same time, be of high risk and uncertainty. But because the ultimate impact of desertification may transcend national boundaries and have a regional or even global impact, and because of the failure of most national economies to meet expenditures to deal with management of drylands, international assistance is justified and should be forthcoming.

This assistance seems particularly needed in two broad areas: transfer of technology and financing of programmes for sustainable development of dryland resources. There is clearly a need for the global community to reconcile two conflicting claims: the desire for economic growth for a rapidly escalating population, including the legitimate aspirations of developing countries to provide for the basic human needs of their populations, and the equally strong desire to restore delicate planetary balances and environmental quality by repairing the damage already afflicted on the natural resource base. The reconciliation essentially depends upon international cooperation based on a sense of a global interdependence and partnership.

Technological Transfer

This is a very broad field: overall, technology means tools and equipment, materials (pesticides, fertilizers, hormones, etc), methods of farming and husbandry, methods of management of farm operations, methods of marketing, etc. There is already available a considerable body of scientific information and technological knowledge that could be applied in various ventures of dryland development. The fact that it is not always applied is primarily due to the inability of local people effectively to assimilate the available knowledge and adapt it to their own situations. This applies to several innovative methods of irrigation and means for enhancing efficiency of water use, fertilizers, soil conditioners and ameliorators, methods for soil conservation, planting

shelter belts, sand stabilization, etc. The need here is to help countries to develop their indigenous science and technology capabilities, including training of technicians and other personnel.

Technological transformation in agriculture, transportation, energy, housing, etc, and the introduction of more benign technologies in dryland resource management may require economic incentives which may need external assistance. Assistance may also be needed in incorporating environmental costs in dryland use programmes.

There is a third group of privately-owned technologies, including bio-engineered organisms, improved crop and fodder plants, improved livestock animals, innovative organisms to be used as bio-fertilizers or pest biocontrols, etc. The international community should look carefully at the opportunities and challenges that agricultural studies are revealing about the prospects of far-reaching improvements to resource management that could be undertaken in developing countries with external assistance.

Lack of indigenous capabilities is not the only major hurdle to technological transformation and its transfer. The other major barrier is the lack of funds to overcome proprietary rights, royalty payments and the like. In the past, international support for the development and transfer of new technologies through research and development funding achieved substantive results in medicines, computers, etc. A similar effort is needed, on a much larger scale, to maintain the productivity and resilience of land resource systems.

One way to resolve some of these problems is through collective self reliance - ie, the establishment of regional mechanisms that can mobilize the resources of several countries. Cooperating countries may be able to gain access to technologies that would be otherwise difficult to obtain, as well as improved means for sustained use of dryland resources. The African Ministerial Conference on Environment (AMCEN, Cairo, 1985) designed a number of African networks of science and technology for purposes of assisting member countries. These networks are now operative with the assistance of UN bodies.

Under the aegis of the Consultative Group on International Agricultural Research, the international donor community established a world-wide network of

international centres of agriculture research. These centres have contributed to the advance of agriculture world-wide and have provided technical services to many countries. This success story of collaborative and fruitful action may inspire the world community to establish a similar world-wide network of international centres of advanced science and technology in fields related to dryland development and control of desertification.

Cost of Corrective Measures

The process of desertification leads to a net reduction (or loss) of biological and economic productivity of land resource systems and thus of their market value. In examining the impact of desertification at national, regional and global level, an economic analysis is helpful in clarifying certain overriding considerations which should govern the availability of external resources.

First, the heavy damage inflicted by desertification at local and national level cannot be adequately redressed without international assistance.

Second, the impact is such that the desertification-prone country cannot be asked to bear the full cost of redress, especially since the balance of benefits is not only with the country concerned but with the international community. The cost-benefit ratio may be changed and the project made viable if the international community makes a substantial contribution to the cost of the project programme.

This could be achieved in part by, thirdly, identifying a substantial advantage to the international community of implementing anti-desertification programmes - eg, global food security.

Fourth, management of desertified lands could be improved and lead to better yields if the project or programme is subject to cost changes or other modifications to permit replicability, greater cost effectiveness and enhanced application.

Fifth, outside assistance should be geared towards training nationals of other countries in ways to lessen the impact of desertification, which will also help lead to a lessening of the global effects of desertification (eg, climate fluctuations and the threat to soils in neighbouring countries).

Apart from these considerations, and in

order to qualify for outside assistance, the recipient countries should have, or be willing to develop, a sound overall policy structure, including a range of critical macro-economic policies, regulations and institutional arrangements as appropriate to individual country needs; and the projects and programmes to be financed should be cost-effective in as much as only operations that maximize results at low cost and require minimal external assistance to achieve desired results should be included.

The total amount of funding required for anti-desertification programmes is large and various estimates have been identified in recent years. It is clear from current trends that adequate funds are not likely to come from voluntary contributions. It is necessary to consider alternative financial mechanisms at the national, regional and global levels. These would include economic instruments for use locally and globally.

Economic Instruments

In recent years some progress has been achieved, notably in the industrialized countries, with the introduction of a whole range of economic instruments including user's fees, environmental taxes of various types, tradeable emission permits, tradeable resource permits, deposit-refund systems, etc. Compared to the *command and control* approaches to environmental maintenance, the use of such economic instruments permits greater flexibility, higher yields and could result in important benefits to society.

First, in the case of anti-desertification activities, the economic instruments described above could produce a level of total funding which is much higher than that which is currently available to meet the needs of desertification-prone countries.

Secondly, these economic instruments affect market signals. One of the main causes of degradation of land resource systems all over the world (not only in the developing countries) is that the market place is constantly sending out wrong signals as to the real scarcity and value to society of these resources. User's fees (for example, for irrigation and water, use of rangelands, etc) are much more efficient (in the economic sense) because they serve to concentrate resource uses to those users who are the most efficient in treating and developing the resource. Because the fees

are related to the level of use there is also a continuous search for better and more innovative technology in order to reduce costs.

The primary objective of implementing economic instruments is to raise adequate funding for environmental (preferably international) concerns, but there are also important corrective elements involved. In the present state of the art, it is not clear how far the developing countries, and particularly the least-developed countries which are also the desertification-prone countries, will be able to levy user's fees and charges. Such charges would have to be levied in industrial countries and those countries then must decide what percentage would be used for national environmental maintenance problems and what percentage for international concerns such as desertification. In so far as the developing countries are concerned, wherever applied, these economic instruments could contribute to improving or correcting the present situation where the exceptionally low charges for the use of resources (frequently below the marginal cost of supply) are distorting energy prices, water prices, fertilizer and pesticide prices, etc. They could also produce beneficial results in regulating grazing levels in rangelands and fishing in coastal waters, as well as serve as re-cycling incentives.

Needless to say, careful attention must be paid in levying user's fees to the interests of low income groups.

Sources of Funds

In a series of resolutions during 1978-1990, the UN General Assembly addressed the problems relating to financing the UN Plan of Action to Combat Desertification. In response to these resolutions several mechanisms for mobilizing additional resources for this purpose were tested, including the Special Account and Consultative Group on Desertification Control (DESCON); and several studies on likely sources and mechanisms of funding were carried out. So far, no viable mechanism exists for mobilizing the resources required for a world-wide programme of action to combat desertification. One reason for this failure was perhaps related to conceiving such a programme as strictly an *environment* programme.

Programmes for combating desertification, as conceived in this paper, comprise three elements: conservation (preventive measures that maintain productivity of land),

reclamation (regaining land that was once productive) and development of dryland resources. As such these are programmes of sustained development of drylands and within this framework environment and development issues are inseparably knit. So any programme for combating desertification should receive its due share of support from world funds and financial mechanisms for supporting already-established development and environmental programmes (eg, UNDP, UNEP, Global Environment Facility, etc), or programmes that may be established as a consequence of the forthcoming 1992 United Nations Conference on Environment and Development.

Desertification is a truly global issue with field manifestations at the national level. Corrective action remains the prime responsibility of national governments. Each government in the dryland territories should set the combating of desertification problems (within its broader context as outlined in this paper) among its priority actions, adopt policies that ensure that it is accorded its due priority, and establish national mechanisms for monitoring, assessment, planning for action and programming for implementation of national endeavours to combat desertification. These measures should become an integral part of action towards national development and appropriate resources for implementation should thus be made available. In this way, national Plans of Action to Combat Desertification will have their due priority in appropriation of national resources and in planning bilateral aid programmes.

The economics of implementing programmes to combat desertification (and the sustainable development of dryland resources) have their own features: long gestation periods, low rates of return in the short term and the need to build up a necessary infrastructure (transport, energy, communication, settlements and services, etc). As such these programmes may require a special mechanism for mobilizing resources and should not have to compete for resources shared with other objectives. The series of studies requested by the UN General Assembly (Ahmad and Kassas, 1987) survey a number of likely sources of funds for the general purposes of development and protection of the environment in which desertification programmes may have a share. This series also provides a detailed

feasibility study on the establishment of a special international mechanism (corporation) for financing the UN Plan of Action to Combat Desertification. The latter attracted the attention of UN General Assembly but not the support of likely donor governments.

The question remains: what are the likely sources of funds that can be earmarked to support national, regional and global programmes for combating desertification; that are additional to ongoing aid sources (for which competition may bar anti-desertification programmes); and that are automatic in their flow so as to meet the requirements of programmes with longer-than-usual gestation periods?

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External Evaluation of the Plan of Action to Combat Desertification

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Introduction

In view of the great concern that desertification remains unabated and that international efforts to halt its spread, as envisaged by the UN Plan of Action to Combat Desertification (PACD) endorsed by the General Assembly in 1977, remain inadequate, the Governing Council at its 15th session requested the Executive Director to arrange for an external evaluation of the PACD to be conducted (decision 15/23, Part A, para. 8).

This evaluation was undertaken between February and August 1990 by six desertification experts, whose nationality and experience covered all the regions of the world affected by desertification. Working independently, they prepared six separate reports which were synthesized by the UNEP Follow-up and Evaluation Section into a single draft report. This report was then discussed and amended by 10 high-level experts in desertification at a meeting held

in Geneva from 6-9 July 1990. A précis of their findings is presented here.

Validity of the Plan's Premises

There was general consensus among the consultants that the PACD is based on sound scientific grounds and is an appropriate instrument to assist governments in developing national programmes for arresting the process of desertification. The basic principles guiding the PACD and its objectives remain sound and the following three priorities for action were and still remain valid:

- * arresting the desertification processes
- * establishment of ecologically sound and productive land use; and
- * social and economic advancement of the communities affected by desertification.

However, some of the PACD's premises need to be reviewed. The goal of implementing the PACD by the year 2000 has proved unrealistic, partly because the assumption that both donors and host countries were ready to "divert" human and fiscal resources from immediate development activities to long term rehabilitation of desertified lands was, in retrospect, overly optimistic.

Equally over-optimistic was the expectation that governments would change their

internal policies that set action priorities in a relatively short period of time. The PACD was presented as an answer to desertification problems as part of a broader plan for sustainable development but many governments did not perceive it as such. This may be because the PACD gives great weight to the causes and symptoms of an ecological and agricultural nature when, in fact, the underlying forces exacerbating desertification are rooted in social and economic conditions.

However, although the PACD specifically pointed out that *desertification* was not an advance of the desert frontier engulfing productive land on its perimeter, the term *desertification* gave many politicians this incorrect perception. The term *land degradation* would have led to better understanding.

The external evaluators suggest that the definition of desertification needs to be sharpened. Earlier definitions represented desertification as an environmental problem that could be combated if the money and technology were available. It is now understood widely that the desertification process, like many other environmental issues, is a complex problem linked with development and the use of land and water resources. It calls for an updated definition. An accepted new definition is that *desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from adverse (effect of) human impacts.*

Validity and Feasibility of the PACD's Recommendations

The recommendations contained in the PACD were the result of discussions among delegates representing 94 countries. In order to achieve consensus the recommendations had to cover the specific concerns of all delegations attending the 1977 United Nations Conference on Desertification (UNCOD) and be broad enough for global application. The result was that the PACD was approved by UNCOD with 28 recommendations which, in retrospect, were so numerous that they overwhelmed countries that lacked capabilities and resources to implement them. Although general in their nature, these recommendations were so comprehensive in their coverage of all aspects of the desertification problem that they seemed more a blueprint for environmentally sound development.

Implementation Mechanisms for the PACD

National mechanisms

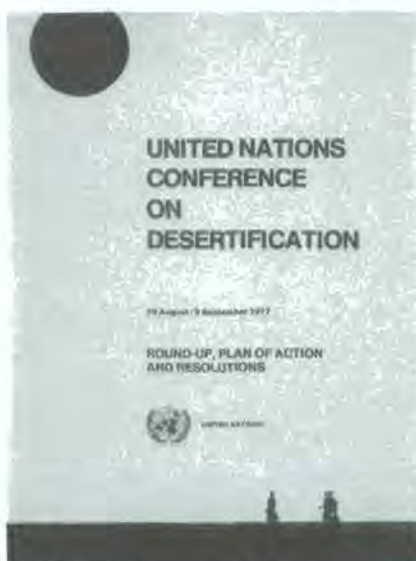
The national mechanisms foreseen in the PACD for its implementation remain valid and would have worked if governments had given priority to implementing the PACD and if adequate funding had been provided.

Regional mechanisms

The regional mechanisms are also adequate. The main constraints to developing regional PACDs and to establishing research centres have been lack of resources and strained political relations.

International mechanisms

With regard to international implementation mechanisms, the Governing Council of UNEP has been successful in specifying particular activities for priority actions and in following up the progress made in implementing the PACD world-wide. The United Nations Sudano-Sahelian Office (UNSO), through the UNEP/UN Development Programme (UNDP) Joint Venture as a special institutional arrangement, has effectively initiated and supported many activities for



The Plan of Action to Combat Desertification is based on sound scientific grounds and is an appropriate instrument to assist governments in developing national programmes for arresting the process of desertification.

the implementation of the PACD in the Sudano-Sahelian region of Africa.

The Inter-Agency Working Group on Desertification (IAWGD) has been useful, although it could have been a more effective mechanism if its decisions and recommendations had been followed up and incorporated into the programmes of the specialized United Nations agencies. However, owing to insufficient organizational structure and personnel, the Desertification Control Programme Activity Centre (DC-PAC), on behalf of the Executive Director of UNEP, did not guide the implementation of the PACD effectively.

Financing Mechanisms

Although the mechanisms for financing the PACD seemed appropriate, they have only generated a fraction of the funding needed to carry out the plan. Financial mechanisms will succeed only if there is political will behind them. In addition, the various mechanisms for funding the PACD were each dependent on new resources or substantial diversion of existing resources. In no case did this happen on the necessary scale.

The Consultative Group for Desertification Control (DESCON) has not been an effective mechanism. The General Assessment of Progress in the Implementation of

the PACD 1978-1984 gave the reasons for the modest performance of DESCON (UNEP/GC.12/9 paras. 84 and 85). These reasons are still valid.

The UNSO resource mobilization mechanism, supported through the Joint Venture with UNEP/UNDP, has proved to be a viable and increasingly effective arrangement for seeking and channelling additional resources into desertification control activities in 22 countries of Africa. This success is due in part to an approach based on seeking specifically earmarked resources from donors for operational field projects that are formulated and implemented in close collaboration with the governments and donors concerned.

Causes of Shortcomings

The main cause of the failure to implement the PACD was the lack of priority it was given. Because of scarce financial resources, governments in developing countries suffering from desertification gave preference to short-term investments with high returns rather than the long-term low-yield investments necessary. Many governments did not recognize the enormity of the desertification threat, or appreciate the costs or complex processes of desertification. They found it difficult to undertake holistic planning by breaking through traditional bureaucratic boundaries that cause sectoral planning by their various ministries and did not and still do not have a clear-cut multisectoral governmental organ to coordinate the implementation of the PACD. Political instability and hostilities in many countries suffering from desertification were a difficult setting within which to mount an effective programme for dealing with environmental problems of natural resources. Moreover, desertification problems were aggravated by the hostilities and consequent influx of refugees.

Lack of financial resources also created constraints. Many donors did not allocate sufficient resources to implement the large regional and global programmes to combat desertification recommended by the PACD. They preferred to invest in projects that would yield quick visible results that would easily translate into cost-benefit figures. Bilateral donors, much like the recipient countries involved, demonstrated an inability to adjust their aid programmes to any significant degree to accommodate the



Fragile ecosystems are progressively being overtaxed due to ever-increasing population pressure. Photo: UNEP/Dan Stiles

campaign against desertification. There was also a marked lack of coordination which meant that governments, donors and international organisations did not follow an integrated approach to combat desertification in the large regions affected by it. Instead they supported anti-desertification projects in an uncoordinated, often in an ad-hoc, manner.

Most governments in countries affected by desertification failed to include desertification control activities in their development plans. In the cases where National PACDs (NPACDs) had been prepared, they were not integrated into the national development plan. Moreover, many governments failed to give due attention to the ever-increasing population pressure in areas subject to desertification and to provide alternative livelihood systems. The consequence is that fragile natural ecosystems are progressively being overtaxed without consideration for their inherent fragility.

National institutions or machinery to combat desertification in many affected countries is inadequate or non-existent. In

cases where a national institution existed, it was not provided with the necessary resources nor with the required political support because of general economic and financial constraints. Most governments in countries suffering from desertification have not put in place adequate national legislation to stop the human-induced causes of the problem. They have encountered difficulties in creating socio-economic structures to promote the successful use of available technologies to prevent and reclaim land lost to desertification and they lack the necessary technical staff and extension services. They also failed to create viable rural financial institutions and sources of credit conducive to reducing desertification.

In some cases where governments did implement measures to combat desertification, the impact was insufficient because they lacked community participation and support. Large projects were implemented from the top down, or the projects emphasized soil and water management in complete isolation from wider programmes for development and social progress.

A large part of Africa south of the Sahara, especially that area most affected by desertification, faced an almost continuous rainfall deficit for most of the period 1970-1985. In the early 1980s, Sudan, Ethiopia, Somalia, Kenya and Botswana, among other areas, were in the throes of a major drought which in some countries led to massive food shortages and loss of herds and human life. Under these circumstances, governments, donors and the international community, which already had a marked preference for short-term investments, placed emphasis on dealing with the immediate crisis, using available financial resources for inadequate forms of assistance, such as relief food aid.

Conclusions and Recommendations

The main causes of the lack of implementation of the PACD were that both governments and the donor community did not give it the necessary priority. Additionally, the PACD was too ambitious for the

resources available - even today it is unlikely that sufficient resources would be immediately available for its full implementation.

However, the PACD itself remains a valid tool for experts and technicians and should remain a global strategy for desertification control. But it lacks focus and omits socio-economic factors associated with desertification that should be better understood by politicians and decision makers. Hence there is a need to address its shortcomings and to prepare guidelines for its implementation, particularly on means of incorporating desertification control activities into national development plans. These guidelines should emphasize socio-economic issues involving land use systems, including management of common land. They should suggest remedies for social inequities, such as land distribution and the proper role of women. Possible incentives for farmers should be emphasized.

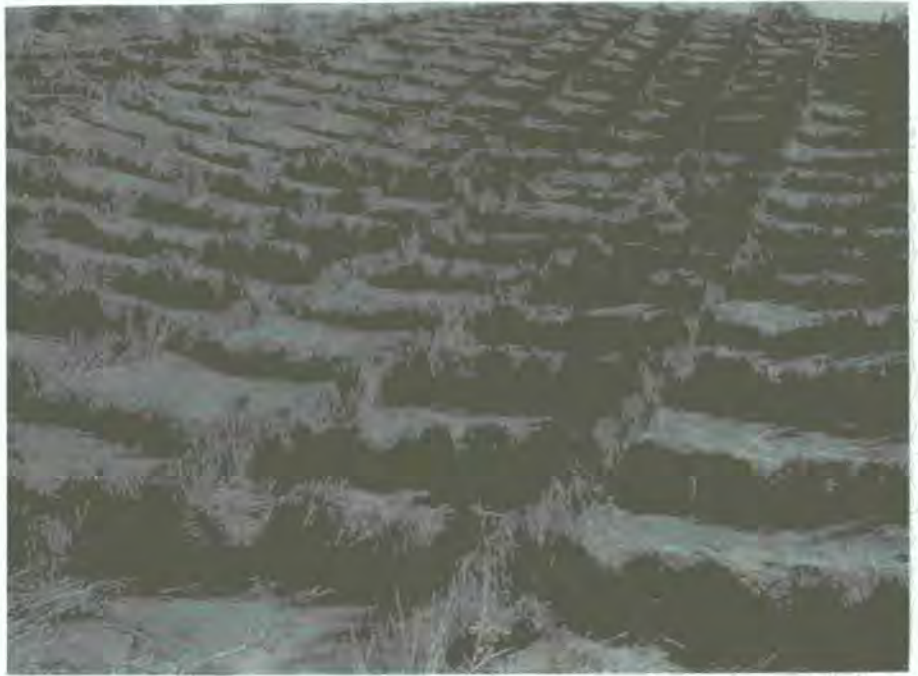
In preparing the guidelines, the importance of instituting a central planning and coordinating mechanism in the government should be emphasized. Implementation of a National PACD (NPACD) should be decentralized so as to ensure positive public participation. The paramount importance of integrating NPACDs into national development plans, together with clearly allotted financial resources, must be emphasized.

The distinction and interrelationships between drought and desertification must be clearly and simply explained, and the following issues should be emphasized:

- * training in the modern methodologies of monitoring physical and social indicators of desertification;
- * research for increasing the accuracy and practicability of these methodologies;
- * supporting developing countries in developing their systems for monitoring desertification.

The guidelines should include means of encouraging NGOs to play their role in combating desertification, particularly at the grass-roots level. They should explain that donor support would be more readily available if anti-desertification programmes were presented to donors as part of the national plan for sustainable development.

There are no suggested changes concerning the mechanisms for PACD



Dune stabilization by extensive grassplanting in Russia. Photo: UNEP/ICCE

implementation. However, at its 44th session, the General Assembly decided that the DESCON mechanism should continue to operate (resolution 44/172). Hence, there is a need for an in-depth study and consultations on how to make it more effective.

Similarly, the IAWGD is a very important mechanism for coordination and ways and means to make it more effective should be explored. The experience gained through UNSO should be used as a basis for strengthening this mechanism and for exploring the possibility of setting up UNSO-like structures for other affected regions of the world.

Experience has shown that the problems of desertification control are complex, difficult and cannot be solved overnight, especially in the 1990s with a larger desertified land surface than in 1977 and a greater affected population. Achievements have been modest but have provided valuable experience. Now, 14 years after UNCOD, governments, the donor community and the UN system have more experience in tackling some of the issues than they did in 1977.

Governments today have a better perception of desertification and realize the size of the problem. What is needed are demonstrable models at the country level, together with convincing data. These

models should be aimed at achieving long-term targets based on linked short-term projects which should help the local populations to improve their livelihood. Efforts should concentrate on a few countries that have demonstrated the political will to combat desertification with a view to making success stories that can be replicated. Emphasis should be placed on preparing National PACDs and obtaining bilateral assistance for their implementation, again step by step.

Apart from political will, the keys to the successful implementation of the PACD are coordination between governments, donors and the international community, more efficient use of existing resources and new resources. Given the current concern for the environment, the time is ripe for such an initiative. However, it must be realized that financial resources of the magnitude needed to stop further loss of productivity caused by desertification and to rehabilitate desertified land are very difficult to raise in full. Efforts should be focused on specific components of the desertification problem. National institutions and national planning mechanisms should first be put in place, then the more tangible and tractable issues of desertification should be tackled step by step.

REGIONAL ACTIVITIES IN AFRICA

Transnational Green Belt Project in North Africa

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The Transnational Green Belt Project in North Africa (GBPNA) symbolizes an Arab joint effort to combat desertification. An organ of the Arab League Foundation, Cultural and Scientific Organisation (ALECSO), it aims to coordinate anti-desertification activities between Egypt, Libya, Tunisia, Algeria, Morocco and Mauritania. The GBPNA is predominantly centred on pastoralism although, being an integrated project, it includes actions concerning agriculture, afforestation, reforestation, management improvement of rangelands, rural development, sand dune fixation, wildlife management and increasing food production.

Desertification in North Africa

Dryland in the six countries of the GBPNA comprises relatively large areas. In Tunisia, with an area of 12.9 million ha, about two thirds or approximately 10 million ha is potentially menaced by desert encroachment. The total area of Libya is about 180.33 million ha of which only about 18% or 32.5 million ha is suitable for agricultural



Four-five month old Haloxylon sp. planted in sandy soils. Photo: Ali Kholdbarin

activities. The total area in Egypt which is subjected to desertification or is totally desertified amounts to more than 13 million ha. In Morocco, arid regions cover the major portion of its total area of 49.21 million ha with arable land covering only 4.65 million ha and forest about 1.4 million ha. In Algeria, the desert covers about 200 million ha with productive land covering only about 37 million ha of its total area of 237.6 million ha. Mauritania is one of the Sahelian countries most affected by desertification. Of the 109 million ha that make up the country, 15 million ha were considered

to be non-desert territories at the beginning of the 1960s. Nowadays only 1 million ha have not been affected by desertification.

An arid climate is characteristic of vast stretches in the six countries of North Africa. The mean annual rainfall is less than 250 mm in the region and studies published on desertification in North Africa indicate that several thousand ha of grazing steps or agricultural land are being lost annually to the desert.

Traditional forms of extensive land use such as shifting cultivation, nomadism and seasonal grazing have been maintained over

centuries without destroying the ecosystem. However, when population pressure led to rising demand for food and hence to more intensive land use, practices became increasingly destructive. Overgrazing, removal of tree cover for fuel and fodder and submarginal cropland developments are some of the practices which have caused destruction of natural vegetation cover and have led to hydrological imbalances, accelerated soil erosion and generally lowered the productive potential. Moreover, the destruction of vegetation has adversely affected the climate, thus further accelerating the process of desertification. The resultant imbalance has not only adversely affected crops, livestock and wood production, but its more serious consequences are the human suffering and social strains that have been built up by the advance of desertification. For centuries, nomadic people on arid land have been on the move. But they moved from one green pasture to another, according to an organized pattern based on experience and wisdom. The problem now is that people can only move in one direction, ie, away from the encroaching desert.

Background

The GBPNA started in 1977. It stemmed from a feasibility study undertaken by ALECSO as part of a global participation. The study and its results were presented as a background document (A/CONF.74/25) to the UN Conference on Desertification, held in Nairobi in August-September 1977. The study was carried out in consultation with a panel of specialists from Algeria, Egypt, Libya, Morocco and Tunisia. The objectives and outlines of the study and the principal elements of a protocol of cooperation among the five North African countries were agreed upon at a technical meeting of government representatives and experts in Tunisia in November 1976. The draft report on the feasibility activities was reviewed and adopted in another meeting of government representatives and experts held in Cairo in February 1977. At the same meeting the protocol on cooperation was discussed, finalized and signed by the Minister of Agriculture of Egypt and the delegates officially representing Libya and the Tunisian Republic. The protocol cited the dangerous process threatening the five countries of North Africa and recognised the availability of manpower and know-how.

Studies Produced

- * Desertification control in North Africa
- * Documenting and analyzing of results, experiments and research into some kinds of forest trees, shrubs and pastoral plants in North Africa
- * Land usage in green belt project states of North Africa
- * Soil and water conservation in North Africa
- * Renewable energy resources in North Africa
- * Sand-dunes fixation and afforestation in North Africa
- * Fodder shrubs in North Africa
- * Saltbush plants and their importance in developing rangelands in North Africa
- * Integration between forests and rangelands concerning protection and utilization
- * Range plants in arid regions of North Africa
- * Afforestation guide in arid regions
- * Range guide in arid regions
- * Windbreaks guide in arid regions
- * Sand-dunes fixation guide in arid regions
- * Resources and marketing of non-wooden materials of native trees and shrubs
- * Feasibility study for the establishment of a seed bank in North Africa

Future Projects 1992-93

Eleven projects have been approved for 1992-1993. These are:

- * Second seminar for leaders, planners and experts in desertification control
- * Development of *Stipa tinacissima* in the GBPNA region (second stage)
- * Collection and multiplication of native range plants with cooperation of local people (second stage)
- * Seed bank of North African countries
- * Development and cultivation of medicinal and aromatic plants
- * Seminar concerning cultivation and development of medicinal and aromatic plants
- * Seminar concerning *Mycorrhiza* and afforestation
- * Meeting concerning Arabic and international cooperation
- * Support to the GBPNA library
- * Meeting of the Permanent Joint Committee and Technical Advisory Committee
- * Development and protection of *Pistacia atlantica* (second stage)

It reviewed the measures which should be taken in cooperation to combat desertification and preserve human and natural resources.

The Secretariat of the Desertification Conference and ALECSO were asked to prepare the Project Document and to take the necessary steps for holding the First Meeting of the Project Joint Committee in

Tunis in December 1977. In the meantime the contribution of each participating country during Phase I was fixed at US \$30,000 as part of the administrative expenses. In addition, the Tunisian Government as host country agreed to offer extra facilities to be detailed in a subsequent agreement. The main support for administration and operations came from UNEP.

According to the statute, a Permanent Joint Committee of government representatives was formed to meet twice-yearly and with a rotating chairmanship to be changed annually.

UNEP made US \$50,000 available to the Secretariat in Tunis in April 1978 and the first activities began in July that year.

Objectives

The long-term objectives of the GBPNA are to protect agricultural lands against desert encroachment and to manage and improve rangeland and develop animal wealth.

The short-term objectives are to formulate a Joint Plan of Action for the whole region, to coordinate different methods of implementing and organizing relevant efforts in each country, to collect and disseminate data and information, to exchange knowledge and experience, to coordinate training and research activities and to establish demonstration projects.

Results

Between 1977 and 1980 (phase I) five projects were devised. After 1980 (phases II and III) research and training activities were coordinated and specific anti-desertification projects were formulated and implemented with the institutional support of the GBPNA Executive Secretariat.

National Activities to Combat Desertification in the Region

Implemented and planned work includes afforestation, sand dune fixation, range management, soil and water conservation, crop and animal husbandry and community development.

Tunisia

In Tunisia, 188,000 ha of sand dunes have been fixed and planted with trees, 70,000 ha of which are now productive forests. The government produces some 30 million seedlings each year and a substantial part of the production is distributed to private growers at a nominal price. There are 45 experimental arboreta comprising 250 species of Eucalyptus and about 900 species of pasture shrubs.

The development of natural range in



Calligonum is established well under the protection of shelter belts in shifting sand dunes.
Photo: Ali Kholdbarin

Southern Tunisia extends over vast land covering about 2 million ha. A representative area of 20,000 ha, later to be extended by 10,000 ha at Uglat El-Martaba, has been reserved for experiments on improved range and livestock management as well as studies on socio-economic problems of the region.

Libya

In Libya, since 1952, extensive programmes of sand-dune fixation have been undertaken. The national programme aims to create a green belt 50 km wide extending along the entire length of the Libyan coast from Tunisia to Egypt. Some 83,000 ha of dunes in this belt have been stabilized and planted. The 1976-1980 plan provided for afforestation of 5,450 ha annually.

Libya has 21 nurseries producing mainly tree seedlings needed for afforestation and windbreaks. The number of seedlings produced annually is now around 70 million. It is estimated that 110,500 ha was afforested between 1952 and 1978 (61,200 ha of sand-dune stabilization afforestation and 59,300 ha of fallow land afforestation, with 94.7 million trees planted in all). Libya has an intensive rangeland development programme under which some 610,000 ha have been fenced in various ecological zones. Between 1974 and 1976, 59,400 ha of forage plants were sown by plane. A sheep breeding programme which started

with two centres in 1971 with 1,350 head in each, was expanded to 12 projects in 1977 with a total of 220,815 animals. Socio-economic projects connected with agricultural and pastoral improvement include provision of suitable homes for farmers, in addition to schools, medical and veterinary centres and agricultural cooperatives.

Algeria

In Algeria, the most important measure undertaken to combat desertification is the establishment of a green belt measuring 1,500 km long and between 20-40 km wide to protect an area of some 3.5 million ha against encroachment of desert from the south. In addition to afforestation, the project includes pilot range development programmes in different localities, each covering 2,500 ha, with the goal of expanding and joining these areas for the establishment of shelter belts and improved pasture. It also includes the establishment of grazing cooperatives, development and rational use of resources and the creation of better settlements for people in the approved forest and pasture lands, thus establishing an equilibrium between agriculture, forests, grazing land and social development.

Morocco

In Morocco, the afforested area is estimated at 1.4 million ha mostly on the slopes of the Atlas mountains and to a lesser extent

inland. There is an annual supply of about 32 million seedlings of which 7 million are planted on private land.

The plan aims to develop 25,000 ha of grazing land annually and between 1940 and 1968 72,000 ha were protected. Recent endeavours are aimed at tackling the tremendous problems of desert creep and salinity in the oases of Warzazat, some of which have been almost completely buried by moving sand.

Egypt

A large programme in desert areas adjacent to the Nile Valley resulted in the reclamation of more than 375,000 ha. This is considered a unique example of reversing desertification. This large project depends for irrigation on Nile water supplied by the Aswan High Dam. Successful attempts have also been made to stabilize patches of coastal sand dunes by planting figs and olive trees on the gentle slopes and valley beds near the coast. Various experiments with natural and introduced forage plants and development of rangeland have been in progress.

In the western oases the development of underground water in the Nubian sand stone resulted in 28,000 ha of land becoming available for new settlers and in Sinai run-off water collection and dispersion measures have been applied to maximize benefits from the limited rainfall in the North.

In Tahreer, which was originally covered with sand dunes, the total reclaimed area amounted to over 60,000 ha of

Scientific Seminars Held	
Subject	Place
Natural vegetation	Mednin, Tunisia
Social problems and their relation to desertification control	Algeria
Animal production and rangelands management and development (in cooperation between UNESCO, ALECSO and ACSAD)	Tunisia
Protection of oasis and establishment from sand encroachment	Mauritania
Erosion control and water policy in arid and semi-arid regions	Tripoli, Libya
Uses of firewood and substitutes	Mednin, Tunisia
New techniques for nurseries, plantation and propagation of plants	Tripoli, Libya
New techniques in producing fodder and fodder seeds	Khasrin, Tunisia
Desertification control in North Africa	Morocco
Salt lands and methods of reclamation	Tunisia
Regional planning for combating desertification	Algeria

irrigated land, now planted with fruits and fodder.

Mauritania

In Mauritania, the Green Belt Project of Nouakchott, which was begun in 1975 by the Mauritania Red Crescent and the World Lutheran Federation, was the first afforestation project of any scope in the country. Many other activities have taken shape since the early 1980s, such as the regeneration of gum tree stands, dune stabilization and fixation and green poles projects. In quantitative terms, the realizations are

modest: less than 2,000 ha have been reforested in 10 years. This is mostly due to the extreme conditions in which the plantations were established (200 mm or less rainfall).

Constraints

Despite the impressive nature of the activities undertaken by each of the six countries of North Africa, the major weakness in the past has been the virtual absence of coordination of these activities and the lack of exchange of knowledge and experience among the countries concerned. The successes and failures of the endeavours of each country have remained more or less locked within its national boundaries. Since desertification problems by their nature and causes are not limited to national boundaries, it is abundantly clear that coordination of the GBPNA would greatly benefit the countries concerned. To achieve this a transnational approach was necessary to establish cooperation for exchange of knowledge and experience through a common platform which would assist the countries individually and collectively in combating desertification at the biological, physical and social level. This awareness led to the concept of the GBPNA within the context of efforts to promote international cooperation to combat desertification called for in General Assembly Resolution 3337 (XXIX) issued in 1974.

Training Courses

Subject	Place
Range management and livestock production	Tripoli, Libya
Preparation of vegetation maps	Mednin, Tunisia
Techniques of afforestation and sustainable kinds of plants	Algeria
Environmental study pattern	Kairouan, Tunisia
Range management and improvement	Kairouan, Tunisia
Soil erosion and water conservation	Tripoli, Libya
Energy uses and substitutes	Tunisia
Methods of correct farming	Jelfa, Algeria
Windbreaks and protective barriers	Morocco
New ways and methods in afforestation	Algeria
Arboretums and seed production	Damascus, Syria
Methods and techniques used for maintaining and conservation of water surface	Tunisia



Natural revegetation of sand dunes after three years of protection from grazing. Photo: Ali Kholdbarin

GBPNA is unique in the Arab world and consequently the project had no previous experiences in planning, operations and even administration to draw on. In the past, the lack of laws and legislation in the field of desertification control and the absence of unified formats for project proposals - which were written only in Arabic and therefore were accessible only to donors in Arabic-speaking countries - have limited GBPNA's success. There was also a shortage of finances for project implementation. Despite this, and the socio-economic situa-

tion which has adversely affected the number of participating countries and the implementation of some activities, GBPNA is still thriving.

Concerted efforts between the Director General, ALECSO and the Executive Secretariat over the past two years have now cleared the way for more efficient cooperation with the promise of increased participation and wider activities. However, the nature of desertification control, whether at the technical, social or political level is a slow process demanding persistence and pragmatism.

Following discussions with all parties it is recommended that a unified format for project proposals is developed and that these proposals are translated into French and English and distributed to potential donors for their consideration and possible contribution. It was also agreed to establish a policy to develop more field-oriented projects and a joint action programme between the GBPNA and the African Deserts and Arid Lands Committee (ADALCO).



United Nations Sudano-Sahelian Office

UNSO - UNDP-UNEP joint venture to assist 22 countries in the Sudano-Sahelian region in anti-desertification activities

UNSO's activities continue to focus on the recovery and rehabilitation of natural productive resources and to secure the promotion of sustained economic development. UNSO is engaged in a number of activities ranging from country-focused assistance in planning and co-ordination to implementation of projects and programmes dealing with the management of natural resources. New activities related to the preparations for the 1992 UN Conference on Environment and Development (UNCED) have also been initiated.

Evaluation of UNSO

In 1990 UNEP and UNDP jointly organised for an evaluation of UNSO and found that their Joint Venture had contributed to:

- * significant fund raising
- * increased awareness of desertification processes and effects in the 22 countries of the Sudano-Sahelian region; and
- * numerous successful programmes and projects.

The evaluation recommended that UNSO's actions at the national level should continue and be strengthened in order to assist governments in the region to:

- * develop National Plans of Action to Combat Desertification (NPACD) and incorporate them into national plans for sustainable development
- * develop or strengthen relevant institutions

- * implement replicable integrated projects and ensure that the *causes* of desertification are addressed and not only the symptoms
- * use available financial resources effectively by avoiding duplication of activities and coordinate the anti-desertification activities undertaken by the international community in the region.

Based on the evaluation findings, UNDP and UNEP have initiated discussions on the programmatic aspects of the venture. The discussions should lead to a revised UNDP/UNEP memorandum of understanding and a strengthened programme for the 1992-1993 biennium.

Support for Planning, Co-ordination and Ecological Monitoring

UNSO's assistance to governments in the areas of planning and co-ordination focus primarily on the preparation of strategic frameworks for developing activities for the protection and management of productive natural resources. UNSO's activities are directed towards improving the capacity of government focal points to deal with natural resource management as well as establishing and strengthening national mechanisms such as advisory/coordinating units, scientific advisory councils or national committees for desertification control. These efforts are geared towards

integrating environmental concerns into the main stream of country development plans.

Almost all of the activities related to planning and coordination are financed through UNSO's General Resources.

Programmes and Projects

UNSO supports programmes and projects addressed at medium to long-term environmental rehabilitation issues by focusing primarily on four broad categories.

Deforestation control

UNSO's strategy in this area calls for such actions as:

- * increasing wood resources supply through afforestation, reforestation, agroforestry, community agro-forestry, restocking of gumbelts;
- * wood resource demand reduction and management through improved wood fuel consumption technologies and wastage reduction; and
- * wood resources substitution by other biomass or non-biomass forms of fuel.

Range management and water resources development

Pasture and rangeland degradation affect many parts of the region as human and livestock pressures approach or exceed the

carrying capacities of the rangelands. The complexity of the management task means that projects and programmes are geared towards integrated resources management involving all or a selection of specific components.

Soil protection and sand dune stabilization

These projects are based on the use of windbreaks to control sand movement and biological fixation by means of planting trees. Biological fixation costs half as much as mechanized stabilization methods which are beyond the means of most local communities. It has the added advantage of involving the local community in transforming their own environment.

Integrated land management

UNSO efforts in programmes and projects have increasingly placed emphasis on holistic approaches which combine different production activities - mainly cropping, livestock development and forestry.

Special programmes

The Sahara-Sahel observatory (OSS), a programme to strengthen mechanisms which currently exist to fight desertification in North Africa and the Sudano-Sahelian region, was initiated in 1989-90 by the French Government in conjunction with UNSO. Activities were launched to carry out an inventory of organisations, programmes, projects and experts (OPE) in the field of monitoring desertification dynamics and in research.

The inventory is designed in two parts: a qualitative inventory based on interviews with institutions during missions by international consultants, and a quantitative inventory based on questionnaires sent out to each of the institutions concerned. For the purpose of the qualitative inventory, UNSO has been sending missions of international consultants throughout the United States, Canada, Europe and Africa to visit the principal organisations whose activities involve monitoring and research of factors related to natural resource degradation.

Regional Activities

Sahel - CILSS/IGADD

UNSO has strengthened its working collaboration with and support for both the Permanent Interstate Committee on Drought Control in the Sahel (CILSS) and the Intergovernmental Authority for Drought and Development (IGADD).

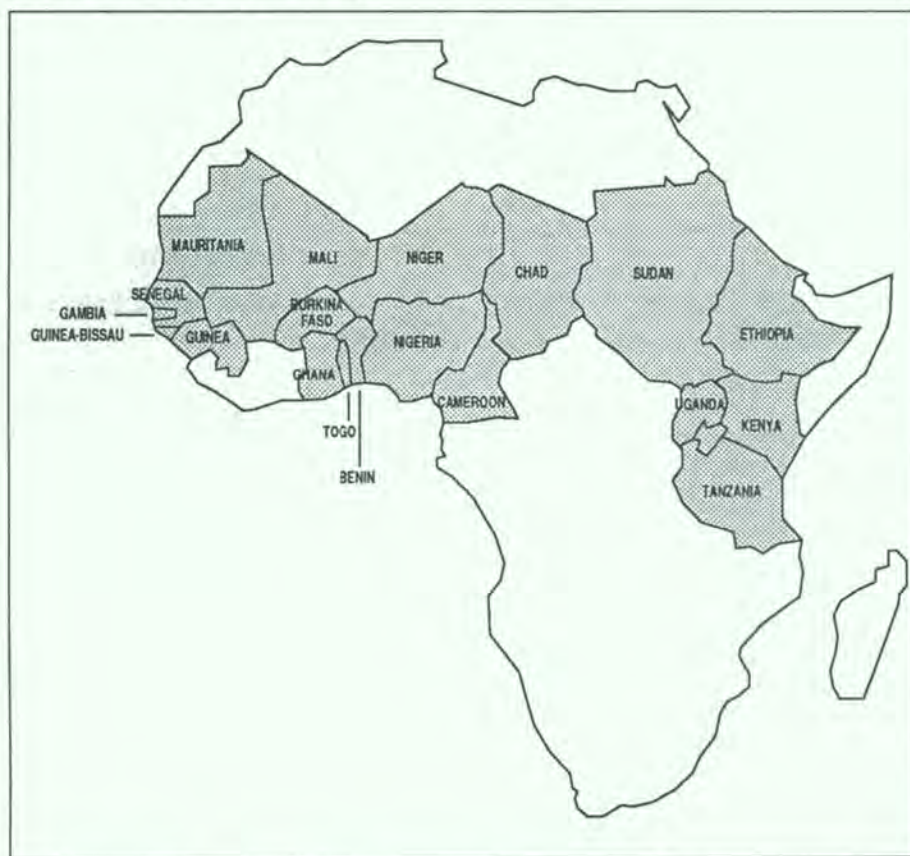
In particular, in cooperation with CILSS and IGADD, UNSO is assisting and supporting the countries of the region in their preparatory process for the 1992 UN Conference on the Environment and Development. To this end a Joint Steering Committee (JSC) has been established to help identify and support key actions related to the UNCED preparatory process, at both regional and national levels.

In accordance with the recommendations of the JSC, in 1990 UNSO launched a number of initiatives in the region to help the creation of National Preparatory Committees (NATCOM). A meeting of the 22 Sudano-Sahelian countries and their regional institutions was held in January 1991 to follow up on the co-ordination and elaboration of national and regional strategies, with a view to ensuring that environment and development issues are treated in a consistent and integrated manner.

In addition, UNSO has provided support to CILSS, notably to the Sahel Institute in Bamako, by providing:

- * support for an integrated control programme against pest infestation of the Sahelian vegetation cover. Through the project which is executed by the Institute, research and training is undertaken and coordinated;
- * training assistance for postgraduate level specialists and intermediary staff in rural development and desertification control within the framework of the Integrated Grasslands Management Training Programme in the Sahel;
- * support for the development of a Sahelian environmental education programme at the secondary level.

In close co-operation with CILSS, UNSO pursued arrangements for launching tree-seed projects in CILSS member states under multi-donor financing. These projects will seek to establish and strengthen national tree-seed centres for the purpose of



UNSO is assisting and supporting countries of the region in their preparations for the 1992 UN Conference on the Environment and Development.



UNSO Technical Publication No. 1



UNSO Technical Publication No. 2

collecting, screening, storing and distributing high quality seed to alleviate the current seed shortages. A regional support project will backstop national efforts and seek to set up a regional network.

UNSO also financed the formulation of a CILSS programme designed to educate high school students to be effective channels for disseminating skills and attitudes which help in combating the effects of desertification. This programme, which was officially adopted by the CILSS Heads of State Conference in January 1988, aims at developing and incorporating an environmental education programme in all academic curricula within a span of 6-7 years. The programme is designed to provide students with better knowledge of their environment and of their relationship to it, and to sensitize them to environmental issues. The project will introduce in the secondary school curricula educational information that promotes better care of Sahelian natural resources. It will also ensure that the necessary institutional arrangements, such as trained teachers and teaching materials of good quality are at hand.

Country Activities

Kenya

In Kenya, UNSO continued to support the government's initiatives aimed at developing and implementing a holistic approach to the management of natural resources and

the environment. Previous UNSO supported activities include the creation of a multi-disciplinary Scientific Advisory Committee on Desertification and assistance in the establishment of the Ministry of Reclamation and Development of Arid and Semi-arid Areas and Waste-lands. Support continues to be given to help strengthen this Ministry.

Tanzania

In Tanzania, UNSO supported the establishment of a mechanism for coordinating desertification control activities. The project, which has helped the establishment of the Drought and Desertification Control Unit within the National Environment Management Council, supports the preparation of a NPACD, the establishment of a database on drought and desertification issues and the mapping of areas threatened by desertification. The proposed NPACD, which is to be adopted shortly, identifies a series of project ideas which donors have requested UNSO to develop into full-fledged projects and submit to them for funding.

Mauritania

UNSO is providing support to the government for the preparation of a thematic round table on desertification. In this regard, UNSO will help the government take part in sensitization missions of senior Mauritanian officials to a number of donors. Such dialogues between donors

and recipients, preceding round-table meetings, should help establish a firm consensus of priorities, programmes and resource implications.

UNSO also provided Mauritania with US \$160,000 in 1990 to support continuation of a project that aims to improve the supply and management of water resources in M'bagne and Bababe. The project includes irrigation of small-scale perimeters for small farmers, as well as assistance for maintenance systems considered vital to sustainable water projects.

Support also continues to the nationwide programme of sand-dune fixation. The first phase of the project was instrumental in the construction of barriers across dried expanses to change ruinous wind patterns and to stabilize about 850 ha of dunes at 15 sites. The present phase, for which the Government of Denmark made a contribution of US \$5 million, will extend the number of sites to 40 with the emphasis now being given to combined agro-sylvo-pastoral development which has led to substantial involvement of the population in the activities.

Chad

In Chad, following the completion of the NPACD, UNSO is assisting the government in the preparation of a comprehensive programme to be presented during the sectoral consultation meetings which are to follow the 1990 donor round table. UNSO has also initiated and completed a project designed to improve the planning and management of agricultural, silvicultural and pastoral resources. Using pictures from the telecommunications satellites LANDSAT and SPOT, the project helped produce maps and data on livestock population and distribution, vegetation cover, bush fires and wind and water erosion features for two northern regions of Chad as a tool for improved natural resources management.

Guinea Bissau

Consistent with UNSO's objective of promoting co-ordination of desertification control activities, UNSO supported a workshop designed to review and harmonize the various strategic frameworks launched in Guinea Bissau for the management of the natural resources and the environment. Such activities are expected not only to integrate or merge the various environment related

frameworks, but also to improve the exchange of information, including indications of planned activities and wider circulation of sector analyses.

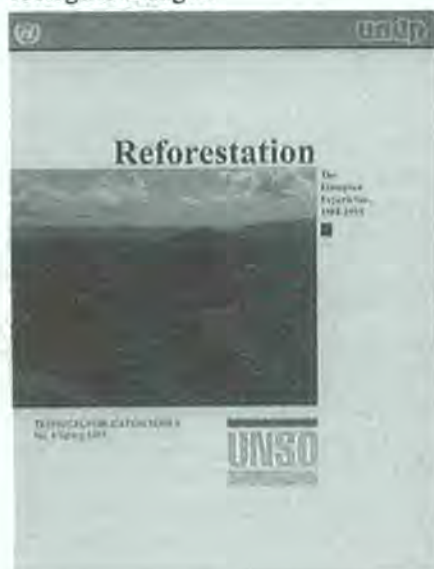
Uganda

In Uganda, UNSO supported the Ministry for Karamoja and the Karamoja Development Agency in the preparation of a development plan for Karamoja. The plan describes the physical condition, natural resource base and environmental problems of this semi-arid zone in northern Uganda and proposes a set of actions to address these problems. Upon approval of the plan by the Government of Uganda, a donors' conference will be convened.

In Uganda, UNSO also held a workshop entitled *A Green Future for Uganda* in cooperation with the Uganda National Council of Women. Eighty participants from the Uganda Women's Tree Planting Movement, the National Council of Women and women from all districts of Uganda discussed environmental issues.

Ghana

Similarly, in Ghana, UNSO initiated a project with the Environmental Protection Council (EPC), to establish a Desertification Control Unit within this environmental body. Through its regional antennas in the north-eastern part of the country, this new unit will carry out a public education programme on drought and desertification control in this area. The Unit will also establish and maintain a data base to monitor ecological changes.



UNSO Technical Publication N°4

Benin/Gambia

In Benin and Gambia, UNSO formulated projects geared towards assisting the respective governments in the preparation and implementation of strategic framework exercises in the natural resources management field. The exercises are composed of various steps, such as the preparation of the strategic framework itself, the identification and strengthening of a focal point responsible for its implementation, the setting in motion of a consultative process within the government and with the donors, as well as the establishment of a national mechanism to monitor and evaluate the process.

Sudan

UNSO has provided US \$2 million for a project aimed at restocking the Gum Arabic Belt in Darfur, Sudan. Many areas in Darfur have become partially deforested as a result of repeated droughts and migration from the rural to the urban areas has left the gum gardens unattended. The project, in addition to restocking the Gum Arabic Belt, provides for the establishment of nurseries to ensure the supply of sufficient quantities and varieties of tree species, apart from *Acacia senegal*. The project is also expected to generate additional income for the farmers from the sale of the gum, to initiate activities to introduce fast-growing fuelwood species and encourage shelterbelts around farms, villages and towns. This project is supported by UNSO through contributions from the Government of



UNSO Technical Publication N°5

Norway and from the Arab Gulf Programme for United Nations Development Organisation (AGFUND) as well as an indicative planning figure (IPF) contribution. UNSO is supporting a similar project for the regeneration of *Acacia senegal* in Mali.

UNSO has also initiated the second phase of a briquetting project with support from the Danish International Development Agency (DANIDA). The project will run for a two-year period at a cost of US \$837,000. Building on the achievements of the first phase, the present project aims to demonstrate the technical and economic feasibility of producing fuel briquettes from agricultural residues, through the operation of a pilot plant installed under the project and through the undertaking of technical studies. The project is particularly concerned with reducing capital and operating costs through the local production of spare parts and the import of basic presses with the local fabrication of associated plants. The project will further examine the possibility of press manufacture in the Sudan and, as a demonstration project, hopes to further encourage private entrepreneurs in the Sudan to install and operate briquetting plants using biomass residues (cotton stalks and ground nut shells). The briquettes produced are mainly bought by small industries.

Burkina Faso

In Burkina Faso, with more than US \$4 million financing from the Government of Sweden, UNSO has launched the third phase of a village woodlots project. This aims to serve both important environmental and productive functions in the land use system and is designed to improve sustained management of the environment and to promote socio-economic development. UNSO is also supporting a US \$1 million agroforestry project in Burkina Faso by establishing a medium and long-term programme of development for agroforestry and agropastoral activities which focuses on natural and artificial regeneration of *Acacia albida*, as well as other local species utilized in traditional agroforestry systems. During the first year of implementation, the project concentrated on carrying out preparatory activities such as organising training workshops and study tours for extension workers.

Negotiations were completed with the Government of Burkina Faso and the Swedish International Development Agency (SIDA) to continue the financing of a project for improved cooking stoves for another three years, beginning in 1990. The new phase will develop self-sustainable marketing channels and enhance the national capacity for manufacturing and distribution of over 200,000 stoves.

Mali

UNSO is supporting the development of the second phase of a project for the integrated development of the lake zone in Mali. In the past the project has established several village-level organisations to ensure the management of rehabilitated land and has initiated family-based reforestation in selected target villages. The project now aims to carry out water and soil conservation experiments and conduct socio-economic surveys relating to the rational management of Bourgou pasture. Preparation is under way for a third phase to help consolidate earlier successful phases.

Senegal

UNSO continues to fund the second phase of the Integrated Programme of Sand-dune Fixation for Terrace Farming and Basin Protection in Senegal. During Phase I, 950 ha of dunes were fixed, 125 km of windbreaks erected, 200 ha of village woodlots established and 600 ha of soils treated to improve their fertility. The success of the first phase and the large extent of the problem led to agreement on the implementation of Phase II, with US \$2.1 million funding from the Government of Norway. The project aims to extend the activities initiated under the first phase by implementing a range of agroforestry activities such as dune stabilization, recovery of soil fertility, road protection, the establishment of windbreaks and woodlots and strengthening national capabilities to carry out further activities.

Cape Verde

In Cape Verde, UNSO is supporting a project to restore vegetation, increase agricultural and fuelwood production as well as improve the quality of life of the rural population in the Sao Joao Baptista Valley. Phase

II of the project, launched in 1990 with a US \$2 million contribution from the Government of Norway, will consolidate the results so far obtained by extending rehabilitation work on an additional 300 ha of hill slopes. It will also restore existing and launch new irrigation schemes as well as upgrade old physical infrastructure. The Sao Joao Baptista Valley incorporates 11 villages with about 1,000 inhabitants - 62 per cent of whom are women and 43 per cent are under the age of 15. The project is expected to benefit the whole population of the valley and has opened up employment opportunities for some 300 people. It is also promoting the establishment of local involvement units to enable the communities to plan and carry out development.

Niger

UNSO continues to support the Government of Niger in implementing an integrated land management project for which the Government of Denmark made a contribution of US \$8.1 million. This is being implemented by the Co-operative for American Relief Everywhere (CARE), an international non-governmental organisation, in cooperation with the Nigerien Forest Service. Some of the major results of the project have been the planting of 600,000 trees/shrubs, the training of 280 farmers in agroforestry practices and the participation of 800 farmers in agroforestry and soil conservation activities.

During the period under review UNSO supported the second phase of the Development of the Lake Faguibine System. With US \$1.8 million financing from the Government of Norway, the overall objective of the project is the restoration and conservation of the food production potential of the Faguibine zone and the provision of water to the villagers. During the first phase, where the project also benefitted from an indicative planning figure (IPF) contribution, a pre-feasibility study was undertaken to develop an efficient water flow system to optimize agricultural production. In addition, priority earthworks and vegetation restoration have been carried out with extensive community involvement. The second phase of the project will complete remaining studies and surveys on the physical, economic and climatic situation to obtain a scheme for optimal utilization of the

land in the Lake Faguibine zone and will proceed with the channel clearing works.

Resource Mobilization

In 1989-90 the total amount of resources mobilized by UNSO through the UNSO Trust Fund was US \$65.4 million, an increase of more than 38 per cent over the resources mobilized in 1987-1988.

The largest concentration of resources mobilized in 1989-1990, US \$26.5 million, was in the form of contributions earmarked for specific projects under trust fund arrangements, identified and formulated jointly by recipient governments, UNSO and donor agencies. Pledges for 1989-1990 to UNSO general resources totalled US \$15.1 million. In 1989-1990, funding amounting to US \$9.2 million was obtained under Management Service Agreements.

UNSO has stepped up its fund-raising efforts while maintaining regular consultations with its main donors, namely, Denmark, Norway and Sweden. France joined the group of UNSO donors by announcing a contribution to UNSO General Resources, as well as an earmarked contribution for the OSS programme.

Co-ordination at the International Level

UNSO continues to build up its links with the international community, including international agencies, bilateral donors and the agencies of the United Nations system. Participating at various international fora provided another means for harmonizing views and information exchange leading to programme co-ordination.

In August 1990 UNSO organised a meeting on Harmonization of Strategic Planning Frameworks. The meeting was attended by FAO, the World Bank's International Bank for Reconstruction and Development (IBRD), the International Union for the Conservation of Nature and Natural Resources (IUCN) and UNEP and established preliminary arrangements aimed at improving harmonization and coordination of the various frameworks of interventions, such as: Environmental Action Plan (World Bank), National Conservation Strategies (IUCN), National Plans of Action to Combat Desertification (UNEP-UNSO) and Tropical Forestry Action Plans (FAO).



There is increasing land degradation in the Sudano-Sahelian region as human and livestock pressures approach or exceed the carrying capacity of the land. Photo: UNEP/Dan Stiles

Increasing Public Knowledge and Awareness

UNSO has concentrated its efforts to create a greater degree of public awareness of the need to improve the protection and management of the productive capacity of natural resources. Its activities focus on supporting awareness-raising events, promoting environmental education and communicating its experiences on projects and programmes to decision makers and development specialists.

During 1989-1990 UNSO produced the first issues in the UNSO Technical Publication Series. The first introduces readers to

the methods and technologies currently in use for monitoring ecosystems, based on the experience of the Ecological Monitoring Centre in Senegal. The second deals with the experience in Mali on the regeneration of bourgou (*Echinichloa stagnina*) to rehabilitate degraded natural pastures. These publications offer to the development community approaches and views drawn from practical UNSO experiences.

Further titles in this series are also planned.

Conclusion

Overall, UNSO made considerable progress during 1989-1990 in addressing the

problems of natural resources management in the Sudano-Sahelian Region.

These issues are beginning to be treated more systematically in country development plans. There is also increasing support among donors, international development organisations and the countries themselves for practical arrangements to co-ordinate, monitor and share information at local level.

As environmental issues continue to be placed further up national and international political agendas, the 1992 UNCED will be an important forum at which to launch a new era of international cooperation.

African Deserts and Arid Lands Committee

The African Deserts and Arid Lands Committee (ADALCO) is one of four committees set up by the African Ministerial Conference on the Environment (AMCEN) to strengthen cooperation between African governments in economic, technical and scientific activities, with the prime objective of reversing the continent's environmental degradation and satisfying the food and energy requirements of the African people.

ADALCO is mandated to initiate action programmes for the implementation of sub-regional activities, in particular for the strengthening and development of systems on the evolution of the environment around three deserts: the Sahara, Kalahari-Namib and Somali-Chalbi. ADALCO also assists other sub-regional organizations (including the Southern African Development and Coordination Conference (SADCC), the Intergovernmental Authority on Drought and Desertification (IGADD) and the Dakar Ministerial Conference on the Environment (COMIDES)) in implementing their programmes for desertification control and actively participates in the preparation of pilot village and stock raising projects.

Main Achievements: North Africa

ADALCO has assisted cooperation between Egypt, Sudan, Libya and Chad in developing the North-East African Sandstone Aquifer and utilizing its ground water for combating desertification. The ADALCO Secretariat mobilized two ADALCO focal points and a consultant who drafted the *Master Plan for Development of the Nubian Sandstone Aquifer for Combating Desertification in North-East Africa*. Five project fact sheets have been drafted by the Egypt ADALCO consultant/focal point and three project fact sheets by the Sudan focal point in the framework of the *Action Programme for Egypt and Sudan Component of the Nubian Aquifer to Combat Desertification*. These were forwarded for consideration to the 4th and 5th ADALCO meetings. Copies of the Master Plan have been handed over to the governments of Egypt, Sudan and Libya and to IGADD.

An ADALCO mission went to Tunisia, Algeria and Libya in July 1990 in order to find out ways and means to reinforce the Green Belt Project of North Africa (GBPNA) which symbolizes an Arab joint effort to combat desertification in Egypt, Libya, Tunisia, Algeria, Morocco and Mauritania. Achievements and on-going and planned activities in implementation of the GBPNA were discussed and reviewed with government representatives, the Director General of the Arab League Educational, Cultural and Scientific Organisation (ALECSO), GBPNA Executive Director, sub-regional institutions and representatives of UN organisations. As a result of the mission recommendations for follow up activities will be presented and discussed at the 5th ADALCO meeting in order to explore ways and means for possible support of the GBPNA within the ADALCO mandate.

Central Africa

Two ADALCO national focal points in the Central Africa sub-region have prepared an action programme and formulated proposals for programmes which would support joint efforts against savanization and sahelization and harmonize the framework for cooperation on the environment of the sub-region. Their report entitled *Programme of Cooperation Against Savanization and Sahelization in Central African Sub-region* was submitted to the ADALCO Secretariat for forwarding to the 3rd ADALCO meeting held 7-9 February 1990 in Ouagadougou, Burkina Faso.

Southern Africa

The Southern African sub-regional group of ADALCO was entrusted with defining programmes for the promotion of food production by controlling the spread of deserts of Southern Africa. The *Outline of an Action Programme to Combat Desertification and Promote Food Production in the Southern African Sub-region*, drafted by an ADALCO focal point with technical input from the ADALCO Secretariat, was presented at the 3rd ADALCO meeting. A copy of this document was sent to the SADCC Coordination Unit in connection

with the development of the *Plan of Action for the Kalahari-Namib Region* which was presented at a Project Formulation Workshop in Bulawayo, Zimbabwe from 21 June to 4 July 1990, organized by the Soil and Water Conservation and Land Utilization (SWCLU) of SADCC, the Government of Zimbabwe and DC-PAC. Dr William Rugumamu, the ADALCO focal point of the Southern African sub-region, attended the Bulawayo Workshop on behalf of ADALCO and prepared and distributed a report: *Towards Formulating Projects to Halt Environmental Degradation and Declining Food and Energy Yields in the Southern African Sub-region*. The Workshop also discussed matters related to land use planning, natural resource management, establishment of natural resource monitoring transects, developing of pilot areas and the institutional framework of the *Plan of Action for the Kalahari-Namib Region*.

West Africa

A report on *The Control of Desertification and the Spread of the Desert in the South Saharan Zone and the Gum Belt through Programmes of Ecological Rehabilitation* prepared by the West African ADALCO consultants/focal points has been disseminated to governments in the sub-region and some institutions, including the Permanent Interstate Committee on Drought Control in the Sahel (CILSS). The report could assist them in better management of natural resources on a sustainable basis in order to control desertification and promote food and energy production.

A Memorandum of Agreement on Cooperation between IGADD and the African Ministerial Conference on the Environment (AMCEN) has been drafted, discussed and agreed upon. Close cooperation between ADALCO and IGADD is a relevant part of the Memorandum and in this connection the two institutions will endeavour to:

- * Develop a programme for implementation of priority AMCEN regional and sub-regional activities in order to achieve sustainable economic development;
- * Promote the establishment and strengthening of national, sub-

regional and regional systems and the necessary cooperation mechanisms that are required for surveying, arresting and monitoring processes of desertification and resource degradation, and for introducing appropriate measures for soil conservation and the protection of vegetal cover through improved cropping systems;

- * Through training programmes and pilot demonstration projects promote the strengthening of national capabilities in land use, planning and management for desertification control as integral parts of national plans for sustainable development;
- * Promote measures, including mass media campaigns and other public sensitization activities to ensure an increase in general awareness of the desertification problem and the full participation of local populations in solving it.

Planned Activities for 1992-1993

- * Develop a programme for strengthening national sub-regional systems and the necessary coherent cooperation mechanisms for surveying, arresting and monitoring the processes of desertification in the IGADD region.

* A minimum of 4-6 countries in the SADC region will be assisted in installing or reinforcing existing operational village projects for sustainable food, fuel and fodder production in line with the AMCEN programme and under the frame of the Plan of Action for the Kalahari-Namib region, as follows:

- * Angola: pilot areas in Bahia Farta in Benguela Province and Vivei in Namibia Province.
- * Botswana: four pilot areas in Gumare, Rakapos, Tsabong and Lephehe.
- * Namibia: pilot projects at 3-4 sites in Hereroland West and East, Namaland and Bushmenland.
- * Zambia: a pilot site in Liangati District.
- * Zimbabwe: three pilot areas in Sansukwe, Dititi and Shashi Wards.
- * Mozambique: Chanhanbuzi pilot village in Manica Province.
- * Continue support for the project on the integrated management and rehabilitation of the Fouta Djallon Massif.
- * Develop programmes for strengthening the Libyan and the Chad components of the North-East African Sandstone Aquifer in order to fight against desertification and promote

food production.

- * Support three Green Belt Project of North Africa (GBPNA) projects agreed upon by the Permanent Joint Committee of the GBPNA, viz:
 - Seed Bank of North Africa
 - Collection and multiplication of native range plants
 - Seminar: *Mycorrhiza* and Afforestation.
- * Train about 30 technicians and village-level leaders from Francophone countries in techniques of ecological management of villages for the sustainable production of food, fodder and fuel envisaged under the AMCEN programme (Mali, Mauritania, Senegal, Zaire, Central African Republic, Benin, Djibouti, Togo, Burkina Faso and Algeria).
- * Hold the 6th and 7th ADALCO meetings.
- * Publish a manual on China's Eco-Farming containing guidelines adaptable for application to AMCEN pilot projects for distribution to all project managers of pilot projects.

ADALCO activities are guided by the objectives contained in recommendations 1 through 22 and 26 of the 1977 Plan of Action to Combat Desertification (PACD). This is in conformity with the general terms of reference as endorsed by the 3rd session of AMCEN.

AMCEN Pilot Projects

In keeping with UNEP Governing Council's decision 14/15 C emphasizing that national programmes and their process of implementation should be grassroots-oriented for easier integration into national economic systems, UNEP continues to support African governments which have identified villages to be developed under the Cairo Programme of African Cooperation. To date, pilot village and stock-raising projects for sustainable food, fodder and fuel production involving popular participation and focusing on women in develop-

ment have obtained funding from the Arab and Gulf States Fund (AGFUND), the UN Development Programme (UNDP), the UN Sudano-Sahelian Organisation (UNSO), the World Food Programme (WFP), the Canadian International Development Agency (CIDA) and UNEP and are under implementation in Djibouti, Egypt, Ghana, Uganda, Zimbabwe and Zaire. DC-PAC has also assisted in the formulation of project proposals for development under the AMCEN programmes in Tanzania and Mozambique. These pilot projects address the problems of degradation of resource systems and the deterioration of the communities' capacity to cope with natural hazards such as drought and floods. The aim is to achieve this by applying simple

technologies, community involvement and deliberate redirection of governmental policies to enable communities to attain self-sufficiency in food, energy and other basic requirements, as a step towards sustainable development.

The pilot village and stock-raising zone projects have received support from African governments but the most serious constraints are their financing and their management. A solution to the financing problem does not seem in sight unless governments make efforts to minimise high-cost capital inputs to the pilot projects, devise effective methods of utilizing locally available resources and integrate traditional systems of resource management.

NEWS FROM UNEP

DC-PAC Activities on Implementing the PACD

The major global challenge to produce more food and domestic fuel for populations that are growing faster than available resources is a cause of land degradation, especially desertification and deforestation which affect more than 75 countries in the dry regions. In the developing countries anthropogenic factors, particularly poverty and related bad land use practices, are responsible for the severe damage to these fragile ecosystems. Such damage is primarily due to excessive exploitation beyond the inherent potential of the rangelands, cutting of trees at rates faster than their regeneration, and over-dosing farmlands with irrigation water. There is growing consensus that in the developed countries similar damage is due to excessive applications of agro-chemicals which have had detrimental side-effects on soil, water, air and human health.

Technical Assistance to Governments

The Plan of Action to Combat Desertification (PACD) which has provided the basis for UNEP's assistance to governments in addressing desertification problems was evaluated during 1989-90 in accordance with GC decision 15/23. The findings of the evaluation, conducted by international scientists with extensive experience in desertification control, reconfirmed the validity of the PACD as an appropriate instrument to assist governments in developing national programmes for arresting the process of desertification. Several delegations at the first substantial session of the Preparatory Committee for the 1992 UN Conference on Environment and Development (UNCED) also expressed the view that the PACD is still valid and remains a scientifically sound basis for combating desertification. There is also general global agreement

that land degradation and desertification require international financial support for long-term development. However, international commitments for aid in anti-desertification efforts have not been forthcoming.

It is against this uncertain global situation that UNEP continues to emphasize in its programmes of assistance to governments the urgent need for creation of ecologically-sound sustainable farming systems. This calls for bringing into play the traditional systems used by local people so as to devise effective strategies for promotion of popular participation in programmes of desertification control. UNEP's approach to governments and NGOs concerned with desertification control has been consistent in stressing that it is these measures which are crucial and decisive if limited available financial resources are to be efficiently utilized. In this context, UNEP has focused its efforts on engaging donors and governments of desertification affected countries in a dialogue to search for effective institutional mechanisms for integrating desertification control programmes into overall national development plans and priorities. In addition, assistance has been provided to selected countries in the identification and development of methodologies for assessing and mapping the status of desertification - its extent, rate and risk - as this knowledge is essential for effective planning for desertification control. Extensive consultations have been held with national and regional research institutions with a view to enhancing the methodologies applicable to global, regional and national assessments of desertification.

National Plans of Action to Combat Desertification

At its 44th session in 1989, the General Assembly adopted resolution 44/172 in which it required the Executive Director of UNEP to take specific actions including: an evaluation of progress in implementing the PACD, preparation of a report containing

relevant expert studies on financing anti-desertification programmes and convening of sessions of the Consultative Group for Desertification Control (DESCON). The General Assembly requested the Secretary-General, together with the Executive Director of UNEP and the Administrator of the UN Development Programme (UNDP) to report to it at its 46th session, through the Economic and Social Council (ECOSOC), on the various provisions of the resolution.

In its decision 15/23 of May 1989, UNEP Governing Council invited governments of countries prone to desertification to accord priority to anti-desertification programmes by preparing national programmes to combat desertification within the framework of national plans for development of natural resources and rehabilitation of impaired ecosystems. The UN's Administrative Committee on Coordination (ACC) noted that one of the key impediments to the implementation of the PACD was the lack of well-formulated National PACDs (NPACDs) and national policies to support them. The ACC urged concerned members of the Inter-Agency Working Group on Desertification (IAWGD) to assist governments to orient their development approaches towards sustainable development. Accordingly, UNEP, the Economic and Social Commission for Western Asia (ESCWA) and the UN Food and Agriculture Organisation (FAO) agreed on a joint thematic programme for the biennium 1990-1991 for assistance to the governments of Bahrain, Oman, United Arab Emirates (UAE) and Yemen in the preparation of NPACDs. This joint exercise is intended to assist the concerned governments to formulate NPACDs as part of national social and economic development plans, to identify priority desertification control projects and to organise national project funding round-tables for presenting the projects to donors. In Yemen, where the NPACD had been prepared under previous arrangements with the government of the former Yemen Arab Republic, it was agreed with the new government to formulate a single plan for the unified Republic of Yemen. Consequently a new draft for the whole country

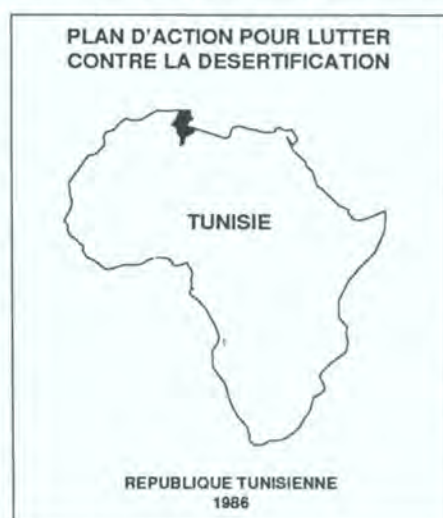
was prepared and discussed with the relevant technical agencies of the new government during the latter part of 1990. The official approval of the draft NPACD and its national long-term programme (1991-2010) is expected to be made later this year. This will be followed by a national seminar to consider adoption of the NPACD and organisation of national fund mobilizing round-tables with potential donors.

UNEP has also continued assistance to other governments which are at different stages in development of their respective action plans for combating desertification.

Argentina

In Argentina the government received UNEP's assistance through the Instituto Argentino de Investigaciones de las Zonas Aridas (IADIZA) in training of its nationals to establish a Geographic Information System (GIS) capability which is essential for the integrated analyses required for assessments of the environmental state and trends in support of the NPACD. Funding support has also been provided to IADIZA to enable the institution to initiate research work on desertification, particularly in relation to mapping and assessment of desertification processes, wild fauna of arid zones, genetics of useful arid zone plants, range management in arid zones, improvement of saline soils, sand dune fixation and watershed management. Support has also been received from the International Bank of Development (IBID) towards implementation of desertification control programmes. However, funding of the several programme activities under the Argentina NPACD is

very limited in the absence of a sustained government policy for its implementation.



Tunisia

In Tunisia the Government has been implementing 8 out of the 21 projects identified in its NPACD formulated in 1986 with the assistance of UNEP. The projects include mapping grazing resources in development zones, establishment of a seed bank, training in desertification control and integrated development of catchment basins. Progress in implementing these projects has been satisfactory, with funding from both the governments' resources and external financing. Other projects have been presented for financial support by UNDP, the International Fund for Agricultural Development (IFAD), the Arab and Gulf States Fund (AGFUND), the Swedish International Development Agency (SIDA) and the German Agency for Technical Cooperation

(GTZ). Implementation of the NPACD in Tunisia has on the whole been a success. Reports indicate that activities carried out under the plan to protect resources and develop agriculture in the regions affected by desertification have contributed to diminishing the extent of desertification damage and have maintained stable agricultural and pastoral activities. Some 60,000 ha of oases and irrigated lands have been protected against sand dune encroachment and 10,000 ha prevented from salinization. It is against this background that UNEP assisted the government of Tunisia to present a comprehensive report on its experience with implementation of the NPACD at the DESCON-7 session in order to share this experience and information with other countries, and possibly to attract additional funding from other donor sources.

Mongolia and Peru

At the request of the governments of Mongolia and Peru for assistance in the preparation of NPACDs, preparatory actions were initiated by a preliminary survey undertaken in Mongolia in cooperation with the Economic and Social Commission for Asia and the Pacific (ESCAP) and involving the participation of experts provided by the USSR Commission for UNEP (UNEP/COM) and the Chinese Government. In Peru discussions have been held with the National Office for Natural Resources Evaluation (ONERN) and arrangements made for the institution to coordinate national technical activities for preparation of the plan with funding support provided by UNEP.

UNEP/USSR Project on Combating Desertification in the Aral Sea Area

Desiccation of the Aral Sea is today rightly listed among the worst ecological disasters of the twentieth century. Formerly the world's fourth largest lake, in the mid 1950s the Aral Sea was a brackish water body with a volume of some 1,000 km³ and an area of more than 60,000 km² (Figure 1). But since

the 1960s the water flow into the Aral Sea has gradually decreased from 50-60 to 30 km³ in the 1970s/1980s to 5 km³ in 1989-1990. Consequently, the lake is becoming shallower and more saline: the water level has fallen by 14-15 metres (down to 38.5 metres above sea level) and its salinity has tripled to 30g per litre.

The water body has divided into two distinct water areas - the Big Sea and the Little Sea - fed by the remaining flow from the Amu Darya and Syr Darya rivers (Kotlyakov, 1991). The dried sea bed has become a source of salt and dust storms and the continental nature of the Aral region's climate has become more pronounced. As the ground water level on the sea shore has

dropped desertification has affected hundreds of thousands of square kilometres with a simultaneous reduction in the land's productivity.

The sharp deterioration in the local population's living conditions has led to an increase in sickness and the mortality rate is the highest ever registered in the country. The public health problem of the Aral region stems from interrelated ecological, social and economic issues which together are having an extremely adverse effect on the human environment. The Aral crisis now affects the fate of the whole country and has been brought to the attention and become a subject of concern to the world community.

UNEP/USSR Project

UNEP is very concerned about the degradation of the Aral Sea and, as a leading UN agency in the field of environmental monitoring, could not be passive in the face of this expanding ecological calamity of global magnitude. Following a visit by UNEP's Executive Director, Dr M.K. Tolba, to the USSR in 1989, where he had talks in the USSR Supreme Soviet on the Aral Sea issue, it was decided to initiate a UNEP/USSR project aimed at formulating ways to save the sea and rehabilitate the local environment.

The project entitled *Assistance for the Preparation of an Action Plan for the Rehabilitation of the Aral Sea* was signed in January 1990. It envisaged, *inter alia*, sending an international working group of consultants and national experts on a fact-finding mission to the Aral Sea to prepare a diagnostic study to serve as an information source for the Action Plan. Once formulated, this plan is to be submitted to the Soviet government. The consultants were also to prepare recommendations for establishing a basin-wide monitoring system for the Aral Sea.

Since beginning the project in February 1990, the expert group has completed the fact finding mission to the Aral Sea and convened three meetings where the diagnostic study and the outlines of the future Action Plan were thoroughly discussed.

At their first meeting in September 1990 the group adopted proposals to expand the original scope of the project to include various new subprojects covering specific environmental problems of the Aral Sea region.

Desertification Issues

It was not by chance that the first of these subprojects concerns desertification. Desertification in the Aral Sea area manifests itself as wind erosion, expansion of dune and *solonchak* mounds, loss of biological diversity, etc.

The reduction in the area of the Aral Sea has exposed great expanses of former sea bed - approximately 30,000 km² in the late 1980s. The *solonchak* mounds quickly form on the exposed sea bed which has become the greatest source of windborne salts. The largest plumes arise from the dried strip along the sea's northeastern and

eastern coast which is up to 100 km-wide and extends for 500 km. The salty dust particles settle on cotton plantations and cause rice fields and harvests to deteriorate. It is estimated that up to 75 million tons of fine dust particles and salts are transported by wind each year. In the Aral Sea region an average of up to 520 kg of sand and salts fall on each ha of land (Micklin, 1988).

The upper soil horizons in the delta of the Amu Darya river where, over the years, fine-grained sands and loams have accumulated during the channel shifts, are now being blown about by the winds to form sand dunes and hillocks.

The shrinking of the Aral Sea along with the greatly diminished flow of the Amu Darya and Syr Darya has had particularly devastating effects on these rivers' deltas. The tugay forests which in 1961 covered 260,000 ha in 5-6 km bands along the arms of the Amu Darya delta, have been reduced to a fifth of that size in little more than two decades. Approximately 300,000 ha of lakes and bogs that previously occupied the western and central parts of the Amu Darya delta have dried up, leaving tussocks of reed rootstocks and stems and giving rise to typical *solonchaks* (Precoda, 1991).

Regulation of stream flows and cessation of floodings has led an immense

area drying out in a band 25 to 100 km wide and about 500 km long along the course of the Syr Darya river.

Of the 178 species of animals previously found in the delta of the Amu Darya, only 38 species remain (Burke, 1990).

Approaching the new project

The First Expert Group Meeting's recommendations to incorporate desertification issues into the Project were further reiterated during the consultations between the USSR Supreme Soviet delegation and UNEP in Nairobi in October 1990. The Protocol on the outcome of the consultation directed *...in the light of experts recommendations to introduce amendments into the main directions of the project to cover the problems of desertification in the region...*

The task of formulating a project proposal was entrusted to the respective Soviet institutions. Soviet scholars proceeded from the supposition that to halt the process of desert encroachment in the region it was imperative first to assess the local status of desertification more accurately on the basis of quantitative and qualitative criteria. This goal was further accentuated by the fact that despite numerous surveys and studies undertaken in the Aral Sea area, there have

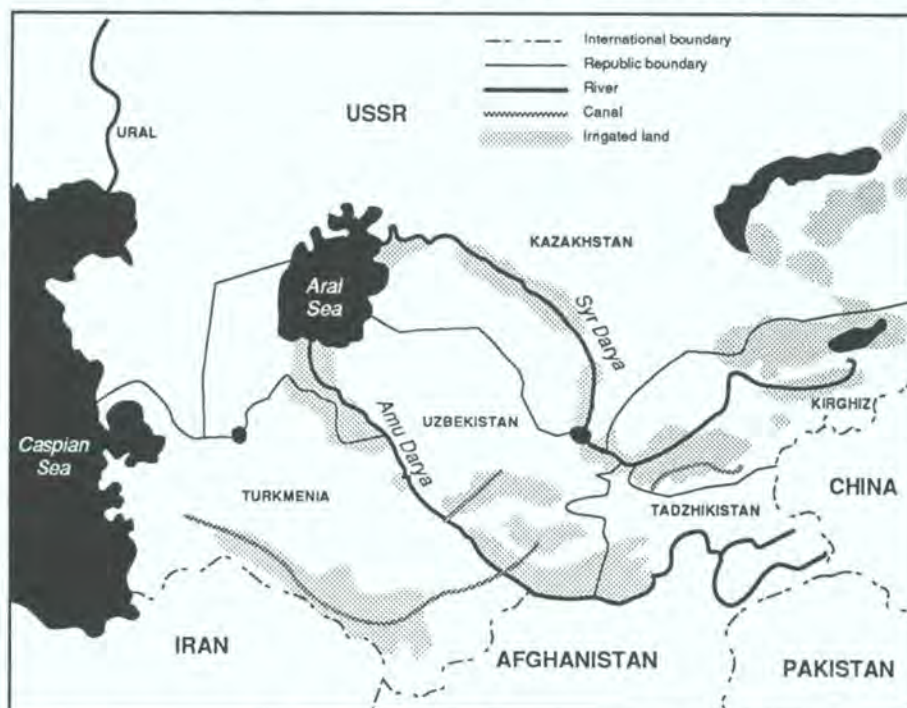


Figure 1: Adapted from: Kotlyakov V.M., The Aral Sea Basin: A Critical Environmental Zone. *Environment*, 1991, Jan/Feb. pp. 4-38.

been few attempts to assess desertification phenomena integrally. In any case, previous attempts were based on the definition of desertification set forth by UNCOD in 1977 and on the FAO/UNEP Methodology of Desertification Assessment and Mapping. As was later revealed, the major handicaps in using this definition and methodology were that there was insufficient data and it was necessary to collect detailed information that was not usually readily available.

As was stated by the Ad-hoc Consultation Meeting on *Assessment of Global Desertification: Status and Methodologies* held in UNEP in February 1990, the unsatisfactory state of methodological efforts was mainly due to the imperative nature of the definition of desertification. The Meeting elaborated and adopted a new definition of desertification in the context of its assessment, namely, *...land degradation in arid, semi-arid and dry sub-humid areas resulting from adverse human impact*. It further recommended that to obtain a reliable and precise picture of the status of desertification in the world or in a specific large region *...an internationally accepted system of methods of measuring the parameters of desertification* should be developed. The aim of the new project is to develop and test a concrete desertification assessment methodology applicable to medium-scale mapping on the basis of the new definition of desertification.

It was decided to concentrate future

exercises in this field in the Southern and Eastern Pre-Aral Region where desertification processes were particularly active.

Apart from this national target the project is also oriented towards several developing countries in arid and semi-arid zones, in particular those with analogous closed salt-lake basins, including Lake Mackadiggadi in Botswana, Tarim Basin and a number of small lakes in China and Mongolia, Lake Chad in Africa and Lakes Turkana and Magadi in Kenya. The project envisages providing these countries with new desertification assessment methodologies elaborated in the Aral Sea area. Despite some ecological differences with the Aral Sea area, it is feasible to carry out thorough comparative studies in these areas in order to get a clear picture of the processes involved. No similar studies have been carried out for these regions, nor have any desertification assessment methodologies been developed or used therein.

Southern and Eastern Pre-Aral Region

At the Second Expert Group Meeting in February 1991, the project proposal entitled *Desertification Assessment in the Southern and Eastern Pre-Aral Region (SEPAR)* was endorsed in general and recommended to UNEP for inclusion in its programme activities for implementation in 1991. The

main objectives are to assess the present desertification status in the SEPAR and to provide the necessary background information for the Action Plan for the Rehabilitation of the Aral Sea. The project also aims to develop and test desertification/land degradation assessment methodologies for application in medium-scale mapping, and to provide governments of countries affected by similar desertification problems with management tools for combating desertification through provision of a methodology of desertification assessment and training of specialists.

It is hoped that ultimately a desertification/land degradation map of the SEPAR with explanatory notes (scale 1:500,000) will be produced, and that guidelines for desertification assessment aimed at regional/provincial rehabilitation of the environment and sustainable development will be published. A scientific report on Desertification Assessment in the Southern and Eastern Pre-Aral Region will be drawn up and workshops will be held for specialists from participating countries where they will be trained in the field in the SEPAR on desertification assessment and mapping.

The principal implementing agencies of the project are the USSR Commission for UNEP (UNEP/COM) in association with the USSR Academy of Sciences and the Moscow State University.

Consultative Group for Desertification Control (DESCON)

The eighth session of the Consultative Group for Desertification Control (DESCON) was held in September 1991 in Geneva, Switzerland. It was attended by 16 government representatives, 7 UN organisations, 3 international organisations/non-governmental organisations and 12 independent consultants.

It was convened as a *session of special character* to review two major reports: the first, the *Status of Desertification and Implementation of the UN Plan of Action to Combat Desertification (PACD)*; and the second, the draft report of the Secretary-

General derived from external studies requested by General Assembly resolution 44/172 on the implementation of the PACD. DESCON-8 also looked at chapter 6, entitled *Desertification and Other Kinds of Land Degradation of the Comprehensive State of Environment Report*, before their submission through the 3rd Special Session of UNEP Governing Council to the Preparatory Process of the UN Conference on Environment and Development (UNCED). These reports had already been discussed by the Inter-Agency Working Group on Desertification (IAWGD) in the two previous days and their proposals were considered at the DESCON-8 meeting alongside the original reports.

In accordance with the new format suggested by DESCON-7 in December 1990 in Rome and further recommended to the General Assembly by UNEP's 16th

Governing Council, DESCON-8 did not this time consider any specific desertification control programmes and projects for funding, but instead was oriented towards exchanging information and discussing relevant issues. Between sessions, as suggested at DESCON-7, the informal DESCON Network of Focal Points will continue to exchange information. So far, 23 governments, 11 UN organisations and agencies and 9 other international and/or non-governmental organisation have nominated their focal point institutions/persons. More governments and organisations are invited to do so.

For the first time, this year there was no DESCON Co-sponsors meeting. This function was taken up by the Inter-Agency Working Group on Desertification (IAWGD) since both IAWGD and co-sponsors of DESCON have practically the same

membership. IAWGD held its 16th session just before DESCON-8.

DESCON will continue to assist governments of affected countries in preparing their National PACDs as part of their integrated national development plans and as chapters for wider plans for environmental

protection or natural resources management. This is in harmony and full coordination with the other related strategies being put in place by various ministries of these countries and with assistance from various international organisations.

The next session of DESCON -

DESCON-9 - will be held in 1993 and will discuss the new, interesting orientations of desertification/land degradation that are anticipated to come out of UNCED which will be held in June 1992 in Rio de Janeiro, Brazil. This is in accordance with the UN General Assembly resolution 44/172.

Inter-Agency Working Group on Desertification

The 18th session of the Inter-Agency Working Group on Desertification (IAWGD) was held from 9 to 10 September 1991 at the World Meteorological Organisation (WMO) Secretariat in Geneva, Switzerland. It was opened by Mr S. Evteev, Assistant Director of UNEP, and attended by representatives of the UN Food and Agriculture Organisation (FAO), UNEP, UN Educational, Scientific and Cultural Organisation (UNESCO), UN Sudano-Sahelian Office (UNSO)/UN Development Programme (UNDP), World Health Organisation (WHO) and WMO.

The meeting was convened as a *session of special character* devoted to reviewing two draft reports prepared in compliance with UN General Assembly resolution 44/172 as one of the preparatory actions for the UN Conference on Environment and Development to be held in Brazil in 1992.

The first report - the *Status of Desertification and Implementation of the UN Plan of Action to Combat Desertification (PACD)* - was based on available reports of various meetings and consultations held between 1989 and 1991 by agencies, intergovernmental bodies and members of the IAWGD and Consultative Group for Desertification Control (DESCON). In commenting on this report, participants at the IAWGD meeting emphasized the need for a concerted effort to improve methods of obtaining data and assessing desertification rates and hazards. It was also mentioned that improved monitoring and evaluation techniques are required to assist decision-makers in designing and implementing

strategies for monitoring desertification in their countries. In general, members of the IAWGD agreed with the policy guidelines for implementing the PACD. However, they expressed reservations with regard to the report's step-by-step system of corrective measures and suggested that some of the targets were over-ambitious and that some actions could be carried out concurrently and should not therefore be instigated separately. They also suggested that actions and preventative measures should be put in place so that areas not yet desertified remain so. Some members stressed the need to emphasize balanced production and good land use practices.

With regard to the chapter on financing the PACD, participants suggested that in order to give decision-makers a clear perspective and various options to consider, it would be advisable to calculate costings around different scenarios based on present levels of aid, adjusted for inflation, rather than putting forward large figures indicating required funding to stop or correct desertification damage in general. They also suggested that it would be helpful to include some comparisons showing, for example, financing required for food production as compared to costs for the reclamation of degraded lands or the prevention of degradation. To make a more realistic estimate of additional funding requirements it would help if UNEP collaborated with FAO, the World Bank, UNSO, the International Fund for Agricultural Development (IFAD), donor agencies and others to obtain figures for current expenditure on dryland development/desertification control. Although it is not possible to change the figures already contained in the report, the IAWGD Secretariat will introduce a paragraph putting forward the participant's comments.

The second report considered by the IAWGD meeting - *Finance Studies on the Implementation of the PACD* - drew upon the advice of several high-level experts in the world of international finance. The FAO representative felt that the proposed new methods to finance programmes of multilateral organisations dealt more with desertification control activities than sustainable development of drylands. The UNSO representative pointed out the difficulty of drawing conclusions from the large variety of funding mechanisms listed and said that it was not always possible to adopt the approach of investment for agriculture and dryland development because there are situations such as persistent drought and related desertification that require social relief measures almost on a permanent basis.

With regard to the promotion and development of technology and its transfer to developing countries, UNESCO and UNSO stressed the need to strengthen national capabilities to adapt foreign technologies to local conditions and to set up pilot projects for research and training to demonstrate new technologies to scientists and farmers. They also pointed out that traditional technologies have been very much diluted and indigenous scientists are not necessarily qualified to revive and promote them. FAO suggested that existing institutions should be used fully before new structures are created.

The IAWGD participants also agreed to discuss the first drafts of chapter 6 - *Desertification and Other Forms of Land Degradation* - of the final State of the Environment report required by UNEP Governing Council for submission to UNCED at their respective organisations and to send their comments on to UNEP.

Assessment and Mapping of the Status of Desertification

In its resolution 44/172 the General Assembly called for a general evaluation of progress in implementing the PACD to be contributed for discussion at UNCED-1992. In reviewing the previous GA resolution 39/168 which also required a further overall assessment of progress in implementation of PACD to be carried out by 1992, the Administrative Committee on Coordination (ACC) noted that the global assessment of desertification and preparation of a Thematic Atlas of Desertification will constitute key components of the report on general evaluation. The ACC further invited UNEP to continue using the Designated Officials of Environmental Matters (DOEM) and Inter-Agency Working Group on Desertification (IAWGD) mechanism to keep the subject of assessment of desertification under constant review. In carrying out the assessment UNEP has attached high priority to cooperating with component institutions and those UN bodies with expertise in methods of assessing and mapping

desertification. In order to consolidate views on assessment methodologies UNEP convened an Ad-hoc Consultation Meeting in February 1990. This meeting agreed on the following working definition of desertification:

Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from adverse human impact.

A Technical Advisory Group, composed of scientists from regional and national research institutions was set up, which met in May and November 1990 and in May 1991. This group has provided guidance on the assessment process, the content, the structure and the design of the *World Atlas of Thematic Indicators of Desertification* which will be the published medium of the global assessment of the status and trends of desertification.

Some limitations regarding the assessment exercise have been identified from consultations during the Ad-hoc Consultation Meeting in February 1990 and with the Advisory Group. As detailed information on desertification at national level is not available worldwide, the assessment of desertification using global and regional data sets will be meaningful mainly at these levels. UNEP is using the Global Assessment of Soil Degradation (GLASOD) Map and climatic information as a baseline for

the global assessment of desertification. Other information such as data on vegetation and rangeland degradation and population pressure is being considered in as far as that data is available.

Considering the complexity of desertification processes the *World Atlas of Thematic Indicators of Desertification* will be used as the main medium for reporting on the global assessment of desertification. This *Atlas* will contain a World Map at an approximate scale of 1:10 million, which will show relevant indicators or factors of desertification/land degradation.

The global and regional section of the *World Atlas* contains maps based on bioclimatic and soil degradation aspects in arid, semi-arid and dry sub-humid areas. Information on vegetation and population are also included. The national/local section features methodological approaches in desertification/land degradation mapping in Argentina, China, Kenya, Mali, Syria, Tunisia and USSR.

The *Atlas* will contain the first systematic approach to mapping thematic indicators of desertification at global, regional and national levels. However, there will still be considerable scope for improvement through the compilation of more detailed data sets, especially those related to the socio-economic aspects of desertification.

Training Course on Desertification Monitoring Technology for the Arab Centre for the Studies of Arid Zones and Drylands and Asia/Pacific Regions

A training course on desertification monitoring technology was held in the USSR from 15 October to 3 November 1991. It was organised by the Centre for International Projects (CIP) in cooperation with UNEP, the Arab Centre for the Studies of Arid Zones and Drylands (ACSAD) and the Division of Industry, Human Settle-

ments and Environment of the Economic and Social Council for Asia and the Pacific (ESCAP). The course was hosted by Moscow State University, the Ukrainian Research Institutes of Soil Science and Agrochemistry in Kharkov, and Crop Farming in Kiev, and the Institute of Deserts in Ashkhabad.

Sixteen specialists from China, the Philippines, India, Egypt, Thailand, Oman, Afghanistan, Syria, Palestine, Sudan, Yemen, Mongolia, Jordan, Morocco and Tunisia attended the course which was intended to upgrade their professional skills and to promote the exchange of information in desertification/land degradation monitoring, assessment, mapping and remote sensing.

The training programme was both theoretical and practical. Prominent Soviet scholars and scientists from leading research and design institutes were invited to speak. Two lecturers from ACSAD and one from CAZRI, India, spoke on their valuable

experiences gained through their countries' different approaches to desertification monitoring and control. ACSAD also presented a report containing a thematic questionnaire aimed at assessing various desertification processes in Arab countries and participants agreed that this could serve as a basis for organizing a monitoring system in the ACSAD/ESCAP region.

Other subjects covered include an early diagnostics survey of desertification processes, multi-scale landscape mapping, information technologies of desertification monitoring, soil protection, technical provisions of remote sensing, desert zone soils monitoring and modern methods to survey soil composition.

At round table discussions the participants presented brief reports on the status of land degradation/desertification in their own countries and it was suggested that these should be published as a supplement to the Training Course Proceedings. Trainees also reviewed and discussed the problem of

saline soils rehabilitation in the Euphrates Basin with an expert from the USSR Commission for UNEP who participated in the experts mission to Syria in 1990-91.

Field trips were arranged to experimental farms in Kharkov and Kiev. In Ashkhabad, laboratory sessions were held and trainees visited demonstration plots at the Turkmenian Agricultural Experimental Station where they were shown modern technologies for monitoring desertification and fixing sand dunes in desert zones.

All the participants were given training materials and teaching aids and expressed a keen interest in the presented reports. At the final session they expressed their appreciation and unanimously agreed that the course had fulfilled its goals. They emphasized the importance of assimilating the experiences of the USSR, Ukraine and Turkmenia in desertification control and monitoring in their own countries. They suggested that it would be expedient to further develop joint UNEP/ACSAD/ESCAP/USSR training programmes and it was proposed to hold a practical training course in one of the countries of the region.

International Training Course on the Reclamation and Conservation of Saline Irrigated Soils

A training course on reclamation and conservation of saline irrigated soils was held in USSR for specialists from Latin American countries from 18 September to 5 October 1991. It was organised by the Centre for International Projects (CIP) in cooperation with UNEP and the Instituto Argentino de Investigaciones de las Zonas Aridas (IADIZA). The course was hosted by the Moscow Land Reclamation Institute, Armenian Research Institute of Soils Science and Agrochemistry in Erevan and the Scientific and Production Unit (SANIIRI) in Tashkent.

In all, 24 participants from Argentina, Bolivia, Brazil, Colombia, Chile, Cuba, Ecuador, Mexico, Peru, Venezuela and Guinea Bissau attended the course which was both practical and theoretical and incorporated lectures, seminars, discussions,



ACSAD and ESCAP participants in the Ukrainian Institute of Soil Science and Agrochemistry, Kharkov, during their training course on desertification monitoring technology, October-November 1991.

exchange of national experiences, field studies, excursions and study tours.

Prominent Soviet scholars and experts from leading research and design institutions were invited to share their knowledge, as well as Mr L. Nijensohn from the Universidad Nacional de Cuyo (Argentina) and Mrs E. Abraham from IADIZA (Argentina).

During the theoretical part of the course in Moscow, participants learned about the problems of salinization of irrigated lands in the USSR, soil regionalization of saline lands, the complex design of land reclamation systems and the ecological and socio-economic impact of salinization on irrigated lands. Extensive field trips to the Ararat valley (Armenia) and Golodnaya steppe (Uzbekistan) brought them into contact with the practical application of diverse land reclamation methods which have transformed formerly infertile and degraded soils into productive agricultural lands. They

also visited various institutes, research and production units, field and experimental stations, and collective and state farms in Armenia and Uzbekistan where these methods were elaborated.

During the course the trainees discussed their own countries' experiences in reclamation and conservation of saline irrigated lands and exchanged views on ways and means to make use of the USSR's experience in Latin America. They were already well-versed with the issues involved and showed a high level of interest in the presented material. At the end of the course they concluded that they had improved their knowledge and this would help them in their professional activities in their respective countries. All participants were highly appreciative of the scientific and organizational level of the course and stressed their wish for closer cooperation between CIP and Latin America in the future.

DC-PAC Training Activities in 1990-1991

	Date	Duration	Number of Participants	Number of Countries	Hosting Country
Training course <i>Desertification Assessment, Mapping and Monitoring for Latin America and Caribbean region</i>	1-31 October 1990	4 weeks	25	10	Mendoza Argentina IADIZA
Training course <i>Diagnostic, Reclamation and Conservation of Gypsiferous Soils for ACSAD/ESCWA region</i>	7-27 October 1990	3 weeks	20	10	Damascus Syria
Training course <i>Rangeland Develop- ment and Desertifi- cation Control for SADCC region</i>	15 September- 6 October 1990	3 weeks	18	7	Ashkhabad USSR CIP
International Training Workshop <i>on Eco-farming Villages for African Countries</i>	3-24 October 1990	3 weeks	18	8	Nanjing China
Regional Training Workshop on <i>Pproject Formulation within the Plan of Action for the Kalahari- Namib Region</i>	25-29 June 1990	1 week	17	7	Bulawayo Zimbabwe
Training course <i>Reclamation and Conservation of Saline Irrigated Soils for LAC region</i>	18 September- 5 October 1991	3 weeks	23	10	Moscow- Verevan- Tashkent USSR CIP
Training course <i>Desertification Monitoring Technology for ACSAD and ESCAP regions</i>	15 October- 3 November 1991	3 weeks	21	17	Moscow- Kharkov- Ashkhabad USSR CIP

The members of IAWGD: FAO, ESCAP, UNESCO, IIED, UNSO and WMO reported that in 1990-1991 they had trained a total of 2,004 individuals in different areas related to desertification control.

Southern African Development Co-ordination Conference (SADCC) Workshop on Project Formulation

In Southern Africa UNEP/DC-PAC is collaborating with the member governments of the Southern African Development Co-ordination Conference (SADCC), both nationally and through the Soil and Water Conservation and Land Utilization Unit (SWCLU) of SADCC.

The Plan of Action for Integrated Land Use Planning in the Kalahari-Namib Affected Areas was developed in collaboration between DC-PAC and SWCLU in response to a request by Southern African member governments to UNEP Governing Council and to the Inter-Agency Working Group on Desertification (IAWGD). The Plan was approved by the SADCC Committee of Ministers of Agriculture and Natural Resources in November 1989. The Workshop on project formulation was held in Bulawayo, Zimbabwe, from 25-29 June 1990. It was attended by 17 representatives from Botswana, Lesotho, Swaziland, Tanzania, Zambia and Zimbabwe and by represen-

tatives from SADCC, CIP, African Desert and Arid Lands Committee (ADALCO), UNEP, the University of P. Lumumba (USSR) and Institute of Deserts (USSR).

The main topics discussed were land use planning, natural resource management, monitoring transects, developing of pilot areas and institutional frameworks in the Plan of Action for the Kalahari-Namib Region.

The country project documents for Botswana, Zambia and Zimbabwe were discussed and recommendations made for further development. Implementing institutions and focal points for these three countries were identified.

Information and database

The UNEP/DC-PAC Desertification Information System (DESI), established in accordance with the Governing Council decision 12/10, uses software developed by UNESCO and includes bibliographic reference information data on project activities and other databases to facilitate the query response services. Three major bibliographic reference databases are on desertification (DESBIB 3,765 records); wind erosion control (BIWIND 5,655 records), and reference materials in UNEP's desertification library (DELI 1,511 records). There are four databases on desertification control project activities: wind erosion

(ACWIND 168 records), network of researchers on wind erosion (REWIND 355 records), activities within the UN (PROCOM 325 records), within UNEP (DEPRO 62 records), and a directory of organisations (DIOR 561 records). The system has been very useful in responding to an average of 200 requests for information received each month. The arid lands and research institutions bibliography database (DESBIB), developed jointly by UNEP and the Office of Arid Lands Studies of the University of Arizona during 1989, has been completed for distribution to universities, libraries, international training and research institutions and environmental organisations.

The *Desertification Control Bulletin*, with about 3,500 English copies per issue,

has been published for distribution as the main medium for dissemination of desertification control information. In addition, the Proceedings of the Ad-hoc Consultative Meeting, Nairobi, 25-28 February 1990 on *Assessment of Global Desertification: Status and Methodologies* (300 pages) has been published (300 copies) for distribution to research institutions, universities and concerned scientists. The National Plans of Action for Combating Desertification in Mali and Mauritania were translated from French to English for distribution (100 copies each) to interested agencies, organisations and individuals for purposes of exchange of information and soliciting financial support for projects under the respective action plans.

Farewell!

UNEP/DC-PAC regretfully has said farewell to Mr Stanislav Sangweni, Senior Programme Officer, who is returning to South Africa to take up the post of Director in the School of Rural and Community Development at the University of Natal, Pietermaritzburg.

Mr Sangweni joined DC/PAC in 1983. He was instrumental not only in assisting with assessments of the Plan of Action to Combat Desertification but also in the Inter-Agency Working Group on Desertification. More recently he helped to bring about the first Chinese Eco-village Workshops for African Ministerial Conference on the Environment pilot village projects, held earlier this year.

Mr Sangweni would like to extend his best wishes to all friends and colleagues with whom he has worked over the years and he expresses the wish that he may collaborate with UNEP in the near future in his new role.

NEWS OF INTEREST

Conference on Collaborative Research for Arid Land Development

A conference on Collaborative Research and Development Applications for Arid Land Development was held from 5 to 10 August 1991 in Santa Barbara, California, USA. The aim of the conference was to obtain an international perspective on the state of the art of arid lands research and its possible application towards sustaining productivity and ensuring the future habitability of arid zones worldwide, through joint US/Japanese collaboration.

New crops and products research pertinent to arid zones were examined to identify the opportunities and constraints involved in producing alternative products from and uses of the world's arid zones. The issues surrounding various desert



management strategies and approaches were also discussed and there was an optional field trip through Southern California and Arizona which offered the chance to see at first hand various arid land management programmes. These include drip irrigation of avocado and citrus fields, reverse osmosis desalting facilities to reduce the salinity of the Colorado river, and multiple water-use systems integrating aquaculture and crop irrigation.

The conference included invited papers on desalinization of soils, sand dune stabilization, biocides, biotransformation of natural plant products, gums, resins, solar energy development, and transportation systems, and others.

It was organised by the Engineering Foundation of New York in cooperation with the University of Arizona Office of Arid Lands Studies, Cooperative States Research Service and the Institute for Physical and Chemical Research, Waikō City, Saitama, Japan.

Engineering Foundation Conferences were established in 1962 to provide an opportunity for the exploration of problems and issues of concern to engineering from many disciplines.

For more information or a copy of the proceedings please contact: The Engineering Foundation, 345 east 47th Street, Room 303, New York, NY 10017, USA. Telephone: (212) 705-7835. Fax: (212) 705-7441.

Crimson Lentils

According to the American journal *Crop Science*, the Crimson lentil (*Lens culinaris* Medikus) has been evaluated as equal to or better than Redchief, the most commonly grown lentil in eastern Washington State and northern Idaho, USA. Crimson's most salient features are its adaptability to low rainfall conditions, its early blooming date (essential if the higher temperatures of summer are to be avoided), tall and upright growth habit (important for mechanized harvesting), and good yield. The crimson lentil "should appeal to international markets," *Crop Science* notes.

This new breed of lentil is derived from Egyptian germplasm supplied by The International Centre for Agricultural Research in the Dry Areas (ICARDA) in Syria to the US Department of Agriculture and Washington State University.

The Egyptian variety from which the Crimson lentil derives, Giza-9, is known as a "purified landrace". A landrace is a crop

variety characterized by modest yields but good adaptability to local conditions. Farmers traditionally used seed mixtures including several varieties to avoid crop failure. Egyptian researchers identified Giza-9, samples of which were sent for storage in ICARDA's genebank. ICARDA in turn made these samples available to scientists at the University of Washington in Pullman, Washington State. Scientists in Washington found that Giza-9 thrived under the conditions of the area and subsequently gave the go-ahead for its release in the USA. According to ICARDA's senior lentil breeder, Dr William Erskine, the Crimson lentil "is illustrative of the value of research conducted jointly in dry areas such as the Middle East and the Western USA."

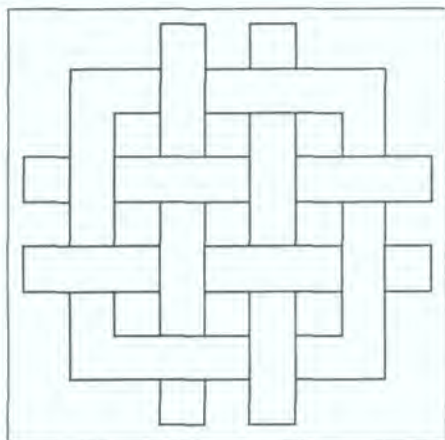
Lentils were probably one of the first pulse crops to be domesticated in the Fertile Crescent. Carbonized lentil remains, found at Tel Mureybit on the banks of the Euphrates River in northern Syria, date back 10,000 years. The cultivation of lentils spread with Neolithic agriculture to southern Europe

and reached Crete by 6000 BC. Lentils were highly esteemed in Pharaonic Egypt; a paste of lentil was found in the 12th Dynasty (2400-2200 BC) tombs at Thebes.

Traditionally lentils have been attributed with a wide range of medicinal properties. Old medical texts report that lentils "thicken the blood", which may refer to their high iron content. Lentils are low in fat but rich in carbohydrates, protein, calcium, iron, phosphorus and the B vitamins. Sprouted lentils are also a good source of vitamin C.

Located in the region where lentils were first domesticated, ICARDA collects and preserves the germplasm of this important crop. ICARDA's Legume Programme, working closely with the Centre's Genetic Resources Unit and the region's national agricultural research programmes, scours this area for rare and potentially critical seed samples. ICARDA's genebank includes close to 100,000 samples of wheat, barley, legume and pasture crops from around the world.

State of the World 1991



Published by W.W. Norton and Co. Inc., 500 5th Avenue, New York, NY 10110, USA or W.W. Norton and Co. Ltd, 10 Coptic Street, London, WC1A 1PU, UK. Price US \$10.

This book by the Worldwatch Institute examines the current state of the earth and attempts to find solutions for sustainable development.

According to authors L.R. Brown *et al*, as environmental problems become global in scale, the world as a whole will have to marshal efforts to ensure ecologically sound development in developing countries. They suggest that political stresses between East and West are likely to be replaced by economic stresses between North and South and that, in the future, the global agenda will come to be dominated by the relationship between nations and nature. But a reorientation of the global economy towards sustainable development calls for fundamental reforms at both national and international levels.

State of the World 1991 discusses the pros and cons of different sources of energy and, in particular, describes and lauds the merits of solar and geothermal energy systems. More controversially, the contamination of the earth's soil, water, and air by the production, testing and maintenance of conventional, chemical, biological and nuclear arms is discussed and the military's share in global pollution and energy consumption is examined. Other issues including family planning, waste management, forestry, community planning and

transportation and over consumption are also mentioned.

The authors conclude that successful economies must be dynamic and capable of adapting to constant change as technologies develop and societies' needs evolve.

Trees of Life: Saving Tropical Forests and their Biological Wealth

By Kenton Miller and Laura Tangle, World Resources Institute Publications, Box 4852, Hampden Station, Baltimore, MD 21211, USA. Pp 224, paperback, ISBN 0-8070-8503-0. Price US \$9.95.

Every hour more than 4,000 acres of forest are destroyed and another four plant and animal species become extinct. At current rates, most of the world's tropical forests and a quarter of the earth's species could have died out in little more than a generation. *Trees of Life* surveys current and historical assaults on the world's tropical forests - half of which have already been cleared or degraded - and examines the costs and consequences in human, ecological and economic terms. The authors reveal how poverty, population growth and the short-sighted policies of governments, international agencies and commercial enterprises are contributing to the massive destruction of the world's biological resources. But they also show that solutions can be found in new approaches to forestry, agriculture, land tenure and foreign aid and offer suggestions for actions by government and individuals.

This is the second in the World Resources Institutes' *Guides to the Environment* series which is written for general audiences to dispel confusion about critical environmental issues.

Reflets Saheliens

This French Bulletin, published quarterly, is dedicated to drought and desertification control in the Sahelian countries. The main theme is the protection of the environment in order to reduce future disasters. Past



Drawing by Nigel Paige in *Food Beginners*.

articles have been written on efforts to achieve food security in the region, desertification control strategies in Mali, biological control of cereal pests and promotion of butane gas as a substitute for carbon and wood fuel. To subscribe, please contact: The Permanent Interstate Committee on Drought and Desertification (CILSS), *Reflets Saheliens*, BP 7049, Ouagadougou, Burkina Faso.

ECA Environment Newsletter

This newsletter aims to maintain a constant dialogue on environmental issues between the UN Economic Commission for Africa (ECA) and its member states. Contributions on environmental problems, management and development in Africa will be welcomed as they will help to sensitize readers and disseminate information. For more information, please contact: Dr Licks Tandap, Chief, Environment Unit, Natural Resources Division, ECA, PO Box 3001, Addis Ababa, Ethiopia.

African Disaster Handbook

Published by the World Health Organisation's Panafrican Centre for Emergency Preparedness and Response, PO Box 3050, Addis Ababa, Ethiopia. Price US \$12.

The aim of WHO's *African Disaster Handbook* is to provide communities with simple, clear and useful guidelines on preparedness measures to take before, during and after disaster strikes. The coping capacity of a community is directly related to

AFRICAN DISASTER HANDBOOK



WORLD HEALTH ORGANIZATION
panafrican centre
for emergency preparedness and response

well-prepared community can mitigate the effects of disaster more efficiently and with reduced loss of life and structural damage.

African Disaster Handbook introduces each type of disaster and then follows with practical information on how to mitigate its effects. It is simply written and extensively illustrated throughout.

(Adapted from reviews in the ark published by the World Health Organisation's Panafrikan Centre for Emergency Preparedness and Response.)

Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting mainly from adverse human impact*

Land in this context includes soil and local water resources, land surface and natural vegetation or crops.

Degradation implies reduction of resource potential by one or a combination of processes acting on the land. These processes include water erosion, wind erosion and sedimentation by these agents, long-term reduction in the amount or diversity of natural vegetation, or decrease of crop yield where relevant, and salinization and sodication of soils.

The new definition recognizes that, although the main cause of desertification is adverse human impact, the impact of natural climatic conditions, particularly recurrent droughts, on desertification could play a role under certain circumstances.

** This definition was adopted by the Third Meeting of the Technical Advisory Group on Desertification Assessment and Mapping convened by UNEP 5-7 June 1991*

Desertification Control Bulletin

United Nations Environment Programme

