



UNITED NATIONS ENVIRONMENT PROGRAMME

3 JUL 1981

DESERTIFICATION CONTROL

Number 5 December 1981



- The United Nations Conference on Desertification (UNCOD) was held in Nairobi from 29 August to 9 September 1977.
- This was the first world-wide effort ever initiated to consider the global problem and responsibilities posed by the spreading deserts.
- 95 States, 50 United Nations offices and bodies, 8 inter-governmental organizations and 65 non-governmental organizations participated.
- The United Nations Conference on Desertification prepared and adopted a world-wide Plan of Action to Combat Desertification (PACD) with 28 specific recommendations.
- The Plan of Action was approved by the United Nations General Assembly at its twenty-seventh session on 19 December 1977.
- Recommendation 23 of the Plan of Action 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 co-ordinating the implementation of the Plan of Action to the United Nations Environment Programme (UNEP) with its Governing Council and Administrative Committee on Co-ordination (ACC).
- Immediately after approval of the Plan of Action, the Desertification Branch was established within UNEP's Office of the Environment Programme to serve the Executive Director and ACC in carrying out their tasks in the implementation of the Plan of Action.
- One of the main functions required by the Plan of Action from the Desertification Branch was to prepare, compile, edit and publish at six-monthly intervals a bulletin giving information on programmes, results and problems related to combating desertification around the world.

Editors

Turgut E. Beskök
(Chief Editor)
Desertification Branch

Seifulaziz L. Milas
Information Service

Editorial Advisory Board

Gaafar Karrar (Chairman)
Acting Head
Desertification Branch

Helen Van Houten
Information Service

Seifulaziz L. Milas
Information Service

Turgut E. Beskök
Desertification Branch

DESERTIFICATION CONTROL



THE UNITED NATIONS ENVIRONMENT PROGRAMME

Number 5 December 1981

ISSN 0379 2455



CONTENTS

Combating Desertification in the Sudano-Sahelian Region	Ruben Mendez	2
Are Solutions to Desertification in the West African Sahel Known but Not Applied?	Michael H. Glantz and Maria E. Krenz	9
Desertification and Desertification Control in Northern China	Zhu Zhanda and Lio Shu	13
News from UNEP		20
Review of United Nations General Assembly and Governing Council of UNEP	Study on Financing the United Nations Plan of Action to Combat Desertification	
Consultative Group for Desertification Control	Planning Missions to Developing Countries for Preparation of National Plans of Action to Combat Desertification	
Inter-Agency Working Group of Desertification	Workshop on the Physics of Desertification	
Special Account for Implementation of the Plan of Action		
Book Reviews		24
<i>Land, Man and Sand</i> , by James Walls	<i>Problem of Combating Salinization of Irrigated Soils</i> , by Victor A. Kovda	

Cover: The destruction of vegetation surrounding towns in arid lands induces the formation of dunes which encroach upon human habitats. *Michael H. Glantz*

DESERTIFICATION CONTROL

is an international bulletin published at six-monthly intervals by the United Nations Environment Programme (UNEP) to disseminate information and knowledge on desertification problems and to present news on programmes, activities and achievements in the implementation of the Plan of Action to Combat Desertification around the world.

- Articles published in *Desertification*

Control express the views of their authors, not necessarily those of UNEP.

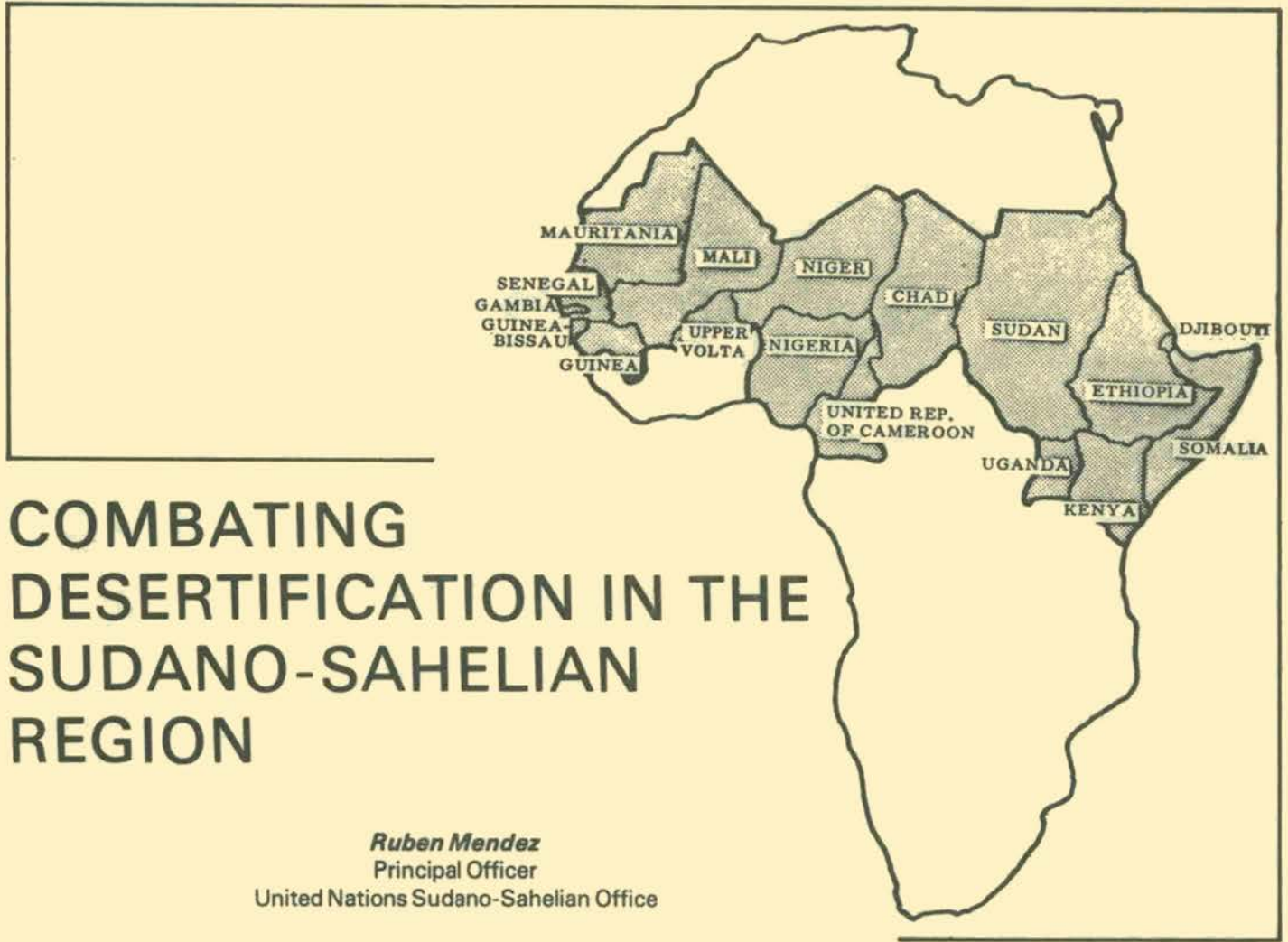
- Designation employed and presentation of material in *Desertification Control* do not imply expression of any opinion on the part of UNEP concerning the legal status of any country, territory, city or area, or its authorities, or concerning the delimitation of its frontiers or boundaries.

- Material not copyrighted may be reprinted with credit to *Desertification Control*, UNEP.

- *Desertification Control* can be obtained free of charge from UNEP.

Inquiries should be addressed to:

The Editor
Desertification Control
UNEP
P.O. Box 30552
Nairobi, Kenya



COMBATING DESERTIFICATION IN THE SUDANO-SAHELIAN REGION

Ruben Mendez
Principal Officer
United Nations Sudano-Sahelian Office

The southward expansion of the Sahara, with its severe effects on adjacent regions, poses one of the most critical and challenging problems facing the international community today. The United Nations Conference on Desertification, which met in Nairobi in 1977, estimated that during the last 50 years, some 650,000 square kilometres (65 million hectares) of once productive land had become desert along the Sahara's southern borders alone, a process which is continuing at an alarming rate. The process accelerated to crisis proportions during the droughts of the late 1960s and early 1970s with devastating effects on human life and health and the destruction of livestock populations.

The area immediately affected, the Sudano-Sahelian region, comprises all or part of 16 countries, forming a belt across Africa south of the Sahara and north of the equator, from the

Atlantic Ocean on the west to the Indian Ocean and the Red Sea on the east. The countries are Cape Verde, Chad, Djibouti, Ethiopia, Gambia, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Somalia, Sudan, Uganda, United Republic of Cameroon and Upper Volta. In addition, Guinea and Guinea-Bissau have been identified as having a particularly close ecological relationship to the region because, among other reasons, they provide a major portion of the rain water which feeds certain rivers which flow into the Sahel.

As shown in the table, the Sudano-Sahelian and related countries are among the poorest in the world, depending largely on agro-pastoral economies subject to the vagaries of arid and semi-arid climatic conditions and recurrent droughts. The overwhelming majority are considered among the least developed of the developing countries. In addition, five of them are land-locked.

Desertification has clearly emerged as one of the most serious problems of the region. In addition to the crises caused by droughts, desertification has clear adverse long-term implications for socio-economic development and the well-being of the people in the areas affected. This is manifested in sharp and permanent declines in productivity and incomes and the loss of livelihoods for a large percentage of the populations affected. Thus, man himself is the ultimate victim of desertification.

The causes of desertification are complex, the basic one being the disruption of the equilibrium of what is largely a fragile ecosystem. The Sudano-Sahelian region is a fragile ecosystem mainly because of low and irregular rainfall, which is in the range of 100–800 millimetres annually in most areas, resulting in a limited biomass and carrying capacity. Approximately 80 per cent of the region's total land area is arid and semi-arid, compared to a world

average of only 33 per cent. This harsh environment is exacerbated by destructive land patterns, especially over-grazing and the cutting of trees and shrubs for energy needs. These land use patterns reflect not only mismanagement but also over-population (human and animal) and an apparent lack of alternative livelihood systems for the people.

In a semi-arid region such as this, climatic boundaries are subject to short-term shifts between wetter and drier years; this expresses itself geographically in expansions and contractions of the dry-land belts so that a semi-arid region may experience arid conditions at one time and sub-humid conditions at another. These fluctuations introduce periodic stress into livelihood systems which can lead to significant changes in the

patterns and structure of land use, such as the expansion of cultivation or increased livestock population in good years. It is often not possible to adjust these expansions promptly when drought inevitably follows, leading to a situation of over-use of land resources in view of the existing bio-climatic situation. Under these conditions, maximum and long-lasting degradation can occur, recovery from which will be slow. If land-use pressures do not decrease, recovery may only be partial, and to a lower level of productivity than formerly, resulting in desertification.

APPROACHES TO COMBATING DESERTIFICATION

There is a consensus among the Governments of the region on the

need for immediate and concerted action to combat desertification. The rate of loss of productive land is dramatic, at a time when food deficits are growing and need to be redressed. There is a need for immediate action before the results of desertification become practically irreversible since with every passing year, the cost of restoring degraded lands rises steeply. While there is room for further research, there is sufficient scientific knowledge and technology available which can be applied immediately to solving the problem. The problem is both environmental and developmental.

Environmental guidelines

From an environmental viewpoint, the basic problem in combating desertification in the Sudano-

The Sudano-Sahelian region proper and related countries:
populations, levels of living, areas and extent of aridity

Country	Population ¹ (000)	Income ¹ per person (US\$)	Land area ² (000 mi ²)	Arid and semi-arid area ² (000 mi ²)	
Cape Verde	306	270	1.6	1.25	80
Chad	4,416	110	495.8	421.39	85
Djibouti	325	420	8.5	8.49	100
Ethiopia	31,799	130	471.8	330.24	70
Gambia	586	260	4.2	0	0
Kenya	15,307	380	225.0	168.72	75
Mali	6,469	140	478.8	454.83	95
Mauritania	1,589	320	398.0	398.00	100
Niger	5,155	270	489.2	489.20	100
Nigeria	82,503	670	356.7	71.33	20
Senegal	5,525	430	75.8	71.96	95
Somalia	3,353	NA	246.2	246.20	100
Sudan	17,885	370	967.5	870.75	90
Uganda	12,797	290	91.1	10.8	12
United Rep. of Cameroon	8,248	560	183.6	18.36	10
Upper Volta	5,642	180	105.9	95.28	90
Total for Sudano-Sahelian region proper	202,405		4,599.70	3,656.80	80
<i>Related countries</i>					
Benin	3,427	250	43.50	8.7	20
Guinea	5,269	270	95.00		...
Guinea-Bissau	779	170	13.90		...
Totals, including related countries	211,880		4,752.10		...
World totals ³	4.4 billion		52,006.00	17,255.70	33

1 Source: 1980 World Bank Atlas, except for total world population, which was estimated from separate but comparable World Bank sources. Estimates are for mid-1979. Income per person based on mid-1979 GNP at market prices.

2 Source: Arid Lands Newsletter, No. 10, April 1979 (Office of Arid Lands Studies, University of Arizona, Tucson).

3 Excluding Antarctica.

SUDANO-SAHELIAN REGION

Sahelian region is the restoration of the delicate equilibrium in the ecosystem. Given the constraints of low and irregular rainfall and a limited biomass and carrying capacity stemming from the arid and semi-arid nature of the climate, the following are some guidelines for the ecological management of resources in the region:

1. Survey of land capabilities and land-use planning: determination of best-suited land use practices, including grazing, tree growth, dry farming, irrigated farming, or other forms of land use patterns.

2. Monitoring: collection and analysis of data on the climatic and hydrologic variables, changes in plant cover and resulting soil loss and sedimentation, livestock and wildlife populations and movement, human ecology, migration, settlements and population growth.

3. Application of appropriate range management techniques: determination of carrying capacity of the range ecosystem, estimation of the optimum stocking rates and periods of rotational grazing for different range types. The number of animal units for a certain size area should be estimated, for instance, with an eye not only to maximizing production, but also to achieving the limits of safe utilization with provisions for regeneration of the range species and reserves for droughts.

4. Development of water resources and rational water use planning: In rangelands this implies the numbering and spacing of watering points in conformity with the carrying capacity of ranges in the region. Rainfed farming should make the best use of rain-water and should be geared to the average amount of rainfall taking into account its annual variations. Where irrigation is applied, there should be proper drainage to prevent waterlogging and salinization. Ground-water utilization should consider the nature of the aquifer (e.g. whether it is fossil water or it is being recharged), the degree of salinity of the water, and the problem of drainage.

5. Soil conservation: application of appropriate soil conservation measures in utilization of land

resources, especially in rainfed agriculture and grazing, combination of grazing and cropping systems, crop rotation, maintaining cover crop under fallow, etc.

6. Management of woodlands: protection, management and utilization on sustained basis, regulation of shifting cultivation, replanting and afforestation.

These are only some examples of guidelines for the ecological management of resources which could help in combating desertification. They may be summed up in the familiar phrase of maintaining the "balance of nature".

Development considerations

From the development viewpoint, there are, of course, the questions of technical feasibility, popular participation and socio-economic cost/benefit considerations. Studies prepared for the United Nations Conference on Desertification show that combating desertification is both economically and technically feasible. Estimates prepared by the Conference Secretariat provide an indication of the costs and benefits involved in corrective measures and of the losses caused by desertification. Corrective anti-desertification measures show benefit/cost ratios of over three. Desertification control projects financed by the World Bank and regional development banks show internal economic rates of returns ranging from 14 to 51 per cent.

The economic feasibility of particular projects, of course, will differ from case to case. In many instances in the Sudano-Sahelian region, rates of return of desertification control projects, from a strictly financial viewpoint, may be less attractive than other development projects presented to planning ministries and external assistance or financial organizations. It should be noted, however, that there are many social benefits, which are not as readily quantifiable as in other, more conventional development projects, but which are of tremendous importance to the countries, the region, and indeed, the world community.

As mentioned above, the transformation of productive land into desert results in vast losses in the food production potential of the Sudano-Sahelian region, at a time when the demand for food is rapidly increasing with the overall growth of the world's population. Recent studies prepared by the experts convened by the Executive Director of UNEP estimate that the value of the current annual loss of production due to past desertification in the world as a whole is on the order of \$26 billion. Recouping even a fraction of this loss through corrective measures could thus be of tremendous benefit to the international community as well as the Sudano-Sahelian region.

An important element in all this is the application of appropriate desertification control techniques and the integration of anti-desertification projects into the countries' development plans. As in all development projects, much depends on the techniques and technology used in combating desertification. It would be useful, therefore, to give below short descriptions of the various means in use for combating desertification.

TRADITIONAL METHODS OF COMBATING DESERTIFICATION

The ways of combating desertification, of course, vary in accordance with the particular problem involved. The following is a brief summary of traditional ways of combating the three main forms of desertification.

Rangeland deterioration

Arid and semi-arid rangelands undergo desertification as a result, *inter alia*, of overgrazing and the cutting of firewood, aggravated by droughts and wind erosion. Rangeland deterioration is manifested in the thinning or disappearance of vegetation, especially of fodder species. The normal vegetative cover is sometimes replaced by hardy but toxic or unpalatable species or by extremely short-lived vegetation. Erosion soon takes over, and



Nomads of the Sahara move from one place to the other following occurrence of seasonal rains. A. Matheson, UNICEF

droughts have increasingly severe impacts.

Combating rangeland deterioration involves the use of grazing patterns that allow vegetation to recuperate. As a first step, surveys may be carried out to determine the characteristics of the ecosystem and to assess its carrying capacity and stocking rates. Rotational grazing, the establishment of protected reserves and grazing reserves in the event of drought are also used. Waterpoints should be planned to give adequate access to all pastures being grazed. Reseeding can be used to induce revegetation. In extreme cases, herds have to be redistributed in accordance with the carrying capacities of the grazing areas. Many of these schemes should of course be carefully formulated, taking account of sociological and political factors.

Deterioration of rainfed cropping systems

Dryland deterioration involves the loss of top soil and increasing erosion, further exposing the land surface to the effects of rain and wind. Yields decline sharply and

agricultural production may practically disappear.

As a first step, there should be mapping of land types and their classification according to appropriate cropping patterns, recognizing the appropriate limits to rainfed cropping. Slash-and-burn should be banned and fields should be allowed to lie fallow with protective covering to prevent erosion. Tree planting and crop rotation should be practised. Where gullying has started, planting trees in the upper catchments and stabilizing gully heads can help arrest the process. Also helpful are the construction of diversion channels, installation of check dams and silt traps along gully courses and planting vegetation in gully beds. Under favourable conditions, gullies can simply be filled in and their banks regressed. Where sheet erosion scours top soil from side areas, this can be countered with contour banks and ditches, with grassed contour strips and terracing.

In the last stages of dryland desertification, wind erosion blows soil away from rainfed croplands as

well as from rangelands, causing sand drifts and dune encroachment. In the final stages of desertification, the Sahel becomes the Sahara. Wind erosion is often countered by planting shrubs and trees in windbreaks and by the construction of hedges of lines of resistant shrubs and trees as barriers against oncoming sands. Bare sand can be temporarily fixed by covering with bituminous coating or mulches of vegetation litter to ease establishment of the vegetation. A lasting stabilization, however, can only be ensured by seeding and planting proper successions of vegetation. Finally, dunes can be levelled or reshaped to remove slip faces in conjunction with action to prevent their reappearance.

Irrigated land degeneration

Irrigated lands in arid and semi-arid areas become desertified as a result of waterlogging, salinization and alkalization. In the final stages, the land surface becomes salt-crustured and is abandoned.

Where irrigation systems are affected by waterlogging and

SUDANO-SAHELIAN REGION

salinization, reclamation involves drainage to lower the water table and leach the soils to reduce the salt content. Reclamation of salinized irrigated land is often a straightforward operation which the World Bank has financed in various regions, including the world's major river valleys.

In the Sudano-Sahelian region, irrigation systems are not yet prevalent, but the importance of proper design, especially drainage, should be emphasized in river basin development to prevent the problems of waterlogging and salinization, which now plague the ill-designed irrigation systems in the Nile, Indus, Tigris and Euphrates river valleys and, in fact, in most of the river basins of the world.

NEWS PERSPECTIVES

UNSO has been considering what may be described as new perspectives in combating desertification. This is not to say that these methods or approaches have not been used before. It is rather that they perhaps require more emphasis or should be introduced and tested in countries where they are not being used.

Transnational approaches

The United Nations Conference on Desertification recommended the organization and implementation of three transnational anti-desertification projects covering all or part of the Sudano-Sahelian region. These projects, as well as the way they are presently conceived by UNSO in the light of recent consultations with the Governments concerned, are as follows:

a) *Stratification of livestock in arid rangelands (SOLAR)*. Although not new, this concept has yet to be applied systematically. Its aim is to optimize the returns of the livestock industry in the region by stratifying the different phases of activity according to the different bands of amount of rainfall. Stratification, however, should be interpreted flexibly, and might include fattening schemes, management of livestock movements along new or established trails, and related projects in sub-

humid and humid areas outside the Sudano-Sahelian region where the marketing of livestock takes place. At least for the present, stratification is viewed by UNSO as a concept under which individual national projects may fall.

b) *Greenbelt*. This again is an old concept, which was popular in the 1930s. It has changed, however, from the idea of a Maginot line crossing the southern boundary of the Sahara. The sub-Saharan greenbelt is now conceived as a mosaic of activities involving protection of existing forest areas, reforestation, afforestation, sand-dune fixation, crop production under appropriate dry farming and irrigation techniques, controlled grazing, etc. The implementation of the concept is especially well advanced in the North African countries. The experiences gained north of the Sahara could be tested south of the Sahara, through technical co-operation among developing countries (TCDC).

c) *Management of major regional aquifer in north-east Africa and the Arabian Peninsula*. That part of this proposed programme covering north-east Africa involves Chad, Egypt, Libya and the Sudan, and thus touches on the Sudano-Sahelian region. Because these countries share a common aquifer with a common geological structure, the programme would involve the management and development of the north-east African aquifer, which is a source of ground water on a regional basis. It is expected that in due course, the countries concerned, UNSO, and related regional and international organizations will carry out surveys and research for the optimum utilization, management and development of this major water resource for combating desertification.

National planning

As has been noted in the United Nations Plan of Action to Combat Desertification, desertification control requires national planning, co-ordination and monitoring. UNSO has been providing assistance to Governments in preparing national plans and in strengthening their planning, implementation, co-

ordination and monitoring machinery. This kind of assistance can help considerably in underpinning desertification control activities and making them more effective.

New and alternative sources of livelihood

There are a number of drought-resistant plant species that thrive in arid ecosystems, have commercial value, have proved useful in some countries and can be introduced or restocked in the Sudano-Sahelian region. These include *Acacia senegal*, which is native to the region and produces gum arabic, once a mainstay of the Sudan's export industry; and jojoba (*Simmondsia chinensis*) which is native to Mexico and the south-western United States and produces a kind of oil analogous to that which is obtained only from the sperm whale, an endangered species. Pilot projects are being carried out to test whether certain drought-resistant species can be grown successfully in the Sudano-Sahelian region and generate a cash crop economy, including export trade, as an alternative or supplement to the traditional rangeland livelihood systems. Jojoba is already being successfully grown in the Sudan, and UNSO is examining whether other drought-resistant species native or exogenous to the Sudano-Sahelian region could be similarly grown. There is still room for research and development, including the development, of improved strains of drought-resistant food crops.

Stabilization of sand dunes

The traditional methods mentioned previously could be supplemented by pilot projects to test their adaptability among different countries. New kinds of vegetative and mechanical fixation material could be developed and used. In addition, new kinds of chemicals with different bases have been developed which are effective in stabilizing shifting sand. Knowledge of the physics of wind erosion can help in planning sand dune fixation projects. UNSO is supporting applied research on the various aspects of problems created by moving sands and their solutions.

Alternative sources of energy

Much has been said about the cutting of firewood as a cause of desertification. It is not sufficient, however, to say that this should be stopped. People should be given alternatives to the traditional use of firewood. Such alternatives could include simple but efficient stoves, other fuels (e.g., biogas, Bagasse charcoal), solar stoves, and ecologically sound programmes of firewood and charcoal production including reforestation. UNSO is initiating programmes for the establishment of fuelwood plantations, for community reforestation to protect existing resources and for the ecologically sound production of charcoal in denser forest areas of Sudano-Sahelian countries. UNSO is also

providing assistance in developing energy master plans involving the optimal use of fuelwood.

Forage production in irrigated areas

In view of the shortage of vegetation suitable for grazing, agro-pastoral units can be established near irrigated areas where the availability of water can increase the production of fodder. The increased supply of fodder could relieve the pressure of overgrazing in the traditional rangelands.

Small dams

In view of the scarcity of rain-water, the construction of small dams, including earthen dams, can help to conserve surface-water and irrigate food crops. Such dams can also slow

down run-off and prevent water erosion.

Communication infrastructure

Because of the short-term shifts in climatic boundaries, population growth and regional differences in rainfall patterns, the establishment of a proper infrastructure including feeder roads and cattle trails can facilitate the movement of people and animals to relieve demographic pressures and spread them more evenly.

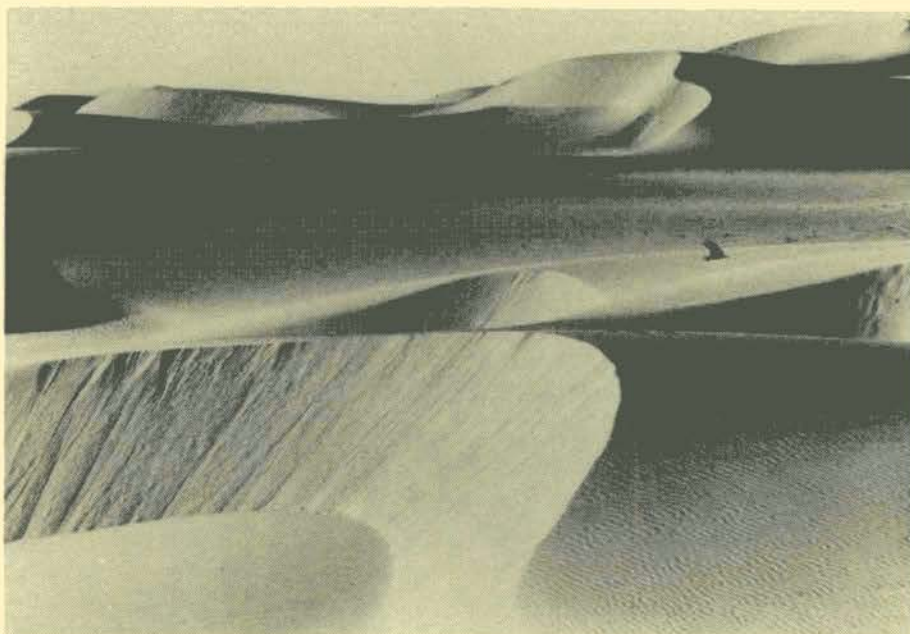
Contingency measures for animal feeds

Because of the irregularity of rainfall, overgrazing becomes particularly rampant during periods of drought. This can be alleviated, and the herdsmen persuaded not to overgraze

When nomads pass through wooded areas they take a stock of wood for their camping and cooking in treeless rangelands ahead, further contributing to desertification. A. Matheson, UNICEF



SUDANO-SAHELIAN REGION



Mobile dunes of the Sahara: the advancing desert frontier in Kordofan Province, Sudan, February 1977. Earthscan! Mark Edwards

their livestock, through the provision of emergency supplies of animal feeds. This method can thus accomplish the dual purpose of relief and desertification control. In this, the Office of Special Relief Operations (OSRO) of FAO, working closely with UNSO, could be of assistance.

Monitoring

With the spectacular advances in the technology of remote sensing and the diversification of its uses, remote sensing coupled with ground surveys can be extremely useful for monitoring desertification and related natural resources.

Population participation

Obtaining the support and participation of the people and planning from the base up are essential to the success of all anti-desertification projects. Desertification in the Sudano-Sahelian region is often termed a sociological problem. Means must be found to give the populations inducements to change harmful land use patterns other than solely by "sensitization", or consciousness raising. The "sensitization" of the populations of desert-prone lands could be more effectively achieved if they were

offered alternatives to their current desertification-inducing livelihood systems, energy utilization patterns and land-use practices. Plant species of commercial value noted previously, for instance, could play the dual role of directly checking desert spread and providing new sources of income as a supplement to or substitute for the traditional livestock industries. Similarly, renewable sources of energy other than firewood could help to reduce or eliminate one important cause of desertification.

It is known that pastoralists in the Sahel will resist fencing off parts of rangelands and are difficult to convince not to graze these areas. One inducement might be to introduce plant species that are unpalatable but have a cash value. Near towns and villages, thorny shrubs are planted. Ultimately, however, there may be a need to revise the legislative codes governing land use in the region.

ROLE OF UNSO IN COMBATING DESERTIFICATION

To help accelerate the fight against desertification on the southern fringes of the Sahara, the United Nations General Assembly decided in

December 1978 to designate UNSO, in addition to its drought-related functions vis-à-vis the CILSS member States, as the arm of the United Nations responsible for assisting, on behalf of UNEP, the efforts of the Sudano-Sahelian countries in implementing the United Nations Plan of Action to Combat Desertification in the region. As desertification is a major form of environmental degradation as well as an obstacle to development, the General Assembly also authorized the organizational enlargement of UNSO as a joint venture of UNEP and UNDP. For reasons noted previously, UNSO's desertification mandate has been expanded to include Guinea, Guinea-Bissau and Benin in addition to the 16 countries of the Sudano-Sahelian region proper.

In accordance with its coordinating responsibilities in the Sudano-Sahelian region, UNSO's main functions are centred on planning and programming, resource mobilization, and the implementation of priority projects financed from the UNSO-managed United Nations Trust Fund for Sudano-Sahelian Activities. Working closely with the international donor community, UNSO uses the resources of the Trust Fund as seed money to generate the widest possible financial and material support in combating desertification in the Sudano-Sahelian region.

In the exercise of its desertification control mandate on behalf of UNEP, UNSO has sent desertification control planning and programming missions to 17 of the 19 countries of the Sudano-Sahelian and adjacent regions. To date, 118 anti-desertification project proposals have been submitted to UNSO for assistance in resource mobilization. The total cost of these projects amounts to \$644 million, of which some \$401 million has been committed from multilateral and bilateral sources, including the UNSO Trust Fund. This does not include projects in Djibouti, Guinea, Guinea-Bissau

continued on page 12

ARE SOLUTIONS TO DESERTIFICATION IN THE WEST AFRICAN SAHEL KNOWN BUT NOT APPLIED?

*Michael H. Glantz
and
Maria E. Krenz*

Environmental and Societal Impacts Group
National Center for Atmospheric Research

There is general agreement about many, though not all, of the causes of desertification. There is much less agreement, however, about how to deal with those causes, not just in Africa but in other arid and semi-arid areas as well. An increasing number of observers suggest that some solutions to several causes of desertification are known, at least in theory, but, because of political, economic, cultural or social reasons (many of which are also known), they are not applied.

A new way of organizing and evaluating existing information may be helpful in a search for better understanding of why known solutions to desertification in the West African Sahel are either not applied or applied with little or no success. It is suggested that the anthropogenic causes and solutions to various aspects of desertification can be divided into and discussed at three levels: the individual, the national and the international levels of social organization.*

First level—human nature and behaviour

First-level causes of desertification are related to human nature and behaviour, a primary aspect of which

The National Center for Atmospheric Research is sponsored by the National Science Foundation of the United States of America.

*This approach was inspired by Kenneth Waltz's *Man, State and War* (New York: Columbia University Press, 1959).

is human perceptions of nature as well as of the activities of others. Perceptions of reality are important in the study of environmental problems in general and of desertification in particular. These perceptions should be made explicit, whether or not they are accurate reflections of reality, because the consequences of actions taken based on them will be real.

The perceptions held by the various individuals or groups of individuals in a society are not equally influential in the environmental policy-making process. Those perceptions that national leaders have about the relationship of man to nature constitute the dominant (in political terms) ideological perspective, while different perceptions held by other groups can be considered as a subordinate ideological perspective. Two major, often opposing, views related to desertification in the West African Sahel are: "man-over-nature" and "man-in-balance-with-nature". Man-over-nature is the dominant ideological stance in the Sahel and, as such, is a major first-level cause of desertification.

It can be argued that many leaders in developed states pursue policies that favour man-over-nature, that is, the use of human ingenuity to overcome obstacles (or constraints) laid down by nature, but that in general they have the economic resources (if not the political will) to deal more effectively with many of their environmental problems.

In developing countries the

situation is different. As Clarke suggested in the *Last Caravan*, commenting on the recent Sahelian drought, the Twareg "became the victims of a total ecological collapse, the sort of collapse that could have been postponed or perhaps averted by money and technology in a rich country but which in a poor one is called an 'act of God' ". National leaders in developing countries tend to favour the use of technology to deal with development problems, despite a widespread awareness that many other, and often more serious, environmental problems accompany the use of that technology.

Most leaders of developing countries often see their choice as one of either economic development based primarily on the infusion of foreign technology and expertise or no development at all. This commitment to development at any cost to the environment is often in sharp contrast to the way some groups within these countries, such as the Sahelian pastoralists, have traditionally perceived their relationship with their physical environment.

Pastoralists have lived for centuries more or less in "balance" with their natural environment, a balance maintained at times deliberately by themselves and at times by nature. The "balance" was maintained through a combination of social relationships, intraregional migrations, out-migrations to the wetter south and to the coastal

WEST AFRICAN SAHEL

states. Adversities such as droughts, famines, diseases, wars, and cattle raids served to keep both human and animal populations somewhat in balance with the available natural resources.

With colonial contact and rule came Western technology and the dominance of the ideology of man-over-nature and all the economic development tactics and strategies that such an ideological stance entailed. The traditional ways that the pastoralists dealt with environmental variability from year to year were blocked by factors which were often beyond their control, for example cash crop schemes, veterinary medicine, deep wells, arbitrarily drawn international borders and the curbing of such events as cattle raids by one ethnic group against another. These and other factors were not accompanied by attempts of the colonial government to compensate for the social, economic, and environmental disruptions that might have been caused. Yet, the pastoralists themselves were ultimately blamed for having degraded their arid ecosystems.

The fact that the farmers to the south were often at odds with the pastoralists reinforced the political and social isolation of the pastoral population. Whenever conflict arose

between farmers and pastoralists, it was the farmer who generally received support from the government. In fact, most Sahelian Governments (except Mauritania) are controlled by people whose roots are in the agricultural sector. These farmer-pastoralist conflicts and government reactions to them reinforced the pastoralists' distrust of their central government, its bureaucratic representatives and the farmers.

Pastoralists' views on such matters as the economic development of the rangelands (i.e., ranching schemes or schemes designed to increase off-take from the herds) were generally not sought by their government and, if offered by them or those sympathetic to their views, were seldom, if ever, taken seriously. It has been suggested that the impact of the Sahel drought had been worsened by a lack of understanding by governments of the traditional ways in which the pastoral nomads were in equilibrium with their environment.

As for the pastoralists, they saw their government as intent on destroying their way of life by forcing them to settle and farm, by over-taxing them, by forcing them to destock, and by robbing them of their traditional grazing areas.

The opposing perceptions of man's place vis-à-vis nature and the con-

comitant perceptions that differing individuals and groups have of each other preclude the general understanding and co-operation needed and foster the continued abuse of the fragile Sahelian ecosystem.

Second level – the state

Second-level causes of desertification encompass the ways in which groups within a state interact with each other and with their government. The primary focus is on group action (whether of social groups or groups within government) and not on the first-level perceptions of individual group members upon which those actions were based. Included at this level are the varying effects on the environment of the competition among opposing groups for a share of scarce national resources as well as competition among government bureaucracies for resources, power, and influence.

An important second-level cause of desertification in the Sahel is the bureaucracy. Sectorally oriented divisions in bureaucratic administration act as constraints on attempts at holistic or ecologically based planning. For example, each bureaucratic unit usually has jurisdiction for its "piece" of the problem, such as water resources, agricultural productivity, marketing strategies, veterinary medicine, health care, and so on. Yet, seldom does one branch of government deal with all aspects of the problems of rangeland management holistically. In addition, while each focuses on its narrowly defined area, it tends to neglect social factors, expecting them to be resolved by some other department. The frequent lack of interaction and co-operation within and between bureaucratic departments as well as ministries and the continual competition for scarce resources among them tends to be yet another constraint on ecologically sound development planning. Finally, the current popular approaches to technological assistance are usually concerned with only one aspect of the problem and tend to reinforce the sectoral approach to rangeland management.



Village in Sahel (1973). What are the solutions to desertification: "man-over-nature" or "man-in-balance-with-nature"? Michael H. Glantz

An example of the involvement of the Sahelian bureaucracy in the desertification process is the construction of deep wells in the arid Sahelian environment. A major shortcoming of these government-sponsored construction projects, resulting from a failure to look at the plan holistically, has been that little (if any) consideration was given to the availability of adequate pastures, a question which often falls under the jurisdiction of a different section within the government bureaucracy. In ordinary times and especially under drought conditions, large increases in animal populations sharply increase the grazing pressures in the areas surrounding deep wells, resulting in the disappearance of preferred vegetation from 20–30 kilometres surrounding the well sites. During the drought, the livestock, in their weakened condition, were unable to travel longer distances in search for forage and therefore perished. The large number of livestock deaths and the deterioration around the wells resulted not so much from the construction of the wells as from the compartmentalization of the bureaucracy which did not enable bureaucratic subunits to deal effectively with the rangeland ecosystem.

Third level—the international system

At least two important causes of desertification can be assigned to the third level—the transfer of technology from developed to developing states and the role of the international technical advisor in the economic development process.

Political leaders in developing states are often eager to accept technological inputs from the developed countries, including advice from technical personnel. Some of these technological inputs in the Sahel have not only failed to achieve their objectives but have in the long run precipitated other environmental problems. Deep wells have already been discussed as primarily a second-level problem but it is one with a third-level component (technology transfer).

Ranching schemes provide another example of technology transfer with



Herder in front of corral, government ranch near Niono, Mali (1975). Trees are cut for corrals at each new encampment causing deforestation in marginal lands. Michael H. Glantz

adverse side effects. These schemes are often primarily designed to increase meat production in the Sahel. The Texas Tech-Africare Ranching Scheme (1974) was based on the transfer of capital-intensive development plans to capital-scarce but labor-surplus regions in the Sahel. That scheme was not implemented, because it would have been an inappropriate transfer of technology. However, other expensive (and often unworkable) schemes have been undertaken. The Tanganyika Groundnut Scheme is one example. The site of this scheme, developed in the early 1950s, was poorly chosen from a climatological standpoint, in that regional climatic data strongly suggested that drought could be expected more often than not. The project failed after several years and considerable expenditure.

Other third-level factors include the transfer of meat marketing strategies, veterinary medicine, tsetse eradication, irrigation projects, cash crop schemes, and weather and climate modification schemes, such as the creation of inland seas, "thermal" mountains, vegetation barriers and cloud-seeding activities. Each of these technological transfers has contributed in some way to the desertification process, partly because they cultivated the hope that large, spectacular projects can save society from the real problems of

poor land management, and partly because technology is so often applied to resolve problems the root causes of which are primarily societal in origin.

In many instances, advisors from the developed states have given in to or even encouraged requests for technological fixes (such as dams, ranching schemes, remote sensing capability, agricultural schemes), even when they knew from experience that such schemes by themselves would not only fail to lead to stable, long-term development but would in all probability lead to desertification in the long run. One reason for this is that advisors are usually expected by their governments and those they are assisting to address only the technical aspects of a problem without interfering in the internal affairs of the recipient state. However, solutions to many of the problems they are asked to deal with may be found in the realm of domestic economics and politics and not necessarily in technology. Thus, the agents of technology transfer in some ways can become part of the problem and not part of the solution to combating desertification in the West African Sahel.

Concluding perspective

The above analysis of the three levels of socio-political organization, however preliminary, suggests the

importance of the first level in the process of desertification in the Sahel. Few, if any programmes, however, have dealt directly with first-level aspects of this extremely important environmental problem.

The real or underlying causes of desertification appear to be associated less with technology transfer or with the competition of social groups for scarce resources than with the perceptions that both individuals and groups of individuals have about each other and that each has about its environment. The perceptions of reality of both the dominant and subordinate groups must, therefore, become a major focus of attention and must be coupled with existing second- and third-level analyses to combat desertification in the West African Sahel. Awareness of all three levels and of how they relate to each other is essential.

In theory, at least, the solutions to the first-level problems are easily identified. They consist of altering the perceptions that subnational groups have toward each other and toward their physical environment. First of all, trust must be developed between these groups. In addition, these groups must recognize and accept the limitations imposed on them by the fragility of their ecological settings.

With respect to the former suggestion, the initiative would have to come from the national government leaders as well as through the various bureaucratic subunits. Pastoralists believe that many of their problems are linked to government policies. Distrust that has developed over many decades and has been reinforced during the recent drought episodes (e.g., government discrimination within the refugee camps in favour of the cultivators) is in large measure the direct result of the actions of governments, both colonial and independent.

Changes in the perceptions of political leaders in these states, while a necessary condition for combating desertification, is not a sufficient one by itself. A change in the development ideologies of various Western foreign assistance organizations

would also be required. Western technical assistance experts, too, must question their reluctance to include the local populations in the planning and development of the land on which they live as well as their attitude about the unassessed transfer of technology to West Africa. Their reluctance to include, for example, the pastoralists in any phase of the development is still apparent despite the growing awareness (as well as lip service) to the fact that their inputs may well hold the key to the success of any development plans for the grazing lands of the West African Sahel. Such changes in perceptions (and strategies) of the experts about the pastoralists and their environment could effectively reinforce the efforts of government leaders to create a new relationship with the pastoralists, one based on acceptance, understanding, and trust.

The second solution suggested above, i.e., improved knowledge about and acceptance of the limits of the ecological setting, is also an essential factor. To live within the limits of an ecosystem, it is imperative first to accept the fact that there are limits, and second to determine what those limitations are and what demand they impose upon social policy.

Many of the causes of desertification are related to human perceptions of man's relationship to nature. This also appears to be true as regards the reasons that known remedies are not applied. For example, it is extremely difficult to alter perceptions based on (hostile) relationships that have taken place over long periods of time. It appears that the conflicting goals of the dominant and subordinate ideological perspectives reinforce this history of distrust. There often appears to be little if any desire on the part of those representing the dominant ideology to compromise "their" development goals and to give up on their hope that technology can save them from the limitations imposed on them by their harsh environment. In addition, their lack of interest in compromising with the pastoralists is reinforced by other groups in society which, in general, tend to side with the

government— i.e., urban dwellers including, in general, the bureaucrats and cultivators.

The social causes of desertification cited to exemplify the three levels chosen for analysis are but a few of those that might have been chosen. Furthermore, each example was interpreted at only one of the several levels of social organization. Nevertheless, the significance of the different levels of social causation of desertification remain clear.

The present analysis suggests that the first-level factors are more important than most commentators have recognized. This does not mean that all solutions to the causes of desertification are reducible to the first-level factors. What it does mean is that there has to be a redirection of attention to include first-level, as well as second and third-level factors, if there is to be any hope of lasting success in combating desertification. Dealing with only second- and third-level factors to resolve the crises associated with environmental degradation will win out over civilization in the Sahelian zone of West Africa. This would be a great defeat for the Governments of less developed nations suffering from problems of desertification, as well as for developed nations and their representatives who genuinely seek to combat desertification.

Continued from page 8

Sudano-Sahelian Region

and Uganda, which have been the subject of very recent mission and which are expected to lead to a substantial rise in the number of projects and the amount of external assistance required.

This is only a partial reflection of the needs of this region, which is probably most affected by desertification in the world today. The problem is immense. But, with adequate resources and an understanding of the process of desertification as well as of the various ways of combating it in the Sudano-Sahelian region, there is hope that man will yet be able to contain and, perhaps, even reverse the southward expansion of the Sahara.

DESERTIFICATION AND DESERTIFICATION CONTROL IN NORTHERN CHINA

*Zhu Zhanda
and
Liv Shu*

Lanzhou Institute of Glaciology, Cryopedology
and Desert Research

Environmental degeneration, of which desertification is one form, has taken place in various arid, semi-arid and even sub humid regions of the world in recent years due to acceleration of the influence of human activities on the environment. Desertification means the process by which desert-like conditions appear in formerly non-desert areas as a result of the destruction of the ecological equilibrium of fragile ecosystems through excessive economic activities. The desertification process manifests the following aspects:

1) It takes place during the period of human history;

2) Apart from latent natural factors facilitating desertification, the dynamic factor leading to en-

vironmental change consists of man's economic activities;

3) The process is one of gradual change, marked by wind erosion, roughness of the land surface, development of patches of shifting sands and the formation and expansion of sand dunes;

4) The process results in a sudden drop in biological production, decline in productive capacity of the land and eventually loss of available land resources.

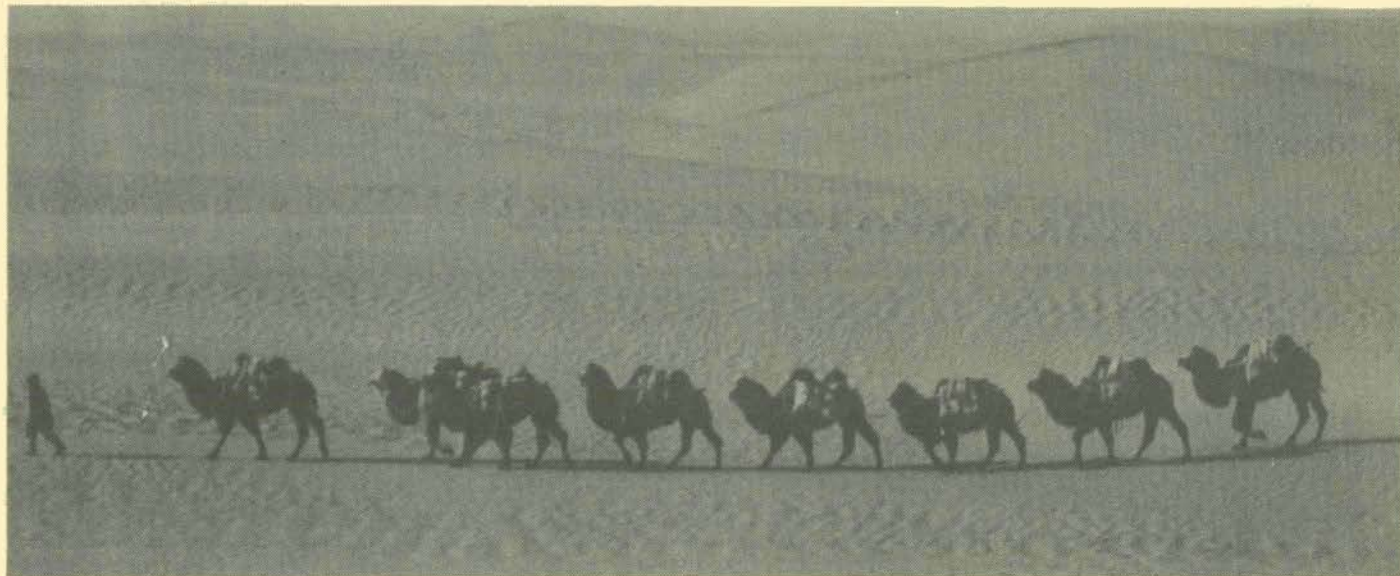
The term "desertified land" includes all land which is in the process of desertification, regions around the edges of deserts that have been encroached upon by sand dunes and regions where sand dunes are re-activated, that is, where shifting sands

become active due to the destruction of vegetation cover on formerly fixed or semi-fixed sand dunes.

The desertified land in China is widely distributed through northern districts of the country. Initial research shows that the area of desertified land formed in the historical period covers approximately 120,000 km² (including the sandy lands in arid steppe and desert steppe zones), while "recent" desertified land formed over the past 50 years amounts to more than 50,000 km².

The two categories total some 170,000 km² of land covering 207 counties, cities and banners in northern China with a total population of 35 million. There are also 150,000 km² of latent desertified

The vast desert areas of northern China still are crossed often by ancient camel caravans.



NORTHERN CHINA

land where desertification will develop if the land is used improperly. In view of this, a great deal of importance should be attached to the problem of desertification in northern China, and timely measures must be taken for environmental protection.

Location and types of desertified land

Desertified land in northern China is mainly distributed through the western part of the North-eastern Plain, and the vast area to the east of the Tarim Basin, extending from the Great Wall and the Kunlun mountain ranges in the south to the Sino-Mongolian and Sino-Soviet borders in the north. It is also found in relatively small areas of eastern Henan and the central and southern regions of the Hebei Plain. The desertified lands fall into three different categories according to origin and geographical distribution:

1) Desertified land in arid steppe and desert steppe zones. The human factor plays a decisive role in development of this type of desertified land and particularly concerns overutilization for agriculture, animal husbandry and firewood collection. This tends to destroy the balance of the original fragile ecosystem,

eventually leading to the destruction of plant cover and the appearance of shifting sands. This type of desertified land is mainly found in the areas to the east of the Wushaoling and Helan mountain ranges and to the north of the Great Wall, where it has resulted in serious damage to agriculture and animal husbandry.

2) Desertified land in or near oases and in the lower reaches of rivers in arid desert zones. This type of desertified land is mainly linked to the change of river courses and to exhaustion of water resources. The abandonment of oases in arid regions is usually a result of either change in the yield of irrigation water (for instance, decrease of water volume or drying up of water resources) or of change in water courses due to choking of river beds in their lower reaches with silt and sand. Other causes include the reactivation of shifting sands on the edges of oases due to destruction of shrub vegetation on sand mounds through collection of firewood and/or overgrazing. These problems are characteristic of most of the region west of the Helan mountain ranges and the Wushaoling.

3) Desertified land in semi-humid regions. These areas tend to have

sandy soils and strong dry-season winds. The soils are characterized by sandy deposits from floods and former water courses (such as the region along the old course of the Huanghe River in the eastern Henan Plain) or alluvial sand layers from rivers (such as Shayuan in the lower reaches of the Luohe River). In these areas the destruction of plant cover through human activities leads to wind erosion and desertification. The area of this type of desertified land is comparatively small and distributed through the plains, but still involves 34 counties or cities.

Desertified land is distributed extensively in northern China and represents different origins and natural environments. Therefore the landscapes of desertified lands differ greatly.

In arid steppe and desert steppe zones the landscape of desertified land tends to present different stages of wind erosion, patches of shifting sands and interspersed sand dunes with fixed and semi-fixed sand dunes near farmlands, steppes, residential centres and water wells.

In arid desert zones the desertified land tends to be distributed along the edges of oases and in the lowest reaches of rivers. It is generally

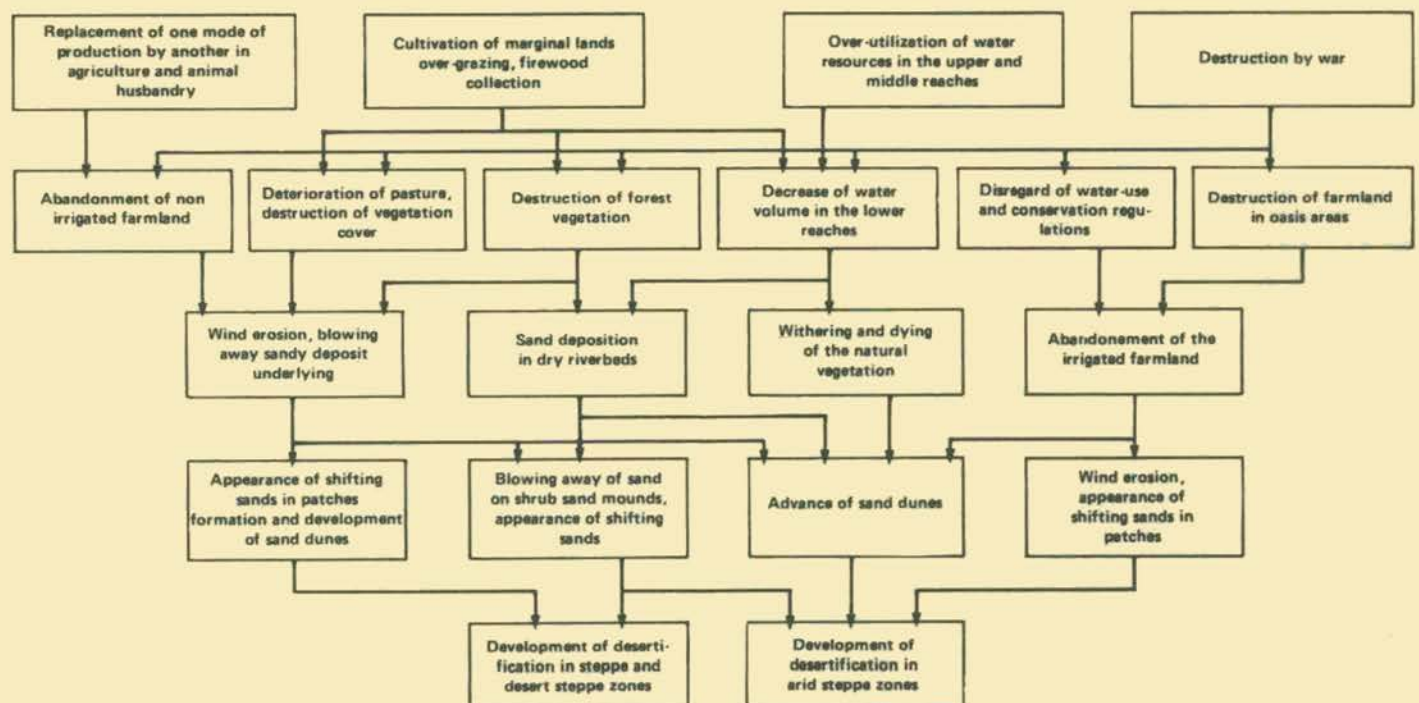


Figure 1: The human factors in the processes of ancient desertification

characterized by semi-fixed sand mounds with some shrub cover from which sand can still be blown away. The landscape will further develop into one of sand mounds with shrub cover interspread with shifting sand dunes (or wind-eroded land).

In sub-humid zones the desertified land is usually distributed in belts along old river courses, and is characterized by barchans, barchanoid ridges or undulating sandy land.

The process of desertification

The process of desertification in northern China can be divided into two main categories: ancient and recent. The ancient process refers to desertification whose origins and development took place in the historical period prior to the past 50 years. In this regard, study of the sites of various ancient towns or cities in desert zones indicates that the environment at that time was not desert. Obvious instances could be found along the northern edge of the Taklimakan Desert, the western part of the Hexi Corridor, the lower reaches of the Ruoshui River and the southern part of the Mu Us sandy land.

The ancient process of desertification and its causes are described briefly in figure 1. The factors involved in the process are complicated and the process varies between different natural zones. In arid desert zones, for instance, once land is desertified, it undergoes little further effect from human activities and the pattern of desertification can be represented by a simple straight rising line. However, in the ancient process of desertification in steppe and desert steppe zones, due to repeated changes in mode of production, the influence of changing annual precipitation and other factors, the desertified land goes through periods of temporary stability or partial restoration. For example, there may be restoration of vegetation in rainy years or after closing off sand dunes to human interference. This would check the progress of desertification and the ecosystem would remain relatively balanced. However, in dry years or as a result of over-utilization in agriculture or

Types of recent desertified land in North China	
<i>Causes of desertification</i>	<i>per cent</i>
Cultivation of marginal lands	23.3
Over grazing	29.4
Destruction of vegetation by firewood collection	32.4
Destruction of vegetation when building factories, mines, communication lines and cities	0.8
Irrational utilization of water resources	8.6
Advance and encroachment of sand dunes	5.5
	100.0

grazing, desertification would expand rapidly over areas of partial restoration. The ecosystem therefore has remained basically unstable. At the same time the process was often accompanied by the growth of population and increasing frequency of economic activities. This aggravated the general tendency of the process of desertification, forming a pattern which can be represented by a curve with undulating waves and a general rising trend.

The recent process of desertification, that typical of the last 50 years, is concerned mainly with desertification resulting from over-utilization of the land for agriculture, grazing or firewood collection. Typical examples may be found in the south-western and central regions of Inner Mongolia and in some of the northern areas of the Yinshan Mountains.

Recent desertified land has been subject to the process of desertification for a comparatively short time, so the landscapes tend to be relatively monotonous. They are characterized by wind-eroded land with patches of shifting sands, by sand mounds with low shrubs or barchans, by the appearance of roughness of surface, or by the formation of landscapes similar to gravel desert. However, there is also recent desertified land which has developed from ancient desertified lands. In such cases the landscape is

characterized by distribution of large shifting sand dunes or interspersions of large sand dunes with fixed and semi-fixed sand dunes. Examples of this are found in much of the desertified land in northern Shaanxi and southern Inner Mongolia.

Recent desertified land is the result of many artificial factors, one of which is usually primary while the others interact on each other. Therefore, the desertified land falls into several types based on characteristics of the main factors that have brought on the process of recent desertification. These types are shown in the table.

As the formation of recent desertified land arises from different factors, the landscapes and the processes of desertification have different peculiarities. Figure 2 outlines the process of desertification resulting from the reclamation of marginal lands in steppes for rainfed agriculture.

The primary factor leading to the desertification of large areas of pastures in steppes is overgrazing; the plant cover on sandy steppes gradually becomes sparser and shorter and exposed land surfaces appear. The surface is often trampled by livestock, loosing the surface layer and permitting large numbers of wind-eroded holes and fissures to emerge. Wind erosion then leads to the development of sandy steppes of patches of shifting sands or low sand mounds with shrub cover. Desertification caused by overgrazing may

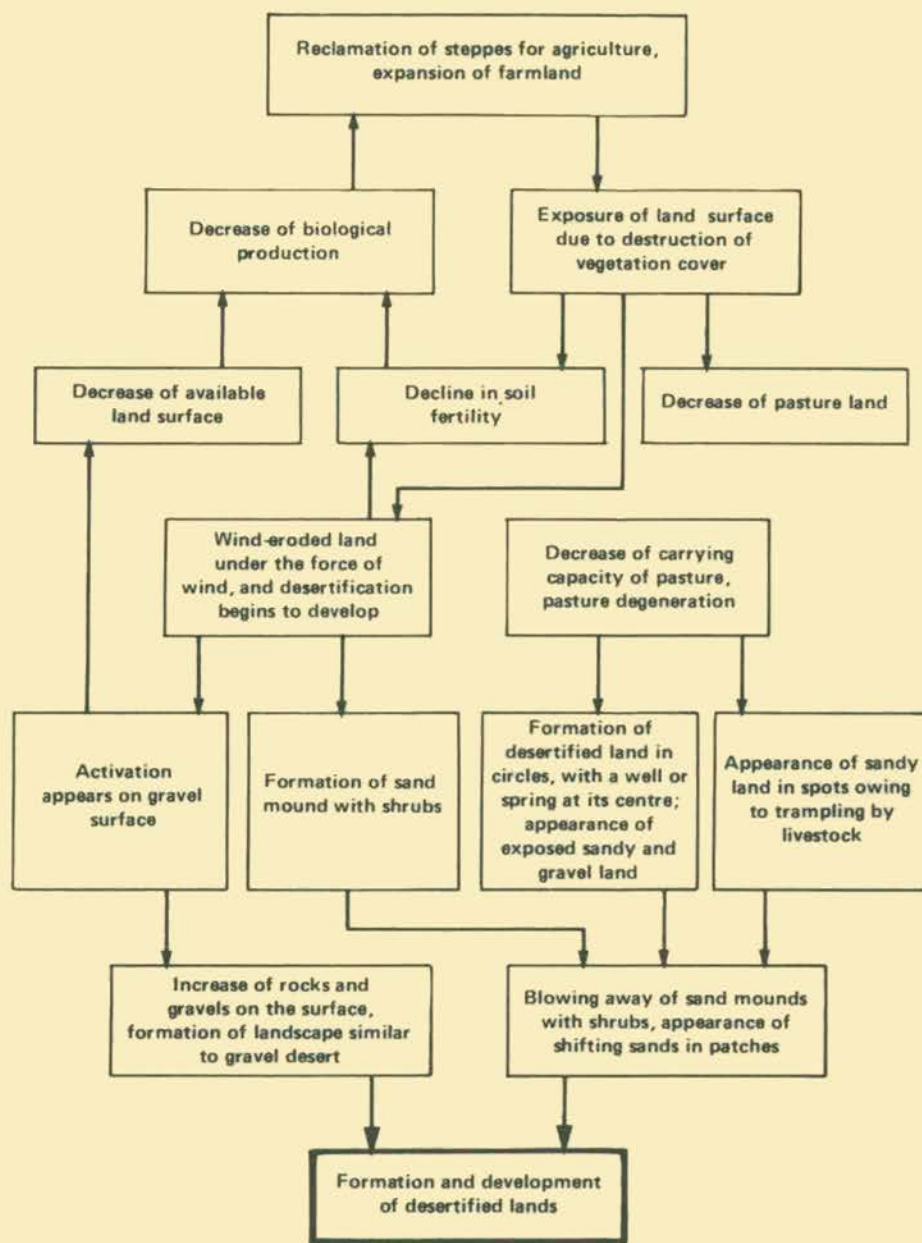


Figure 2: Development of desertification owing to the reclamation of steppe (marginal lands) for agriculture.

lead to circles of desertified land, generally two to three kilometres in diameter, with a well or spring at the centre around which the vegetation has been destroyed.

Desertification caused by firewood collection tends to give rise to shifting sands where the vegetation has been destroyed and is ordinarily found near residential sites. Desertified lands resulting from construction of factories, mines, communications lines and cities are characterized by an abrupt appearance, while desertified

land caused by irrational use of water resources is commonly found in the lower reaches of rivers and dispersed in a belt-like formation.

It must be noted that in the recent process of desertification population growth is the primary pressure leading to destruction of the fragile ecological equilibrium and that the other excessive artificial activities frequently arise from this pressure. Therefore it is of essential importance to control the growth of population in order to avoid the increase of

population pressure, restore the ecological balance and reverse the desertification process.

Measures to control and reverse desertification

The reversal of desertification involves transformation in the direction of restoring ecological balance. In view of the characteristics of the desertified lands in northern China, the following measures have been adopted:

1) Rational utilization of natural resources in arid and semi-arid regions, orientation of land utilization along lines compatible with the ecological characteristics, determination of the appropriate utilization index in accordance with the capabilities of the land and with the possible tendency of environmental change after exploitation and utilization;

2) Controls suitable to the local conditions of the places where the desertified lands are found. The control measures adopted in arid steppe and desert steppe zones include:

a) Increasing the emphasis on forestry as compared to animal agricultural eco-structure through combinations of agriculture and forestry based on a framework of projective forestry networks (figure 3);

b) Reducing livestock pressure on rangeland and establishing artificial forage grass farms;

c) Protecting the existing natural vegetation and enclosing desertified land to permit grass to grow, and covering abandoned farmland (figure 4);

d) Introducing afforestation in depressions and inter-dune areas and growing sand-fixing plants on the surface of sand dunes to fix shifting sands (figures 5 and 6);

4) Desertification controls taken on desertified land in arid desert zones, mainly concerned with rational utilization of water and land resources and the establishment of protective forest systems. They include:

a) Overall planning with the drainage areas of inland rivers as the ecological unit, determination of the

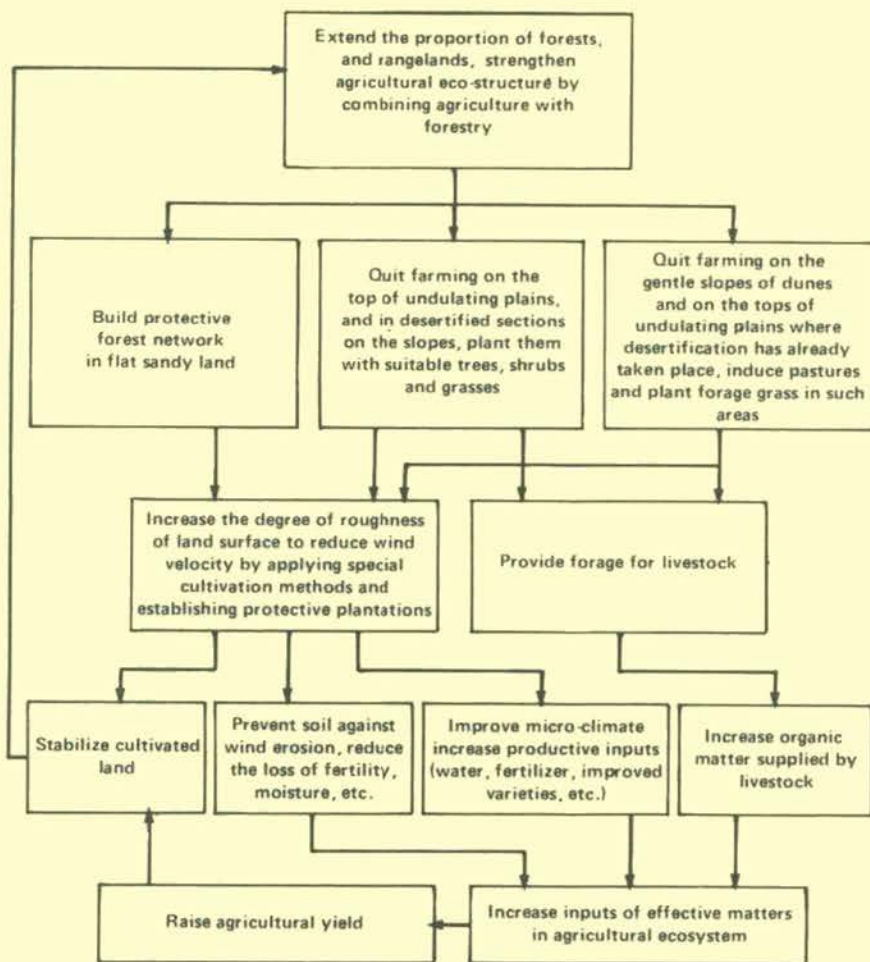


Figure 3: Programme for reversing desertification

proper ratios of water utilization in the upper, middle and lower reaches of the rivers and adjustment of the ecostructure by combining agriculture, forestry and animal husbandry with a view to maintaining and adjusting the equilibrium of the ecosystem of the drainage area.

b) Building wind barriers to stabilize the surface of sand dunes (figure 7) as an important step in the successful use of plants for sand fixation, selection of suitable sand-fixing plant species and adjustment of the rational dispersion and disposition of sand-fixing plantations in regions where farmland is subject to sand dune encroachment.

c) Combating wind and sand damage in oases by building wind-break networks in the oases, establishing protective forest belts composed of trees and shrubs around

the edges of the oases and creating mosaics of enclosed protected sand



Figure 4: When abandoned farmlands are protected, they are quickly covered by natural vegetation.

dunes to permit the growth of grass around the periphery of the oases.

Principles of classification of desertified land

The delineation of natural zones or regions with regard to desertification control in northern China has been carried out from the viewpoint of preventing or controlling desertification through adoption of measures suitable to local conditions. The principles upon which this delineation is based are as follows:

1) The principle of natural zones: While desertification is a process of environmental degeneration with its principal symbol being the appearance of wind/sand activities over the affected land, the process and characteristics of desertification differ under different natural conditions, and so, accordingly, do the measures for the control or reversal of these processes. Therefore, the general characteristics of development of desertification in each region should be regarded as the primary index in the delineation of natural zones. On this basis, desertified land in northern China can be divided into three major regions:

a) The region where desertified land is distributed through subhumid zones;

b) The region where desertification is developing in steppe zones, in

NORTHERN CHINA

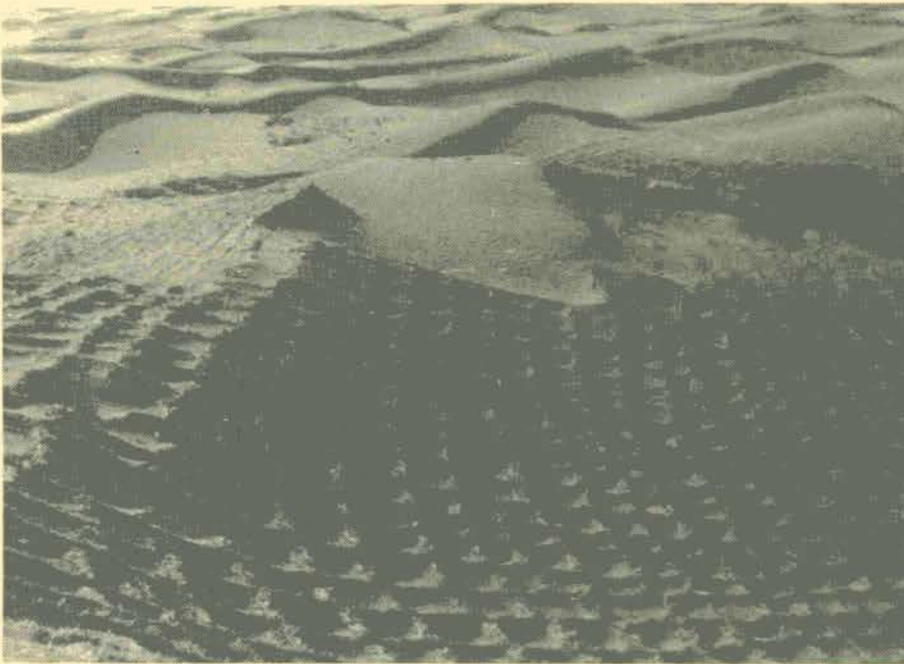


Figure 5: Moving sand dunes must be covered with vegetation for a lasting fixation. Usually mechanical pre-fixation by checkerboard palisades or by mulching is necessary for establishment of the vegetation.

semi-arid areas and in desert steppe zones; and,

c) The region where shifting sands are advancing, and fixed and semi-fixed sand dunes are reactivated in arid desert zones.

The control and reversing processes in the three regions differ because they fall under different natural conditions. In the case of desertified land in subhumid areas, the desertification process may reverse of its own accord if the ecological balance is not further destroyed. In such a case a few minor measures would accelerate the process of reversal. There is also a possibility that desertification in arid steppe and desert steppe zones may reverse itself, but the reversal process is relatively slow and capricious due to the fragile ecological balance, and with increasing desertification the possibility of self-reversal diminishes. Therefore, it is necessary to control land utilization and take a number of other control measures to gradually reverse the desertification process in these areas. After destruction of the ecological balance in arid steppe and desert steppe zones there is no possibility of self-reversal of desertification, because the natural conditions are severe. The adoption of appropriate measures becomes necessary for its control.

2) The principle of increasing degrees of desertification. The landscape in the same natural zone differs in accordance with the degree of advancement of desertification. Therefore the degree of desertification could be taken as the secondary index for classification, and can be used for reference to the measures to be taken in accordance with local conditions. At the same time such a classification reflects the tendency of the desertification

process in the region in question so that prevention and control measures could be taken in time. According to differing degrees of desertification, desertified lands can be divided into the following four types:

a) *Latent desertified land.* This refers to land where desertification has not yet taken place or has just started, but where there exist conditions for occurrence of desertification and its further development. This means the presence of such critical factors as a surface soil layer composed of loose sandy or gravel deposits, strong dry-season winds, etc. Under such conditions, any misutilization of the land can destroy the vegetation and easily lead to desertification.

b) *Developing desertified land.* Land where wind erosion, roughness of surface, or patches of shifting sands and some sand mounds have appeared due to ecological imbalance resulting from overutilization. These factors show that desertification is already developing and expanding. However, it can usually be reversed if necessary measures are taken and land resources are used rationally.

c) *Strongly developing desertified land.* Land where spots of shifting sand dune or shrub-sand mounds from which sand can be blown away have appeared and linked up in stretches, reflecting aggravation of wind and sand activities and marked



Figure 6: The depressions in dune areas can be developed for agriculture by planting networks of protective tree belts and windbreaks.

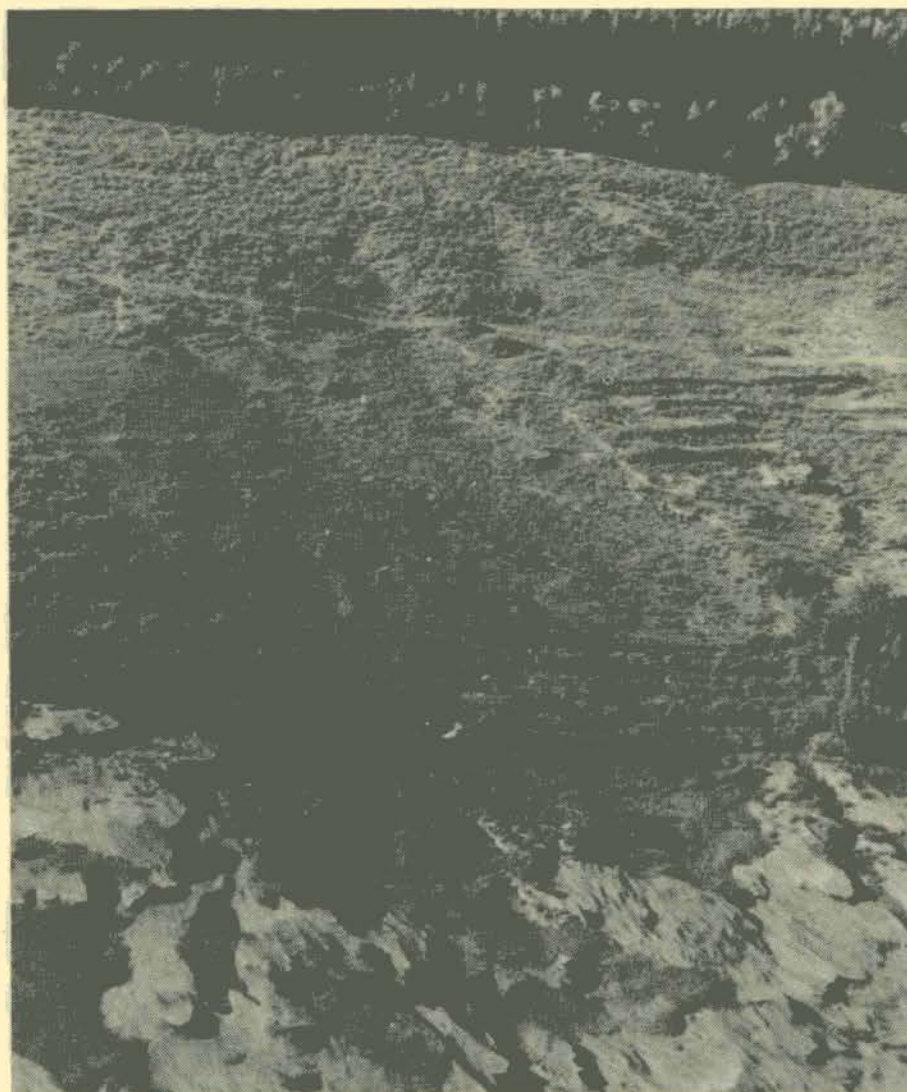


Figure 7: Putting up windbreaks in proper intervals protects the land surface against wind erosion. When intervals are too far apart, erosion can still occur.

loss of available land resources.

d) Seriously desertified land. Land where over 50 per cent of the surface is covered with dense shifting sand dunes or shrub-sand mounds from which sand can be blown away.

Conclusion

In northern China, desertification is recognized as an important national problem. Desertification control in general must be based on ecological characteristics of different natural

zones or regions and on application of control measures suitable to each natural zone by taking into account the degree of desertification involved. In northern China desertification control measures are being carried out in accordance with these principles and along the following lines:

1) Developing desertified land. As the degree of desertification has not yet reached the serious stage and the land can still yield a certain amount of

biological production, this type of land is often not given adequate consideration. However, since human activity is comparatively frequent and desertification is already taking place, the process will develop rapidly in the absence of timely control measures. Obvious examples of this are to be found in the northern areas of the Yinshan Mountains and in central Ii Ju State. The measures are:

a) prompt action to reorient cropping methods and control dry-farming techniques;

b) implementation of appropriate control measures such as establishment of windbreak networks, reducing the pressure of grazing, closing off natural grassland and protecting natural vegetation.

2) Strongly developing desertified land and seriously desertified land. These should be the focal point of desertification control as they constitute a great threat to agricultural production; effective measures include building systems of shelter-belts, planting forests in the depressions among the dunes and growing sand-fixing plants on dunes.

3) Latent desertified land. This type of land accounts for only a small percentage of the desertified land in northern China. It could easily become "developing desertified land" under incorrect utilization. It is important that adequate consideration be given to this type of land and that necessary preventive measures be taken in time. These should be complemented by planned land use based on the land capabilities in the region. Grazing should be regulated in accordance with the carrying capacity of rangeland. Such an approach to utilization of land resources would stop the advance of desertification, reverse the process and therefore ensure sustained productivity.

FROM UNEP

REVIEW OF UNITED NATIONS GENERAL ASSEMBLY AND GOVERNING COUNCIL OF UNEP

At its thirty-fourth session, the General Assembly of the United Nations adopted three resolutions of relevance to the Implementation of the Plan of Action to Combat Desertification (34/184, 34/185 and 34/187, adopted on 18 December 1979). The Governing Council of UNEP, for its part, adopted on 29 April 1980, decision 8/17 on the same subject.

The General Assembly resolutions and Governing Council decision addressed the seriousness of the desertification problem, the state of the special account to combat desertification, the works of the Consultative Group for Desertification Control (DESCON), the Inter-Agency Working Group on Desertification (IAWGD), and the desertification control activities of the United Nations Sudano-Sahelian Office (UNSO).

The operational parts of the General Assembly resolutions requested:

a) inclusion of Djibouti, Guinea and Guinea-Bissau in the list of countries receiving assistance through UNSO in implementation of the Plan of Action;

b) inclusion of the pilot project for the restoration and improvement of the Fouta-Djallon massif in UNEP's programme of action against desertification;

c) submission of a report by the Secretary General, in consultation with the Governing Council of UNEP, on the basis of a study prepared by a group of high-level experts to be convened by the Executive Director dealing with: (i) the proposals put forward in the United Nations System of

possible ways and means to finance programmes of multilateral organizations, (ii) a financial plan outlining the components and costs of a programme to stop further desertification, (iii) methods of mobilizing domestic resources and the practicability of obtaining loans on a concessionary basis, (iv) the feasibility of the creation of a public international corporation to attract investments and provide financing for anti-desertification projects with non-commercial return, and (v) the means for encouraging the active participation of foundations in the financing of anti-desertification programmes.

The desertification control programme of UNEP was reconsidered to include the implementation of the operative parts of the resolutions and of the requirements for assisting in alleviating the constraints on implementation of the Plan of Action which were identified by the Administrative Committee on Co-ordination (ACC).

CONSULTATIVE GROUP FOR DESERTIFICATION CONTROL

Second Meeting Nairobi March 1980

General Assembly Resolution 32/172 of 19 December 1977 authorized the Executive Director of UNEP to convene a Consultative Group, to meet as and when required, comprising representatives from the agencies, organizations and other bodies of the United Nations system, such other organizations as might be required, donor countries and multilateral financing agencies as well as developing countries having a substantial interest in combating desertification, to assist in mobilizing resources for the activities undertaken within the framework of implementing the Plan of Action. At present the Consultative Group is co-sponsored by nine United Nations organizations; 20 countries and eight multilateral financing agencies contribute as core members, and 20 countries are associated with the Group as observers.

The second session of the Consultative Group was held in March 1980 and the follow-up to its work was continued throughout the year. All the recipient countries were informed of the interest expressed by specific donor countries in supporting project proposals submitted to the second session. The Desertification Branch of UNEP and UNSO maintained contacts with the recipient countries and donors, and has been informed of the status and achievements. The follow-up records indicate that, of the 27 project proposals submitted, 8 of them were fully financed, 7 have received some commitment for finance for technical assistance, and 1 has been set aside by the Government who presented it. On the remaining 11 projects contacts with the Governments and donor organizations were continuing.

Preparations were under way for the third meeting of the Consultative Group scheduled to be held in Geneva on 26-28 August 1981. A total of 13 project proposals had been finalized for presentation to the meeting, six by the Governments of Argentina, Peru, Burundi, Tanzania, People's Democratic Republic of Yemen and Yemen Arab Republic with assistance provided by UNEP, six by the Governments of Gambia, Mauritania, Senegal, Somalia, Sudan and Upper Volta with the assistance of UNSO, and a global project by FAO. These project proposals were to be sent to the co-sponsors, members and observers of the Consultative Group before the end of January 1981.

INTER-AGENCY WORKING GROUP ON DESERTIFICATION

Third Meeting Geneva

1 September 1980

The Inter-Agency Working Group on Desertification (IAWGD), composed of representatives of the specialized agencies and other organizations of the United Nations concerned with desertification problems, was

established in September 1978 to co-ordinate their programmes and activities related to the implementation of the Plan of Action to Combat Desertification. The third meeting of the Working Group was held at the Headquarters of the International Labour Organisation (ILO) in Geneva on 1 September 1980. The session was chaired by the Assistant Executive Director of UNEP, Mr. Sveneld Evteev and attended by the representatives of ECA, ECWA, UNESCO, UNDP, UNEP, ILO, FAO, WHO, WMO, WFC, UNSO and the World Bank.

The meeting discussed the draft Inter-Agency Report on Desertification Activities and its Addendum, the "Compendium of the Programmes of the United Nations System in the Field of Desertification", which was developed in accordance with the observations and suggestions expressed in the second meeting.

Analysis of the draft report and compendium at the meeting illustrated once more the importance of both documents in joint-programming and co-ordinating the implementation of the Plan of Action to Combat Desertification by the United Nations System as a whole. Efforts were in progress during the rest of the year to update information, identify gaps and formulate suggestions on how the agencies, either individually or collectively, should address themselves to the problems of desertification.

SPECIAL ACCOUNT FOR IMPLEMENTATION OF THE PLAN OF ACTION

The special account was created pursuant to recommendation 28 (e) of the Plan of Action to Combat Desertification, which was endorsed by the General Assembly Resolution 32/172.

The Executive Director, with a letter of 20 August 1979, invited Governments to give favourable consideration by contributing

generously to the special account. Thirty-four Governments expressed their general support.

On 16 June 1980 a second letter was sent to all Governments bringing to their attention the General Assembly Resolution 34/184 of 18 December 1979 and Governing Council Decision 7/13A of 3 May 1979 and urging them to contribute to the special account. Twenty-four Governments replied, three of them positively: Brazil, without specifying its contribution; Chile, which pledged US\$10,000; and Bangladesh, which offered to contribute in its own currency. The fund held in the account remained at US\$5,000 paid by Mexico.

STUDY ON FINANCING THE UNITED NATIONS PLAN OF ACTION TO COMBAT DESERTIFICATION

The General Assembly, at its thirty-fourth session with resolution 34/184 of 18 December 1979, expressed concern over the lack of financial resources for implementation of the Plan of Action to Combat Desertification and, as part of its search for a solution, requested the Secretary General in consultation with the Governing Council of UNEP to submit to the General Assembly at its thirty-fifth session a report based on a detailed study of this question by a group of high-level specialists in international financing to be convened by the Executive Director.

The Executive Director convened the Group of High Level Specialists at Geneva from 21 to 25 July 1980. The Group considered and adopted a draft of the study prepared by a core group of its members. The study consisted of three parts:

- 1) An inventory of means of financing involving automacity;
- 2) A financial plan and analysis outlining components

and costs of a programme for combating desertification;

- 3) Analysis and recommendation for mobilizing the resources required under the financial plan.

According to the financial plan for combating desertification, about one third of earth's surface is arid and semi-arid. Between 600 and 700 million people depend on these fragile ecosystems for their livelihood. The total area affected by desertification is estimated at 3.372 million hectares, or 80 per cent of the world's agricultural land in arid and semi-arid regions. Nearly half of the land affected by desertification is in the developing countries. A programme designed to stop desertification in these countries would require annual expenditure in the order of \$2.4 million over a period of 20 years, all of which would have to be raised externally. The currently provided external financing for desertification control is about \$500 million, which leaves a requirement from external resources of about \$1.8 billion annually.

Based on an inventory of means of financing involving automacity, the study recommended the following measures as feasible, practical and obtainable:

- gold sales by the International Monetary Fund and use of profits for assistance through a trust fund;
- integrated programmes for commodities;
- exploitation of non-living, ocean resources;
- international trade tax;
- fees for "parking slots" of satellites in geo-stationary orbit;
- tax on military expenditures and linking disarmament to development.

The Secretary General presented his report on Financing the United Nations Plan of Action to Combat Desertification to the General Assembly at its thirty-fifth session.

After taking note of the report of the Secretary General, the General Assembly with resolution 35/73 requested the

Secretary General to prepare, in consultation with UNEP and with the assistance of similar groups of experts:

- 1) Feasibility studies and concrete recommendations for the implementation of the additional means of financing deemed practicable;
- 2) The detailed modalities of obtaining resources on concessionary basis;
- 3) A full feasibility study and working plan for the establishment of an independent operational financing co-operation for the financing of desertification projects.

The Secretary General will report on the results of the above-mentioned studies to the General Assembly at its thirty-sixth session.

PLANNING MISSIONS TO DEVELOPING COUNTRIES FOR PREPARATION OF NATIONAL PLANS OF ACTION TO COMBAT DESERTIFICATION

The Desertification Branch of UNEP has undertaken two planning missions to Burundi and Tanzania during the second half of 1980. In accordance with the findings of the exploratory missions, sent in August 1979 to identify the type of expertise needed from UNEP in combating desertification in these two countries, the planning mission to Burundi was composed of specialists on regional planning, soil conservation and rural sociology, while the planning mission to Tanzania included specialists on land-use planning, soil conservation and rangeland management.

The major purpose of the missions was to assist the concerned Governments in the establishment of a national machinery within the existing Government system to combat desertification and to help them in preparing a National Plan of Action to Combat Desertification as recommended by the United Nations Conference on Desertification.

Additional objectives of the missions were: (1) to identify and, whenever feasible, to formulate high-priority projects aimed at combating desertification, and (2) to assess the extent of desertification and suggest high-priority areas for Government policy and action.

During the period of July — December 1980 the planning missions visited the desertification-prone areas of Burundi and Tanzania and, in close consultation with the counterpart Government officials, prepared a draft of the national plan of action to combat desertification for each country. The draft plans included: (1) proposed national machinery; (2) priority areas of action and policies, including research, training, information, etc; (3) high-priority projects for combating desertification.

One priority project from each country was also developed for presentation to the third meeting of the Consultative Group for Desertification Control, to be held in August 1981, for funding purposes. These projects were selected to satisfy the following conditions: (1) provision of a selected site where the desertification problem was acute and the type of problem tackled was adequate; (2) provision of a production component, a training component and some technical assistance; and (3) provision of some internal financing.

WORKSHOP ON THE PHYSICS OF DESERTIFICATION

The International Centre for Theoretical Physics (ICTP) has organized, with the assistance of UNEP, a workshop on the physics of desertification which was held from 10 to 28 November 1980 in Trieste, Italy, followed by a one-week field study in Libya.

ICTP, sponsored by the United Nations Education Scientific and Cultural Organization (UNESCO) and the International Atomic Energy Agency (IAEA), is devoted to the training of graduate and post-graduate fellows from developing countries in all branches of physical and related sciences. The activities organized at the Centre range from three-day topical meetings to three month full courses and are designed to provide the participants with training facilities ranging from refresher lectures to intensive training courses. Originally limited to the theoretical physical sciences, the Centre has, since 1975, widened the scope of its activities, orienting them towards more applied sciences, including environmental ones. The Workshop on the Physics of Desertification was the Centre's first activity in the field of desertification control. UNEP co-sponsored this activity within the framework of its training programme on the control of desertification, particularly in the developing countries of arid and semi-arid regions of the world.

The purpose of the workshop was to provide the participants from developing countries prone to desertification with a fundamental understanding of the physical aspects of the rapid deterioration of fragile ecosystems, their causes and consequences, and the ways and means to deal with them. The programme of lectures centred on the physics of sand dune formation, sand and dust storms, and soil erosion. Various methods of sand dune stabilization and dust storm control were also covered, while

recent developments in observational and modelling techniques were reviewed.

Eighty participants, most of them from developing countries, took part. The workshop was particularly successful in bringing up-to-date information to the participants, who showed considerable interest in this important issue. The proceedings of the workshop will be available for distribution towards the end of 1981.

Inquiries in this respect may be addressed to the International Centre for Theoretical Physics, P.O. Box 586, 34100 Trieste, Italy.

NEWS FROM UNSO

The General Assembly, by resolution 33/88 of 15 December 1978, decided to designate the United Nations Sudano-Sahelian Office (UNSO) as the arm of the for supporting, on behalf of UNEP, the efforts of Sudano-Sahelian region countries in the implementation of the Plan of Action to Combat Desertification. A joint UNDP and UNEP venture was established to support UNSO in carrying out this additional responsibility. The number of the countries benefiting from the support of UNSO within the frame of this joint venture number 18 at present; they are Cape Verde, Chad, Djibouti, Ethiopia, Gambia, Guinea, Guinea-Bissau, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Somalia, Sudan, United Republic of Cameroon, Uganda and Upper Volta.

For the activities and achievements of UNSO during 1980 in the implementation of the Plan of Action to Combat Desertification, the reader may refer to the article published in this issue with the title "Combating Desertification in the Sudano-Sahelian Region" by Ruben Mendez.

NEWS FROM UNESCO

The General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO) at its twenty-first session in 1980, approved a project entitled "Major Project of Research, Training and Demonstration Applied to the Integrated Management of Arid and Semi-Arid Regions" to be launched in the framework of UNESCO's Programme on Man and the Biosphere (MAB).

The overall objective of this major project is to assist countries in finding ecologically and economically sound techniques of land resources development in arid and semi-arid zones. In particular, the project is aimed at:

- improving the quality of life of the local populations concerned, while maintaining and increasing the productivity of the ecosystems on a sustained yield basis;
- finding direct solutions to the most urgent environmental problems associated with desertification and ecological degradation;
- providing a scientific basis for the rehabilitation and rational development of arid and semi-arid ecosystems;
- contributing to the application of integrated ecological approaches into regional development planning in arid and semi-arid zones.

The immediate objective of the major project is to develop nationally based pilot projects combining field research, training and demonstration actions conducted on an interdisciplinary basis with a comprehensive approach, and in association with planners, decision-makers and the populations concerned.

The expected results of these pilot projects are:

- to complement the existing knowledge of a sectoral and disciplinary nature by elaborating scientific guidelines for integrated solutions of actual complex problems of land development and rehabilitation in arid and semi-arid zones (soil-water-plants-animals-people interrelationships);

— to increase the number of trained specialists capable of planning and implementing comprehensive development efforts;

— to test practical application of scientific guidelines through applied research and to demonstrate them to those dealing with planning, financing and implementing development activities as well as to the local population concerned.

In order to concentrate scarce resources and to avoid duplication of research efforts, the MAB programme uses an approach aimed at ensuring that pilot projects within a region with similar ecological and socio-economic conditions are complementary. The focus of this major project is to develop further the idea of regional networks in arid and semi-arid zones in Latin America, Africa (Sahelian countries, East and South Africa), the Arab States, and Asia (Central and South Asia). The target is to set up at least some 12 integrated pilot projects, three in each of the regions concerned. An effort will be made to ensure these networks cover the different priority problems involved in the development of arid and semi-arid lands, such as pastoral and agricultural activities, reforestation with drought-tolerant tree species in order to combat desertification and create renewable energy sources, ecological, technical and socio-economic aspects of irrigation, and oasis cultivation.

The different pilot project networks will also cover the main types of arid ecosystems (hot and cold semi-deserts, dry savannahs under tropical climates, steppes, Mediterranean maquis, arid mountain ecosystems), thus facilitating exchange of information within each region and between the different regions.

The major project which is based on the conceptual framework of MAB research theme 3, concerned with grazing

lands, and 4, concerned mainly with irrigation, takes account of the syntheses already undertaken by UNESCO in the series "Arid Zone Research" and, more recently, in several MAB Technical Notes.

However, this major project is of much larger scope than these two MAB themes, and touches upon the fields included in practically all the MAB themes.

The other characteristics of the major project that distinguish it from previous activities are the emphasis given to training, to demonstration and to application of research results at the field level, the scope of operations undertaken, and the regional co-operative machinery involved.

It is planned that the core of the networks constituting the major project will include the existing pilot projects in each of the four regions. In implementing the major project on arid and semi-arid regions, close liaison will be maintained or developed with various international organizations, which are also dealing with the problems of these projects (e.g. through joint activities with UNDP, UNSO, UNEP), for application of the results of such projects (e.g. through co-operative arrangements with FAO for consideration of research findings in the operational management projects executed by FAO), and for synthesis of the research results obtained in different groups of pilot projects in a particular technical field (e.g. through convening technical seminars with SCOPE, IUCN and other non-governmental organizations). At the same time, steps will be taken to avoid undue overlap and duplication of efforts between the work of UNESCO and of other organizations concerned with the development of arid and semi-arid regions.

NEWS FROM COUNTRIES

Canada

The Canadian Secretary of State for External Affairs announced on 19 September 1980, during the visit to Canada of the Co-ordinator of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS) that the Canadian International Development Agency (CIDA) had decided on a contribution of \$1.5 million to the CILSS. The contribution, which will be spread out over two years, will provide the CILSS Executive Secretariat with Canadian specialists who will work with the Sahelians in developing and implementing a rehabilitation strategy, will contribute to the operating budget of the Secretariat and will finance an international symposium on the plant life of the Sahel.

In 1977 CIDA gave support to CILSS with a contribution of \$1.0 million to a project called "Institutional Support of the CILSS".

CIDA's Sahel programme is concentrated in four main areas: self-sufficiency in food, protection of the environment, improvement of highways and access to the sea, and balance of payments assistance.

Mexico

A National Plan of Action to Combat Desertification is under preparation by the Secretariat of Programming and Budget. The revised outline of the Mexican Plan of Action (November 1979) was received by UNEP during the second meeting of the Consultative Group on Desertification in March 1980, when the progress in preparation was discussed between the representatives of Mexico and the Desertification Branch.

Mexico is co-operating with the United States on the implementation of the Plan of Action to Combat Desertification in the region. Three areas of co-operation are

under consideration at present: desertification monitoring, cost-benefit methodologies as applied to desertification, and food-climate relationship in arid lands. A proposed meeting on desertification monitoring for the Americas to be financed by Mexico and the United States and co-sponsored by UNEP (GEMS) was scheduled for September 1981 in Mexico City. The purpose of the meeting was to elucidate a desertification-monitoring methodology and particularly to formulate a joint Mexico/USA approach to shared deserts such as the Sonora.

Turkey

The Government established in 1979 a Secretariat under the Prime Minister's Office to deal with the environmental problems of the country and to plan and co-ordinate related activities of different governmental departments which also include desertification control. The semi-arid lands of Middle Anatolia, especially its southern stretches, are the most desertification-prone region of the country. Nearly half a million hectares of land are affected by wind erosion in this region. Water erosion is wide-spread all over the country and at its advanced stages is seen in denuded forests, heavily grazed ranges and rainfed agriculture lands.

The major state agencies fighting desertification in Turkey are the General Directorates of Soil and Water (TS) and of Afforestation and Erosion Control (AGM). Anti-desertification activities gained momentum in the country in the late forties and since then more than half a million hectares of degraded forest land have been afforested and 200,000 Ha of moving sand dunes have been stabilized.

The Government of Turkey has been dealing since 1957 with soil erosion problems in cultivated lands. Up to 1978 different soil conservation measures have been taken on 346,000 ha of cultivated land belonging to nearly 90,000 small farmers. The programme for 1979-1980 envisaged the treatment of an additional 48,000 ha.

United States of America

The Federal Government has launched a large programme of assessment of desertification in the United States. The principal objective of the programme is to provide a broad appraisal of land conditions in 17 states of the great plains and western United States where there is natural water deficiency. The resulting report, entitled "Desertification in the US: Status and issues", will serve a variety of domestic purposes as a source of information on desertification issues, a list of research capabilities, available remedial measures, and descriptions of regional, state and site-specific conditions.

The first draft of the document was completed in July 1980 and distributed to over 900 reviewers representing a wide spectrum of organizations and individuals concerned with some aspect of land management. The second draft is under preparation as a result of the comments on the first draft and consultations with other bureaus and agencies. The inclusion of new material is also under consideration. The report is expected to be ready in late 1981.

The Desertification Assessment programme is the responsibility of the Bureau of Land Management of the US Department of the Interior and includes the formulation of a National Plan of Action to Combat Desertification for the United States. A draft outline has already been prepared by the Bureau for the National Plan of Action, a copy of which was received at UNEP in late 1979.

BOOK REVIEWS

LAND, MAN AND SAND: DESERTIFICATION AND ITS SOLUTION

James Walls
Macmillan, 1980
336 pp., US\$19.95
ISBN 0-02-699810-6

This book is based on 15 case studies prepared for and presented to the United Nations Conference on Desertification (UNCOD) held in Nairobi from 29 August to 9 September 1977.

Six of the case studies were prepared by United Nations organizations. Two of them report on desertification in dry regions with cold-season rainfall (the Region of Conborbala, Chile, and the Oglat Mertaba, Tunisia), two on desertification occurring in dry regions with warm-season rainfall (Luni Development Block, India, and the Eghazar and Azawark, Niger), and two on desertification affecting irrigation projects (the Greater Musayyeb Project, Iraq, and Mona Reclamation Experimental Project, Pakistan). The remaining nine case studies were prepared by six countries and include Gascoyn Basin (Australia), Turfan Oasis, Wushanchao Commune and General Desert Reclamation (China), Turan Project (Iran), Negev (Israel), south-eastern Oregon (USA), and Gelodnaya Steppe and Turkmenia (USSR).

All six of the United Nations studies, prepared by contributions from FAO, WMO and UNESCO, give examples of the menace of desertification threatening regions of two main rainfall types of the world's arid and semi-arid zones. The nine studies by the six countries, on the other hand, tend to depict success stories proving that desertification can be contained and degraded lands can be reclaimed. The former studies demonstrate the seriousness of the danger, the latter radiate optimism about successful containment efforts.

The book provides a brief but useful historical background of the conference in the first section. In the following 15 sections, the author takes up the case studies one by one and uses "each as an occasion for discussing desertification in one or another of its more general aspects". The desertification problems and their solution are analysed and discussed with frequent references to the related case study.

Although in a subject area so complex and multifaceted as desertification and desertization it is difficult to add in explanation or evaluation to what has already been considered in the case studies, Mr. Walls brings clarity and coherence to the intricate data and methodologies used. He succeeds in bringing out the essence of the problems, with shortcomings of the studies, in a way that attracts and maintains the interest of the reader. Those who are new to the subject will obtain a reasonable amount of information as to both the scientific and the social aspects of desertification. The collection and presentation of all the case studies in one volume gives the reader a wide perspective of the desperate desertification problems of arid and semi-arid regions scattered over the five continents of the world. Mr. Walls writes with facility and it is a pleasure to read the book. It addresses a large and growing audience of not only concerned readers in areas affected by desertification, but also a more general public who are becoming increasingly conscious of the nature of the fragile ecosystems that man inhabits.

T. E. Beskák

PROBLEM OF COMBATING SALINIZATION OF IRRIGATED SOILS: SELECTED LECTURES

Victor A. Kovda
Published jointly by the United Nations Environment Programme and the Commission of the USSR for UNEP
Moscow, 1980
274 pp.

The USSR Commission for UNEP (UNEP/COM) in co-operation with the United Nations Environment Programme (UNEP) has published in Moscow this collection of selected lectures by V. A. Kovda, former President of the International Soil Science Association, Director of the USSR Agro-Pedological Institute, Moscow.

The collection includes lectures delivered by the author at the International Training Course on Reclamation of Saline Irrigated Soils organized in the USSR in co-operation with UNEP within the framework of the UNEP/USSR Project: "Desertification Control Training Courses" launched in 1978. The lectures cover a wide range of pressing and interlinked modern problems such as food production and droughts, irrigation and increase of biological productivity of arid lands, etc., as well as some aspects of soil salinization in the world. Theoretical concepts of the problems are widely illustrated by examples of their successful practical solution or failure in different physico-geographic and socio-economic conditions.

The lectures collected in the book are presented under 17 chapters with following titles:

- Trends of general change in biosphere
- Food and drought problems
- Irrigation and increase of biological productivity
- Typology of landscapes and irrigation
- To combat salinization of fertile soils
- Brief review of global

geography of saline soils

- General conceptions and terminology in the study and reclamation of saline soils
- Origin and migration of salts in grounds and soils
- The ancient geo-chemical streams of salt solution in lowlands
- Salinization of marine and lacustrine deposits
- Biological cycles of salts and their accumulation in soils
- Problem of quality of irrigation water
- Centres and regions of recent salt accumulation
- Geo-chemical landscapes of deserts and steppes
- Problem of combating salinity of irrigated soils in the USSR
- Secondary soil salinity in the world and measures of prevention
- Indices of soil salinity and methods of reclamation

The lectures will be of practical interest and use for research and management workers, planners and decision-makers, post-graduates and students — all those who deal with problems of rational utilization of land and water resources.

The bibliography given at the end of the book consists of 198 references from all over the world and provides a source for the workers in salinization of irrigated soils, who seek detailed information on any specific aspects of the problem. The book is obtainable from the Commission of the USSR for UNEP. Requests should be addressed to:

The Director
Commission of the USSR for UNEP
44-2-89 Vavilov Street
11733 Moscow
USSR

V. Litvinenko

DESERTIFICATION CONTROL

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 in countries facing desertification problems, as well as all others interested in arresting the spread of desertification.

Manuscript preparation

Manuscripts should be prepared in English and forwarded in two copies. They must be clearly typewritten on one side of the page only with double spacing and wide margins. 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 corner.

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 of reference in the text. Only essential tables should be included and all should be identified as to source.

Illustrations

Line drawings of any kind should each be on a separate page, drawn in black china ink and in the same or larger size in which they will 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 in black and white. For satisfactory results, high quality black and white prints, 18 × 24 cm (8 × 10 in) on glossy paper are essential. Colour transparencies of high quality may be accepted; however, the quality of their black and white reproduction 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.

Notes and references

Notes and references should be listed on separate pages at the end of the manuscript. Notes 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 initials, year of publication, title, publisher (or journal), volume number and page numbers.

Other requirements

Desertification Control 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, while articles longer than 4,500 words are not accepted.

A reasonable fee is paid for the articles accepted for publication.

Cover photographs

The editor of *Desertification Control* is seeking photographs for consideration as bulletin covers. All submissions should be addressed to:

The Editor

Desertification Control

UNEP

P.O. Box 30552

Nairobi,

Kenya

Technical requirements

Photographs must be colour transparencies of subjects related directly to desertification: deserts, process of desertification, lands, animals, human beings, structures affected by desertification, control of desertification, reclamation of desertified lands, etc. Submissions must be of high quality for enlargement to accommodate a 30 × 42 cm (12 × 17½ in) format.

Caption

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

Copyright

It is assumed that all submissions are the original works of the photographer and all the rights are owned by the photographer. *Desertification Control* gives full credit to photographers for the covers selected, but does not provide remuneration.

