A/CONF.74/2

UNITED NATIONS CONFERENCE ON DESERTIFICATION

29 August – 9 September 1977

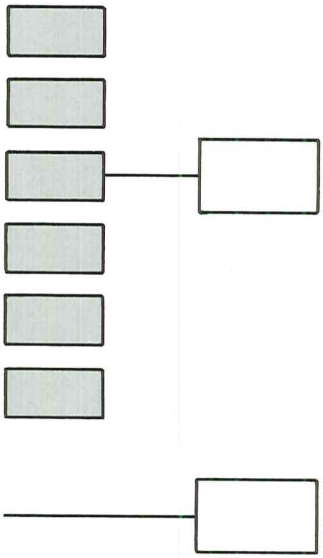
WORLD MAP OF DESERTIFICATION

at a scale of 1:25 000 000

Maps 1 through 6

Component Analyses

Africa
Scale: 1:25,000,000



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WORLD MAP OF DESERTIFICATION

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EXPLANATORY NOTE

Prepared by the Food and Agriculture Organization of the United Nations,
the United Nations Educational, Scientific and Cultural Organization,
and the World Meteorological Organization

I. Objectives

1. This map was prepared in accordance with the provisions of General Assembly Resolution 3337 (XXIX) on international cooperation to combat desertification with a view to delineate, on a world scale, areas of deserts and those areas, mainly on the fringes of deserts but elsewhere as well, which are at risk of desertification. The map was produced by FAO and Unesco in cooperation with WMO and UNEP, and with the advice of the internationally recognized senior consultants to the Secretary-General of the Conference.

II. Definitions

2. To understand the legend and the methodology used in preparing the map, some definitions are in order:

Deserts: Regions where vegetation is scarce or absent because of deficient rainfall or edaphic aridity.

Desertification: The intensification or extension of desert conditions; it is a process leading to reduced biological productivity, with consequent reduction in plant biomass, in the land's carrying capacity for livestock, in crop yields and human wellbeing.

Vulnerability of land to desertification processes: The inherent susceptibility of the ecosystem to desertification is determined by its present climate, terrain, soil and vegetation conditions. This intrinsic vulnerability is regarded as inseparate from human influence.

High human and animal pressure: The criteria utilized are the density of population and the density of livestock. A third factor included under human pressure is intense pressure of cultivation associated with mechanization. The assumption is made that overcultivation and overgrazing are proportional to density. Areas of intense irrigation prone to salinization are too small to be shown on the world scale.

Degree of desertification hazards: The risk of degradation by desertification was evaluated from a consideration of the foregoing factors under present conditions. The risk is a function both of the inherent vulnerability of the region and of the human or animal pressures on its resources.

The risk is greater in arid and semi-arid than in extreme-arid zones to the extent that the difference between an assumed initial stage and the potential final stage is greater. The existing degree of desertification may be assessed from the difference between the existing condition and an assumed initial stage.

III. Methodology

3. In any region, it is possible to evaluate the progress of desertification phenomena, whether by an historical approach, by monitoring desertification processes such as vegetation changes, or by

comparing degraded and non-degraded conditions in similar areas. At a world scale these approaches are not possible; the degree of desertification hazard has here been evaluated subjectively according to the following criteria: climate, inherent vulnerability of the land, and human or animal pressure.

4. Bioclimates: A bioclimatic map, which has been used as a basis for the preparation of the present map, showing zones of aridity was prepared by Unesco with data provided by WMO from some 1 200 meteorological stations. The limits of the zones were decided primarily from a climatic aridity index:

$$\frac{P}{ETP} = \frac{\text{Precipitation}}{\text{Evapotranspiration}}$$

Evapotranspiration is calculated by the method of Penman, taking into account atmospheric humidity, wind and solar radiation. The interpolation of bioclimatic limits between stations was determined by data from maps of vegetation, soils and topography, and from unpublished information on those elements. The bioclimatic zones correspond in general to aridity values of less than 0.03, 0.03 to 0.20, 0.20 to 0.50, and 0.50 to 0.75. Arid zones in tropical and temperate climates are also considered here, thus excluding cold deserts such as those of Antarctica, the tundra regions and the high desert plateau of Tibet.

The hyperarid zone $\left(\frac{P}{ETP} < 0.03\right)$ was delimited less by the climatic index than by the absence of vegetation except for ephemerals and shrubs in river beds. This zone corresponds to the extreme desert and is virtually unsettled.

The arid zone $\left(0.03 < \frac{P}{ETP} < 0.20\right)$ comprises dryland areas with sparse perennial and annual vegetation. Nomadic pastoralism can be practiced here, but rainfed agriculture is not possible.

The semi-arid zone $\left(0.20 < \frac{P}{ETP} < 0.50\right)$ includes steppe or tropical shrubland with a discontinuous herbaceous layer and increased frequency of perennials. Livestock breeding and rainfed agriculture are both possible in this zone.

The subhumid zone $\left(0.50 < \frac{P}{ETP} < 0.75\right)$ is characterized by more dense vegetation. It includes tropical savannas, mediterranean maquis and chapparal, and steppes with tchernozem soils. Rainfed agriculture is common in this zone for crops adapted to seasonal drought.

Hyperarid zones (extreme deserts) are coloured grey on the map because they are no longer subject to desertification. The delimitation of the other bioclimatic zones, shown by different types of shading, provides some indication of regional vegetation cover and of its potential for regeneration.

5. Vulnerability of land to desertification: Each map area corresponds to a physiographic or edaphic unit for which a particular vulnerability has been assessed. The assessment of vulnerability has been made systematically from a consideration of climate, terrain, soil characteristics and vegetation in order to ensure consistency.

The information on soils was derived from the FAO/Unesco Soil Map of the World at a scale of 1:5 000 000. In addition to the soil unit, this map provides information on soil texture, ground slope and other conditions relevant to land use, such as stoniness, salinity, lithic character (where depth of soil is less than 50 cm) and other useful information relevant to present degree of desertification and desertification hazard.

The Unesco Vegetation Map of the Mediterrean Region and a world vegetation map by Schmithusen have been used to adjust limits derived initially from climatic data and to evaluate the inherent resistance of the natural vegetation to human pressure.

The influence of vegetation on vulnerability to desertification was assessed in the first place from climate, because the vegetation map in itself shows neither the amount of vegetative cover nor its power of regeneration. The source vegetation maps were in any case largely dependent on bioclimatic and pedologic maps.

In this Explanatory Note the table for the prediction of vulnerability of land to desertification from the criteria of climate, terrain, soil, and vegetation cannot be presented in extenso, but we give this example:

Soil	Relief	Vegetation	Climate
Arenosol (sandy soil)	Flat to undulating	Thorny bush	Arid

The interpretation of the above area was: ''highly vulnerable to sand drift and sand accumulation by wind erosion or deposition'' because arenosols are sandy, are dry a long time during the year, have little or no vegetation cover between the trees and shrubs, and accordingly are exposed to wind action. In a semi-arid zone with dry savanna vegetation, the vulnerability of land would be less because the soil is humid during a longer part of the year, the organic matter is greater, and a better grass cover protects the soil against wind erosion.

6. Indications of vulnerability of land to desertification processes: These have been reduced to four classes in order not to overload the map - but could be increased for larger-scale maps. The dominant process has been indicated on the map by a capital letter.

W Areas subject to sand movement:

This class of region is subject to many related eolian processes, indicated for instance by active sand dunes (erg, nefoud, koum), fixed dunes with barren sandy patches on their crests, sand sheets on sandy soils which may be modified by overgrazing or overcultivation and form sandy hillocks (nebkha), and residual sandy surfaces left by deflation of fine material.

R Stony and rocky surfaces subject to stripping by deflation or sheet wash:

An important indication is the occurrence of stones at the surface. These include the reg or serir of the Sahara and the gibber plain of Australia; also included are piedmonts mantled with stones or rock debris and areas of extensive rock outcrop or of calcareous or gypseous hardpan (hamada).

V Areas subject to soil stripping and accelerated gully erosion:

Desertification processes in these areas include stripping of topsoil and accelerated run-off leading to gully erosion on slopes and/or sheet erosion on flat land. There may be an enlargement of bare areas through sealing of the soil surface by rain splash or by deposition of silt or fine sand on the surface soil in depressions, resulting in increased run-off and a decrease in available water and hence poor seed germination. In undulating areas, sheet, rill and gully erosion by intense rain, particularly following a long dry season, can result in the loss of vegetation by removal of seeds or by undermining of trees.

S Surfaces subject to salinization and alkalinization:

In these areas there is likely to be an expansion of saline and alkaline soils, with vegetation degraded or absent through excess salt or bad soil structure, for example impermeability due to sodium excess. These are (A) mainly depressions with interior drainage and include sebkhas, chotts, kevirs, takyrs, playas, salars and salinas; (B) alluvial and littoral plains of very low gradient and with fine texture soils.

7. Human and animal pressure: Population and animal densities have been used as measures of human and animal pressure on the land, which, when excessive, results in overstocking, excessive cultivation through reduction of fallowing or through mechanization, and eradication of trees for firewood. The limits of 7 inhabitants per km2 or one animal unit per 5 ha were chosen as critical for the arid zone, and 20 inhabitants per km2 and one animal unit per ha for the semi-arid zone. Population and cattle densities were taken from various reports and atlases. Where possible, only rural population was considered, because

town population affects only a small surrounding area, not depictable at a scale of 1:25 000 000. For animal units we have adopted the following equivalents: one bovid = 10 sheep or goats = 2 asses = 1 horse = 1 camel. The values of critical animal or human population densities were fixed arbitrarily in the present exercise, but at a later stage it is hoped to evaluate potential biomass of pasture and productivity of crops by modelling data on soil, climate, and type of vegetation or crops, and in this manner to determine an appropriate limit for the density of man or animals in any region.

8. Desertification hazard: This has been evaluated on the basis of vulnerability of the land combined with human or animal pressure, and is classified into three categories: very high, high and moderate.

The desertification hazard is very high if the region will be subject to very rapid desertification if existing conditions do not change.

The desertification hazard is moderate if the region will change only slowly from its present stage to a more degraded stage if existing conditions do not change.

A high desertification hazard lies between these two conditions.

IV. Conclusions

9. This map represents only a first approximation, which should be used to promote national action to make a better assessment of the problem.

The main purposes of such a map are:

i. to provide a preliminary synthesis of the available cartographic information on desertification and to present it uniformly on a global basis;

ii. to locate homogeneous areas and representative sites for monitoring and conservation and development programmes;

iii. to serve as a framework for more detailed surveys in selected areas. At larger scales, consideration should be given to: a greater number of parameters to evaluate vulnerability classes, identifying more desertification processes, using more quantitative criteria, particularly on the carrying capacity of land, identifying more degrees of desertification hazards and placing less stress on the purely climatic factors. This has been done in applying the methodology of the World Desertification Map to a desertification map at 1:5 000 000 of Africa north of the Equator, and in still greater detail to the synoptic maps to be included in the case studies to be made available to the Conference;

iv. to show critical zones. Such a map can inform the planner where a hazard of a given intensity exists, and so guide him on what measures should be taken to improve the environment, depending on the degradation processes involved.

10. It is necessary to emphasize that desertification hazards shown on this map are relative to future land management. If conditions change, for example a decrease in human pressure or the adoption of new techniques to improve land, irrigation, or range management, the risk of desertification may be diminished or removed.

V. Annexes

11. The extent in km2 of area already affected and likely to be affected by desertification, by continents and by bioclimatic zones, is reflected in Annexes 1 and 2. Map legend in Annex 3.

ANNEX 1

Extent in km2 of area already affected and likely to be affected by desertification, by continents

	South America		North and Central America		Africa		Asia		Australia		Europe	
	km2	%	km2	%	km2	%	km2	%	km2	%	km2	%
Very high degree of desertification hazards	414 195	2.3	163 191	0.7	1 725 165	5.7	790 312	1.8	307 732	4.0	48 957	0.5
High	1 261 235	7.1	1 312 524	5.4	4 910 503	16.2	7 253 464	16.5	1 722 056	22.4	-	-
Moderate	1 602 383	9.0	2 854 293	11.8	3 740 966	12.3	5 607 563	12.8	3 712 213	48.3	189 612	1.8
Extreme desert	200 492	1.1	32 638	0.1	6 177 956	20.4	1 580 624	3.6	-	-	-	-

ANNEX 2

Extent in km2 of areas likely to be affected by desertification, by bioclimatic zones

	Hyperarid		Arid		Semi-arid		Subhumid	
	km2	%	km2	%	km2	%	km2	%
Very high degree of desertification hazards			1 110 477	6.4	2 180 546	12.1	158 528	1.2
High			13 439 968	77.3	2 440 098	13.6	579 717	4.3
Moderate			2 105 167	12.1	12 452 272	69.4	3 172 905	23.3
Extreme desert	7 991 710	100						

ANNEX 3

DESERTIFICATION MAP OF THE WORLD
1:25 000 000

L E G E N D

DEGREE OF DESERTIFICATION HAZARDS (in zones likely to be affected by desertification)

- Very high .....
- High .....
- Moderate .....

VULNERABILITY OF LAND TO DESERTIFICATION PROCESSES

- Surfaces subject to sand movement ..... **W**
- Stony or rocky surfaces subject to areal stripping by deflation or sheet wash; extreme erosion leads to formation of stony pavements and exposure of hard pans or rocks **R**
- Alluvial or residual surfaces subject to stripping of topsoil and accelerated runoff, ... gully erosion on slopes and/or sheet erosion or deposition on flat lands ..... **V**
- Surfaces subject to salinization or alkalinization ..... **S**

HIGH HUMAN AND ANIMAL PRESSURE

- Human pressure (included mechanization) ..... **H**
- Animal pressure ..... **A**

BIOCLIMATIC ZONES

- Hyperarid .....
- Arid .....
- Semi-arid .....
- Subhumid .....

Map 1
SOIL CONSTRAINTS

Soil Constraints
Contraintes Imposées aux Sols
Limitaciones del Suelo
عن التربة المعوقات الناتجة
土壤因素

Почвенный фактор

None to Slight — Nulle à Faible — Nulo a Leve — 无至稍有危险 — От нулевой до слабой
Moderate — Modérée — Moderado — 轻到中危险 — Умеренная
Severe — Sévère — Severo — 严重危险 — Сильная
Very Severe — Très Sévère — Muy Grave — 极严重危险 — Очень сильная

Map 2
WATER ACTION

Water Action
Action de l'eau
Acción del Agua
الماء تأثير
水力

Воздействие воды

None to Slight — Nulle à Faible — Nulo a Leve — 无至稍有危险 — От нулевой до слабой
Moderate — Modérée — Moderado — 轻到中危险 — Умеренная
Severe — Sévère — Severo — 严重危险 — Сильная
Very Severe — Très Sévère — Muy Grave — 极严重危险 — Очень сильная

Map 3
WIND ACTION

Wind Action
Action du Vent
Acción del Viento
الرياح تأثير
风力

Воздействие ветра

None to Slight — Nulle à Faible — Nulo a Leve — 无至稍有危险 — От нулевой до слабой
Moderate — Modérée — Moderado — 轻到中危险 — Умеренная
Severe — Sévère — Severo — 严重危险 — Сильная
Very Severe — Très Sévère — Muy Grave — 极严重危险 — Очень сильная

Map 4
SALINIZATION

Salinization
Salinization
Salinización
التملح
盐化

Засоление

None to Slight — Nulle à Faible — Nulo a Leve — 无至稍有危险 — От нулевой до слабой
Moderate — Modérée — Moderado — 轻到中危险 — Умеренная
Severe — Sévère — Severo — 严重危险 — Сильная
Very Severe — Très Sévère — Muy Grave — 极严重危险 — Очень сильная

Map 5
ANIMAL PRESSURE

Animal Pressure
Pression Exercée par la Population Animale
Presión Animal
الحيواني الضغط
动物压力

Воздействие животных

None to Slight — Nulle à Faible — Nulo a Leve — 无至稍有危险 — От нулевой до слабой
Moderate — Modérée — Moderado — 轻到中危险 — Умеренная
Severe — Sévère — Severo — 严重危险 — Сильная
Very Severe — Très Sévère — Muy Grave — 极严重危险 — Очень сильная

Map 6
POPULATION PRESSURE

Population Pressure
Pression Exercée par la Population Humaine
Presión Humana
البشري الضغط
人口压力

Демографическое воздействие

None to Slight — Nulle à Faible — Nulo a Leve — 无至稍有危险 — От нулевой до слабой
Moderate — Modérée — Moderado — 轻到中危险 — Умеренная
Severe — Sévère — Severo — 严重危险 — Сильная
Very Severe — Très Sévère — Muy Grave — 极严重危险 — Очень сильная

FAO/UNEP

MAP OF DESERTIFICATION HAZARDS
Component Analyses
1:25,000,000

Africa
UNCORRECTED PROOF