

Desertification: Challenges Ahead

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Abstract : The definition of desertification has undergone several changes over the last few decades. Yet, the word still means different things to different people, leading to confusions in assessment. Personal opinions and perceptions, rather than proven scientific data are the basis of many previous assessments. Hence, it is now becoming difficult to garner enough institutional and government support to carry out large-scale control measures on such information. Moreover, technical solutions to many problems are available and can be sharpened, but the socio-economic questions are still difficult to answer. These are difficult hurdles ahead.

Key words : Land degradation, dryland, data, rangeland, cropland, control, challenges.

Much has happened to confuse our understanding of desertification and its control since the United Nations Conference on Desertification was convened in 1977 at Nairobi, Kenya. Approximately 100 countries participated enthusiastically in a conference that addressed one of the most important environmental threats to the well-being of mankind. The United Nations Environment Programme (UNEP) was assigned principal responsibility for organizing and hosting the conference. Preparations for the meeting and administrative support were provided by a secretariat chaired by the Executive Director of UNEP, Dr. Mustafa K. Tolba. Many excellent reports were prepared under the direction of the conference secretariat and by individual countries for presentation as background documents. Two of the best country documents were the country report for India and the comprehensive book, *Desertification and Its Control*, also an Indian contribution. Several case studies were made specifically for the conference to illustrate the different kinds of desertification problems and the result of attempts to control them. Case studies were submitted for Tunisia, Chile, Niger, India,

Iraq, Pakistan, Australia, China, Iran, Israel, the United States and the Soviet Union.

Impetus for convening the desertification conference came initially from the African Sahelian countries. Those nations had experienced a very severe drought in the 1969 to 1973 period, which had wrought havoc to the livestock industry and to pastoralists in the arid regions. Hundreds of thousands of cattle, sheep and goats had died and large number of villagers and pastoralists had been forced to flee to refugee centers in the south. Drought was the early focus of preparations for the conference, but it soon became apparent that the long term problem was land degradation, not drought. The word "desertification" was chosen to represent land degradation in the drylands of the world, where droughts are common and human pressures on the land resources are frequently destructive.

The objective of this paper is to discuss the disputes that have risen about what desertification is, its extent and severity, and the challenges that are faced in attempting to control the phenomenon.

Definitions

Two French ecologists working in North Africa and West Africa are credited with coining the term "desertification." Lavauden (1927) published a paper on degradation of arid grazing lands in southern Tunisia. That appears to be the first time that desertification was used in a scientific report. Lavauden never defined "desertification." His first use of the word was to say that, in the overgrazed region around the community of Maknassy, "...desertification, if I may be so bold as to say, is purely artificial. It is uniquely the action of man." He notes that a landholding of about 3,500 ha near Maknassy had been kept in excellent grazing condition by a fence that allowed the owner to control livestock numbers. He mentioned that the good parcel of land was surrounded by degraded grazing land which had been "desertified" by man.

A second Frenchman named Aubréville wrote a book in 1949 titled *Climats, Forêts, et Desertification de l'Afrique Tropicale*. In that book, Aubréville did not define "desertification" either, but described the circumstances to which he applied the term as excessive soil erosion in the forests of humid tropical West Africa due to tree cutting and exposure of soils to raindrops. There is no evidence in the book that Aubréville was aware of Lavauden's use of the term 22 years earlier.

At the United Nations Conference on Desertification (UNCOD), desertification was explicitly defined as the "diminution or destruction of the biological potential of the land, and can lead ultimately to desert-like conditions" (UNCOD, 1977). There is no mention of the climatic zone to which the definition applies but all of the conference documents referred to arid regions, including the global desertification hazard map. In 1990, UNEP produced a new definition that equated desertification with land degradation and specified the climatic zones to which the

term applies. That definition said that desertification is "land degradation in arid, semiarid, and dry subhumid areas resulting mainly from adverse human impact." That definition, which is my preferred one, was changed in a 1992 modification of the definition by the United Nations Conference on Environment and Development (UNCED). It introduced climate and said that desertification is "land degradation in arid, semiarid, and dry subhumid areas resulting from various factors, including climatic variations and human activities."

Each of the definitions (Lavauden, Aubréville, UNCOD, UNEP, UNCED) differs, to a lesser or greater degree, from the others. It is, perhaps, understandable then that desertification still means different things to different people. Currently, the greatest difference exists between those who think desertification refers to all kinds (e.g., vegetation degradation, water erosion, salinization, etc.) and all degrees (e.g., slight, moderate, severe, etc.) of land degradation and those who believe that desertification refers only to land degraded by human action to the point where a completely barren wasteland has formed. The UNEP and UNCED definitions refer to the first condition (all kinds, all degrees); a number of Swedish scientists restrict desertification to the extreme, barren-land condition called "desert-like" (Anon., 1991), and frequently refer to it as irreversible. The suggested definition is that "desertification, or serious dryland degradation, is the spread of desert-like conditions of low biological productivity due to human impact under climatic variations." The definition does not limit desertification to any climatic zone, arid or humid.

Desert-like Conditions

Human-induced desert-like conditions are of limited extent. My original estimate of the fraction of global arid lands that are very

severely desertified (desert-like) was only 0.2% (Dregne, 1983). There is no apparent reason to believe that the estimate is much different today. Very little land has become desert-like due to desertification processes throughout history. By far, the majority of degraded land is slightly, moderately, or severely degraded, not very severely (irreversibly) degraded. If society is to be concerned only with land that humans have made desert-like, then the problem assuredly is a minor one because there is so little of that kind of land.

But land degradation, by all accounts, is a widespread environmental threat. One has only to look at the 430,000 sq. km of China's loess plateau or to know that sediment has raised the bottom of the Yellow River three meters above the surrounding North China Plain to know that accelerated erosion in the plateau is serious. Salinization of the irrigated land in Pakistan has reduced crop yields on hundreds of thousands of hectares since controlled perennial irrigation began in the 1800s. The battle to prevent and control salinity is a never-ending task in the Indus river basin. Yet, very little salt accumulation in irrigated lands is irreversible. Salinization is one desertification process for which solutions are well known and economic to apply. Vegetation degradation on rangelands is, by far, the most extensive desertification problem in the arid regions. It is so recognized by range scientists in India (ICAR, 1977), China (NRC, 1992), United States (ARS, 1974), parts of Africa (Behnke *et al.*, 1993), Turkmenistan and Uzbekistan (Nechaeva, 1985), and elsewhere.

Common though desertification is as a land degradation process, there are few instances where it reaches the ultimate stage of producing desert-like barren conditions. Most of the time unpalatable and noxious shrubs, forbs and annual grasses on rangelands replace native perennial grasses. Once

undesirable shrubs become established, it may easily require decades of protection to restore something approaching the original conditions in arid ecosystems, if it ever will occur. Wind erosion of crop lands and degraded rangelands can produce mobile barren sand dunes but that is not widespread, globally. Salty spots in irrigated fields may be barren of vegetation if the salt level in the soil is high enough. However, with good management the salt concentrations can be lowered to acceptable levels in a few years.

Desertification Control

Immediately after the 1977 conference on desertification was held, enthusiasm was high for controlling and reversing a problem that was perceived as a serious threat to the well-being of mankind and to the conservation of natural resources. A Plan of Action to Combat Desertification (PACD) had emerged from UNCOD as the document that described the desertification phenomenon, showed its importance, and set the path that should be taken to combat it. UNEP was given the responsibility to serve as the lead United Nations agency in carrying out the PACD. UNEP established a Desertification Branch as the focal point for action. UNEP also organized an Interagency Working Group on Desertification (IAWD) to assure cooperation among all the United Nations agencies involved in combating desertification (e.g., FAO, UNSO, WMO, World Bank, etc.). A Consultative Group on Desertification Control (DESCON) was given responsibility to secure funding for projects to be undertaken - through the Desertification Branch - to combat desertification.

United Nations agencies, led by UNEP, were responsible for developing a heightened awareness of dryland environmental issues among the general public, scientists, government officials and non-governmental agencies (NGOs) in the years after UNCOD. Desertification became a widely used term, at least

in part because it conjured up a mental picture of land destruction even among people who had little understanding of what desertification is.

As the result, principally, of UNEP's efforts, United Nations agencies and government donor organizations have provided money and technical assistance to dozens of developing countries that are trying to control and reverse desertification. One of the most effective actions UNEP has taken is to enlist numerous NGOs in the battle against desertification. NGOs have been effective in increasing public awareness among school children and villagers, in planting trees, stabilizing sand dunes, and conserving soil. The Desertification Branch initiated publication of the excellent Desertification Control Bulletin and is still the prime source of information on global activities on desertification.

The early success in publicizing desertification induced UNEP to promote the Desertification Branch to a Desertification Control Programme Activity Center (DC/PAC) and a more influential position in the UNEP hierarchy. Financial support from governments for desertification projects and programmes never reached the same level as the announced concern for the problem, however. For whatever reason, political will to put money into anti-desertification efforts did not materialize (Dregne, 1984).

Desertification programmes seem to have lost some of their allure in recent years. DC/PAC is now the Dryland Ecosystem and Desertification Control Programme Activity Center (DEDC/PAC). It seems that emphasis on desertification should be receiving more attention in UNEP, not less, considering that the 1992 UNCED approved preparation of an International Convention to Combat Desertification. That convention is expected to go into effect when the required number

of countries have approved it by the end of 1996.

Desertification Questions

Ironically, just when some Swedish geographers are questioning whether desertification, as studied in the central Sudan, is fact or fiction, approval of the desertification convention is near. Hellden (1995) feels that there is concern, legitimate or not, that the global desertification threat will be perceived as overblown, if not baseless, until there is scientific documentation of the threat. To date, that documentation has not been done (Dregne, 1991). Practically all evaluations of land degradation in either the arid regions or the humid regions, except for a regrettably small number of experimental plots, are based on opinion. Sometimes those estimates of how much degradation has occurred are informed, sometimes they are not. Presumably, estimates in the country-by-country survey by Dregne and Chou (1992) of land degradation and the global map of soil degradation constructed under the direction of Oldeman *et al.* (1990) are based on informed opinion. In any event, the scientific data base is very poor.

It is both amusing and irritating that the informed opinion method of making a best-available estimate of land degradation (Dregne and Chou, 1992) and soil degradation (Oldeman *et al.*, 1990) is criticized by persons who claim the published estimates are wrong, but who refuse to say what the correct numbers are. Progress in much of science flows from successive approximations of uncertain data. There is no question that present estimates of land degradation may have a high margin of error. Criticizing others while refusing to publicly cite their own estimates does not contribute to production of more accurate numbers. There are many people knowledgeable about desertification who could improve current estimates if they spoke up.

Data on the costs of land degradation to individuals and society are virtually non-existent. Consequently, support for desertification control is being solicited by concerned people without being able to justify that support. It is no wonder that there is little political will to place high priority on desertification control and that it is difficult for UNEP or any other organizations or individuals to persuade decision makers to take action. In the absence of reliable data on the extent, severity, and location of desertified land in affected countries and the cost of the damage done, it would be irresponsible of governments to allocate major resources to an undocumented problem. Yet, that is what governments and donor agencies are asked to do.

As has been said endless time, desertification is both a technical and a social problem. Technical solutions, when adjusted for the site specificity of land degradation, are known. Solutions to the social questions have generally not been sought, probably because they are

the really difficult ones to answer. The basic cause of desertification undoubtedly is a socio-economic question that must be answered if desertification is to be controlled. In the absence of reliable data, one can only speculate on solutions.

Rangeland Desertification

Rangeland vegetation degradation has been questioned, particularly by scientists working in Africa, because of the wide variations in interannual rainfall. The large changes in green biomass are sometimes blamed on human activities (and called rangeland degradation) when they are actually due only to rainfall differences. Still, most ecologists believe that rangeland degradation has and is occurring. What seems to be usually overlooked is that rangelands in Africa and Asia have been grazed for centuries. It is quite possible, indeed probable, that present vegetation conditions represent a landscape that has been degraded for many generations of pastoralists. Fig. 1 is a simplified generalization of the occurrence in adjoining rangelands of Mexico and the United States. Northern

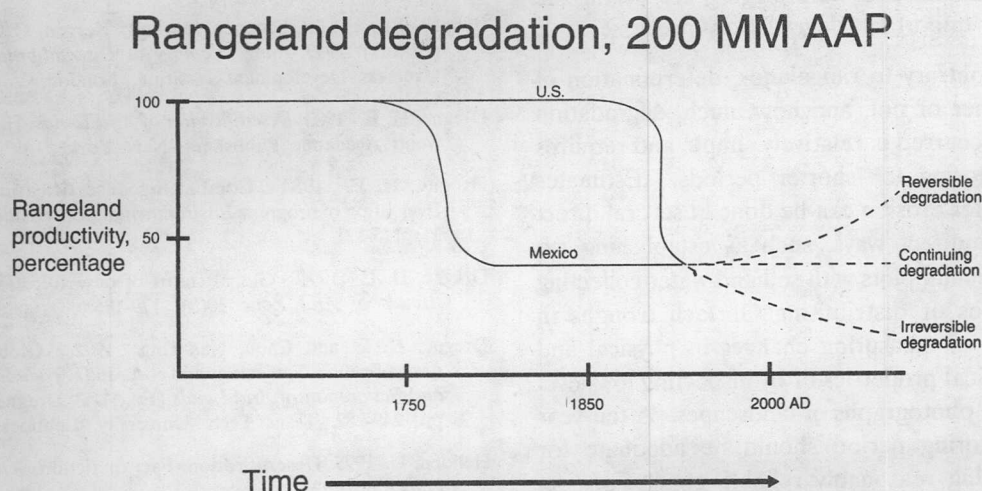


Fig. 1. Rangeland degradation history in northern Mexico and southwestern United States.

Mexico was settled long before the southwestern United States was. The state of Sonora in Mexico supplied meat to the local mining communities and to the large cities of central Mexico (e.g., Mexico City and Guadalajara) in the 17th and 18th centuries. Cattle numbers became excessive in the 1700s and degraded much of the grazing land. That same situation occurred in Arizona and New Mexico in the United States, but about one hundred years later. By 1920 (75 years ago), millions of cattle had ravaged much of the pastoral lands in those two states. Comparing range conditions today with conditions 50 years ago would show little or no change because the land was already degraded by the 1940s. Undoubtedly, the same situation occurred in the Middle East and Sahelian and Sudanian Africa. A 50-year period for range comparisons is simply too short a time to enable significant conclusions to be drawn.

Cropland Desertification

In rainfed croplands of the drylands, land degradation consists principally of water and wind erosion, soil crusting and compaction, and loss of organic matter. In irrigated lands, salinization and waterlogging are by far the most important degradation processes.

Contrary to rangelands, determination of whether or not, and how much, degradation has occurred is relatively simple and requires monitoring for shorter periods. Estimates of water erosion can be done in several direct and indirect ways, such as establishing experimental plots with soil and water collecting devices or distributing Gerlach troughs in fields or measuring changes in physical and chemical properties or by inspecting low-level aerial photographs of landscapes. A ten-year monitoring period should be adequate for reaching reasonably reliable conclusions on soil degradation. Wind erosion is more difficult to measure because of the aerial move-

ment of soil particles. Soil crusting and compaction can be estimated fairly easily, and organic matter content of soil is measured routinely. Salinity content of soils and depth to water tables is easily measured.

Conclusions

The challenges that lie ahead in desertification control are mainly two: the first is to obtain scientifically reliable data on the location, magnitude, and cost of the land degradation problem in individual countries. The second is to use that data to generate the political will necessary to strengthen degradation control efforts. Neither will be easy.

References

- Anonyms 1991. Summary of the Orenas expert meeting on desertification. *Ambio* 20: 382-383.
- ARS 1974. *Review of ARS Research Program on Western Range Ecosystems, Tucson, Arizona*. Agricultural Research Service, U.S. Department of Agriculture, Washington D.C. 112 p.
- Aubréville, A. 1949. *Climats, Forêts, et Desertification de l'Afrique Tropicale*. Societe de Editions Geographiques, Maritimes et Coloniales. Paris.
- Behnke, Roy H., Jr., Scoones, Ian and Kerven, Carol (editors). 1993. *Range Ecology at Disequilibrium*. Overseas Development Institute, London.
- Dregne, H. E. 1983. *Desertification of Arid Lands*. Harwood Academic Publishers, New York.
- Dregne, H. E. 1984. Combatting desertification: Evaluation of progress. *Environmental Conservation* 11: 115-121.
- Dregne, H. E. 1991. Global status of desertification. *Annals of Arid Zone* 30(3): 179-185.
- Dregne, H. E. and Chou, Nan-Ting 1992. Global desertification dimensions and cost. In *Degradation and Restoration of Arid Lands* (Ed. H. E. Dregne), pp. 249-282. Texas Tech. University, Lubbock.
- Hellden, U. 1995. Desertification: Fact or fiction. *Our Planet* 6(5): 33.
- ICAR 1977. *Desertification and its Control*. Indian Council of Agricultural Research, New Delhi.

- Lavauden, L. 1927. Les forêts du Sahara. *Revue des Eaux et Forêts* 6: 265-277 and 7: 329-341.
- Nechaeva, Nina T. (editor). 1985. *Improvement of Desert Ranges in Soviet Central Asia*. Harwood Academic Publishers, New York.
- NRC 1992. *Grasslands and Grassland Sciences in Northern China*. National Academy of Sciences, Washington D.C.
- Oldeman, L. R., Hakkeling, R. T. A. and Sombroek, W. G. 1990. *World Map of the Status of Human-induced Soil Degradation*. International Soil Reference and Information Centre, Wageningen, The Netherlands.
- UNCED 1992. *United Nations Conference on Environment and Development*. Agenda 21, Chapter 12. United Nations, New York.
- UNCOD 1977. *United Nations Conference on Desertification*. Round-up, Plan of Action and Resolutions. United Nations, New York.