

DATA BOOK OF

DESERTIFICATION/
LAND DEGRADATION

Center for Global Environmental Research



National Institute for Environmental Studies
Environment Agency of Japan



序

砂漠化/土地荒廃は、地球規模の環境問題の中で最も直接的に人間活動による影響を受けやすい問題の一つである。このために、砂漠化/土地荒廃は、地域社会に与える影響が大きいという地域的な側面と、地表面アルベドの変化などを通じて地球温暖化の問題と密接な関係を有するという地球的な側面とをあわせ持つ。このことは、問題に取り組むに際して、現象の把握に必要とされるデータや情報が多岐にわたること、また、現象のモデル化が難しいことを意味する。例えば、砂漠化/土地荒廃では、地域の降雨量、気温などの気候学的変数、土壌の構造や土壌水分、酸性度などの物理、化学的変数、動植物分布などの生物学的変数、周辺の水系や地表面傾斜などの地理学的変数に加え、周辺の人口分布、土地利用形態、産業構造などの社会経済学的変数がある。その発生、進行に複雑に関与している。影響の評価や対策を講ずるに際しては、地域的な要因と地球的な要因を十分に検討しなければならない。

地球環境研究センターでは、これまで地球環境問題に関する調査・研究報告を編集・出版してきたが、1996年12月に「国連砂漠化防止条約」が発効するなどの国際的な状況に鑑み、平成8年度では、砂漠化/土地荒廃に焦点をあてて調査を行うこととした。本分野の第一任者である立正大学門村浩教授（東京都立大学名誉教授）に編集をお願いし、パシフィックコンサルタンツ株式会社の協力を得て、内外の最新の情報を収集、解析し、「砂漠化/土地荒廃データブック」を完成した。

本データブックでは、問題の要因、影響、また、問題解決のための取り組みについて要点を整理し、図表を中心にわかりやすく解説することを心がけた。専門家のみならず一般の方々にとっても砂漠化/土地荒廃についての有用な情報が提供できれば幸いである。

なお、本データブックの作成に当たっては、情報の収集、解析に多くの方から多大な協力を頂いた。ここに記して謝意を表したい。

平成9年3月
国立環境研究所
地球環境研究センター
総括研究管理官
安岡善文

Preface

Desertification/land degradation is the environmental issue that has both of the global and regional aspects. It is regional in the sense that it is directly induced by the human activities and that it also gives serious impacts on regional society reversely. At the same time it is global in the sense that it is closely linked with other global issues such as global warming through the dynamical change of the earth surface albedo. This implies that it requires wide variety of data and information from local to global and complicated modeling scheme. For example, in desertification/land degradation processes, different types of parameters are closely interconnected including climatic variables such as precipitation and surface temperature, physical and chemical variables such as soil types and soil salinity, biological variables such as vegetation and animal distribution, geographical variables such as river systems and topographic features as well as socioeconomic variables such as population density, land use pattern and industrial structure. Detail investigation on these parameters is required to tackle with desertification/land degradation.

The Center for Global Environmental Research has been publishing several research and survey reports on global environmental issues. In 1996 the CGER took an opportunity to have a survey on desertification/land degradation on the occasion that the "United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa" enters into force on December 1996, and published this "Data Book on Desertification/Land Degradation" in cooperation with Professor Hiroshi Kadomura of Rissho University (Professor Emeritus of Tokyo Metropolitan University) and with Pacific Consultants Co., Ltd.

The editors and authors made efforts to clarify the various aspects of the desertification/land degradation issue, and to explain them as simply as possible with illustrative figures and tables. We hope this Data Book gives useful information for the researchers in this field as well as the general public interested in the global environmental issues.

Finally, we would like to express our sincere thanks to the people for their contribution to the publication of this Data Book.

March 1997

Yoshifumi Yasuoka
Director
Center for Global Environmental Research
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編集主幹より

砂漠化/土地荒廃は、世界の陸地の1/3を占める乾燥地域における最も深刻な地球規模の環境問題である。人間活動と繰り返して現れる厳しい干ばつ影響とが相まって、このプロセスは世界の多くの乾燥地域、とくに発展途上にある国々で、食糧生産基盤、水とエネルギーの供給システム、さらには社会経済システムからなる生命維持システムを破壊することを通して、人間生存を脅かし続けている。こうした砂漠化/土地荒廃と干ばつの影響は、発展途上にある乾燥地域における持続可能な発展を妨げる最大の環境束縛要因である。また、それは見かけ上「生態的な病」の様相を呈して進行するが、貧困や人口の増加と移動、土地制度の不備、国際貿易・市場における不利な条件など、多様な社会経済的束縛条件を根源とする「社会的な病」なのである。気候変動や生物多様性など、他の地球規模環境問題と相互に密接な関連をもつ現象でもある。

このデータブックは、こうした重大な地球規模の問題である砂漠化/土地荒廃に関して、内外の最新の研究情報を集大成して、その全貌を解説するとともに、その解決のための課題をコンサイスな形に取りまとめたものである。1996年12月27日には、ボトムアップアプローチと社会経済的側面への対応を基本戦略とする『国連砂漠化防止条約』が発効した。砂漠化/土地荒廃の防止のための国際協力による対応行動に新たな展開が期待できるようになったこの時期に、本データブックが刊行される意義は大きい。新たな対応のための基本データとして広く活用されることを望みたい。

平成9年3月

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門村 浩

From Editor in Chief

Desertification/land degradation is the most serious global environmental issues in the world drylands which occupy one-third of the Earth's land surface. Coupled with the adverse effects of human activities and severe and persistent droughts, this process has increasingly threaten the human survival in many parts of the world drylands, particularly in developing countries, by destroying the life-support systems, i.e., food production, water and energy supply systems, and even socioeconomic system. For this reason, desertification/land degradation and the effect of drought should deserve particular attention as the major environmental constraints for the sustainable development in the developing countries. Although the processes of desertification/desertification appear as an "ecological disease", it is a "social disease" caused by deep-rooted, various socioeconomic constraints such as poverty, population growth and migration, land tenure problem, and marginality in international trade and marketing. It has also close connection with other major global issues, particularly with climate change and biodiversity.

This data book summarizes the currently available worldwide information and data on desertification/land degradation, and suggests the better ways to combat this important global issue. United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, which stresses the importance of bottom-up approach and socioeconomic dimensions in combating desertification/land degradation and the effect of drought, was enter into force on 27 December 1996. For this reason the publication of this data book is truly timely. I am confident that this book will be useful to all those who commit themselves to various aspects of this issue.

March 1997

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1.

砂漠化／土地荒廃データブックの目的と構成

Objectives and Structure of the Data Book
of Desertification/Land Degradation

砂漠化／土地荒廃データブックの目的：

土壌は、形成されるまでに数世紀を要するが、風食や水食により短期間のうちに失われる。砂漠化／土地荒廃は地球上のあらゆる場所で生じているが、特に土壌が脆弱で、植被が薄く、気候の変化が大きい地域において著しい。砂漠化／土地荒廃は、自然的要因と人的要因が複雑に絡み合って生じており、自然環境への影響と同時に、深刻な社会経済的影響をも及ぼしている。本データブックは、砂漠化／土地荒廃に関する研究活動やその成果について、この問題に興味を持つさまざまな分野の研究者及び政策決定者に、理解しやすい形で紹介することを目的として作成された。

Objectives:

It takes centuries to form soil, but it can be blown and washed away by erosion in a short period. Land degradation occurs everywhere, but areas especially affected are those where the soil is fragile, the vegetation is sparse and the climate is variable. Degradation is caused by a complex interaction of natural and human-induced factors, and results in serious environmental as well as socio-economic deterioration. *The Data Book of Desertification/Land Degradation* was compiled for researchers and policy makers in various fields. It aims to clarify current understanding and introduce research activities and results concerning desertification/land degradation, in one comprehensive book.

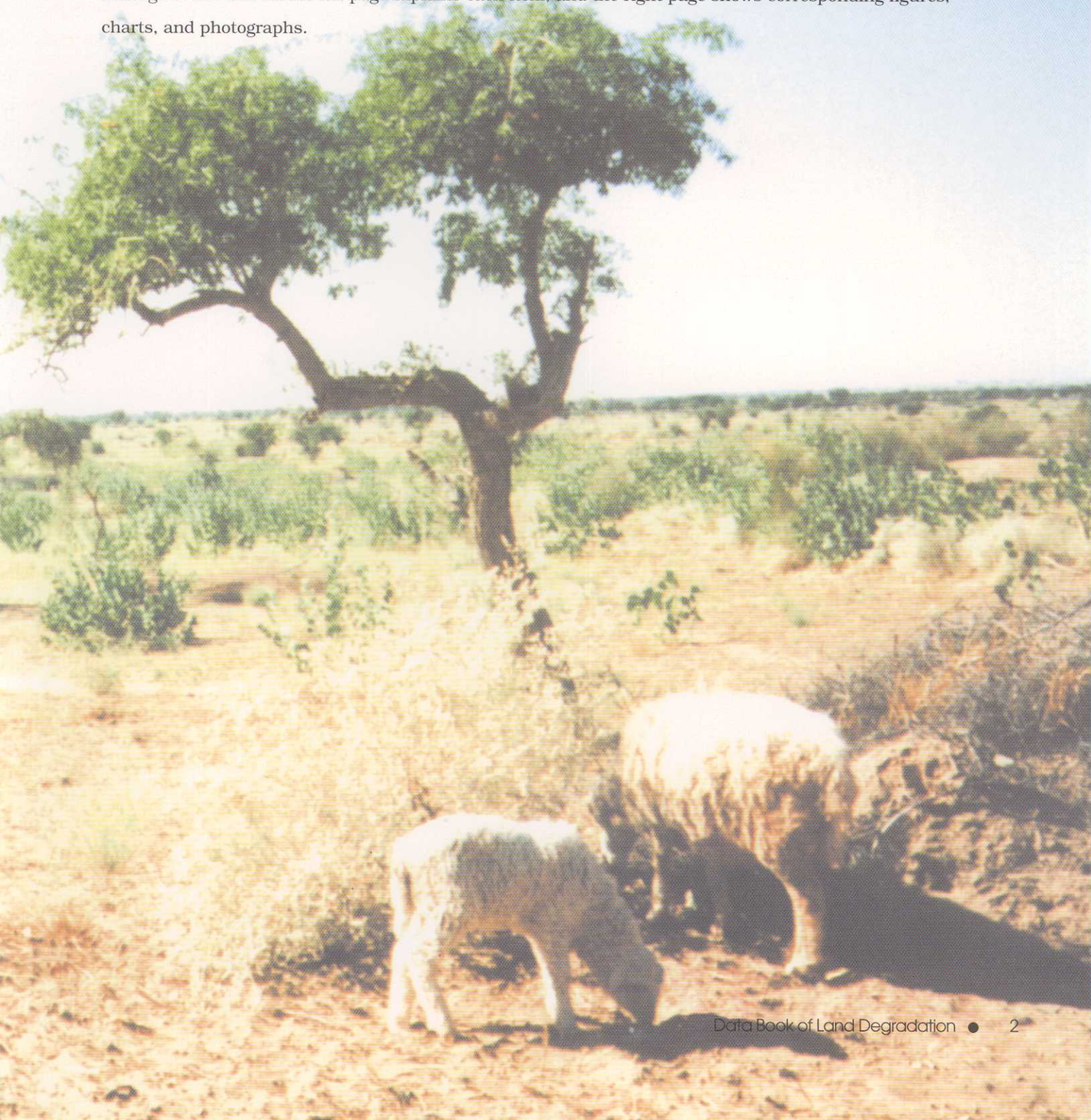


砂漠化／土地荒廃データブックの構成：

このデータブックは、砂漠化／土地荒廃問題の意味、定義、影響と要因、国際的な取り組み、現状把握と影響評価のケーススタディ、対応策などに関する7項目から構成されている。見開きページの左側には各項目に関する説明文、右側には関連する図・表・写真を掲載している。

Structure:

This Data Book consists of 7 sections on desertification/land degradation, including introductory comments, significance, definitions, causes and impacts, international activities, case studies, and response strategies. The text on the left page explains each item, and the right page shows corresponding figures, charts, and photographs.



2.

砂漠化／土地荒廃問題の重要性

Significance of Desertification/Land Degradation Problems

砂漠化／土地荒廃は、あらゆる気候帯において、さまざまな形態で生じている。1991年の国連環境計画（UNEP）の報告書によれば、乾燥地の農地約52億haの約70％に及ぶ36億haにおいて土地荒廃が生じており、全世界の陸地の約30％、全世界の人口の1/6にあたる8億5千万人に影響を及ぼしている。

アジアにおいては、乾燥地の約22％、それ以外の地域の約15％が砂漠化／土地荒廃の影響を受けている。特に発展途上国への影響が大きい。先進国も同様の問題に直面している。

砂漠化／土地荒廃は、特に日本においてはさほど影響のない問題であるかのように受け取られている。しかし、地球上の広範な地域における土地の荒廃は、食糧生産の低下、途上国の貧困の増大、長期的には気候変動や生物多様性への影響など、一国、一地域を越えて世界全体に影響を及ぼしつつある。

1994年6月に採択され、1996年12月に発効した「深刻な干ばつまたは砂漠化に直面している国々（特にアフリカの国）における砂漠化の防止のための国際連合条約」（以下「砂漠化防止条約」とする）の前文は、この問題の持つ意味について、以下のように述べている。

砂漠化／土地荒廃は、世界のすべての地域に影響を及ぼす、地球規模の環境問題である。その影響は現段階では特にアフリカを中心とした発展途上国に集中している。

砂漠化／土地荒廃は、物理的、生物的、政治的、社会的、文化的及び経済的要素間の複雑な関わり合いによって生じる問題であり、貧困、不十分な保健及び栄養、食糧安全保障の欠如、難民などの重大な社会問題を通じて、持続可能な発展に影響を与えている。

砂漠化／土地荒廃の対策には、適切な系統的観測、厳密な科学的知識、及び継続的な再評価が必要とされる。そのためには、国際社会の共同行動が不可欠である。

Desertification/land degradation may occur in all climate zones of the world. According to a 1991 UNEP assessment about 3,600 million ha, or 70% of the 5200 million ha of drylands used worldwide for agriculture, are already degraded. Desertification/land degradation now affect almost 30% of the total land area of the world and 850 million people, one-sixth of the world's population. About 22% of Asia's drylands and 15% of its other land area is affected by desertification/land degradation. Developing countries are most affected, but developed countries also face problems with desertification/land degradation.

In many developed countries, particularly in Japan, desertification/land degradation is not often considered to be a serious global environmental problem. However, it is a problem which crosses national and regional boundaries, reducing food security, increasing poverty in developing countries, and affecting climate and biodiversity over the long term.

In the preamble of the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (referred to as the Convention to Combat Desertification) which was adopted in June 1994 and become effective in December 1996, the global significance of desertification/land degradation is clearly stated. Desertification/land degradation are problems of global dimensions in that they affect all regions of the world. They are particularly severe in developing countries, notably in Africa at present.

Desertification/land degradation are caused by complex interactions among physical, biological, political, social, cultural and economic factors. They affect sustainable development through their interrelationships with important social problems, such as poverty, health and nutrition, food security and displacement of population.

To combat desertification/land degradation, sound systematic observation, rigorous scientific knowledge, and continuous re-appraisal of the situation are required. For these, cooperation of the international community is essential.

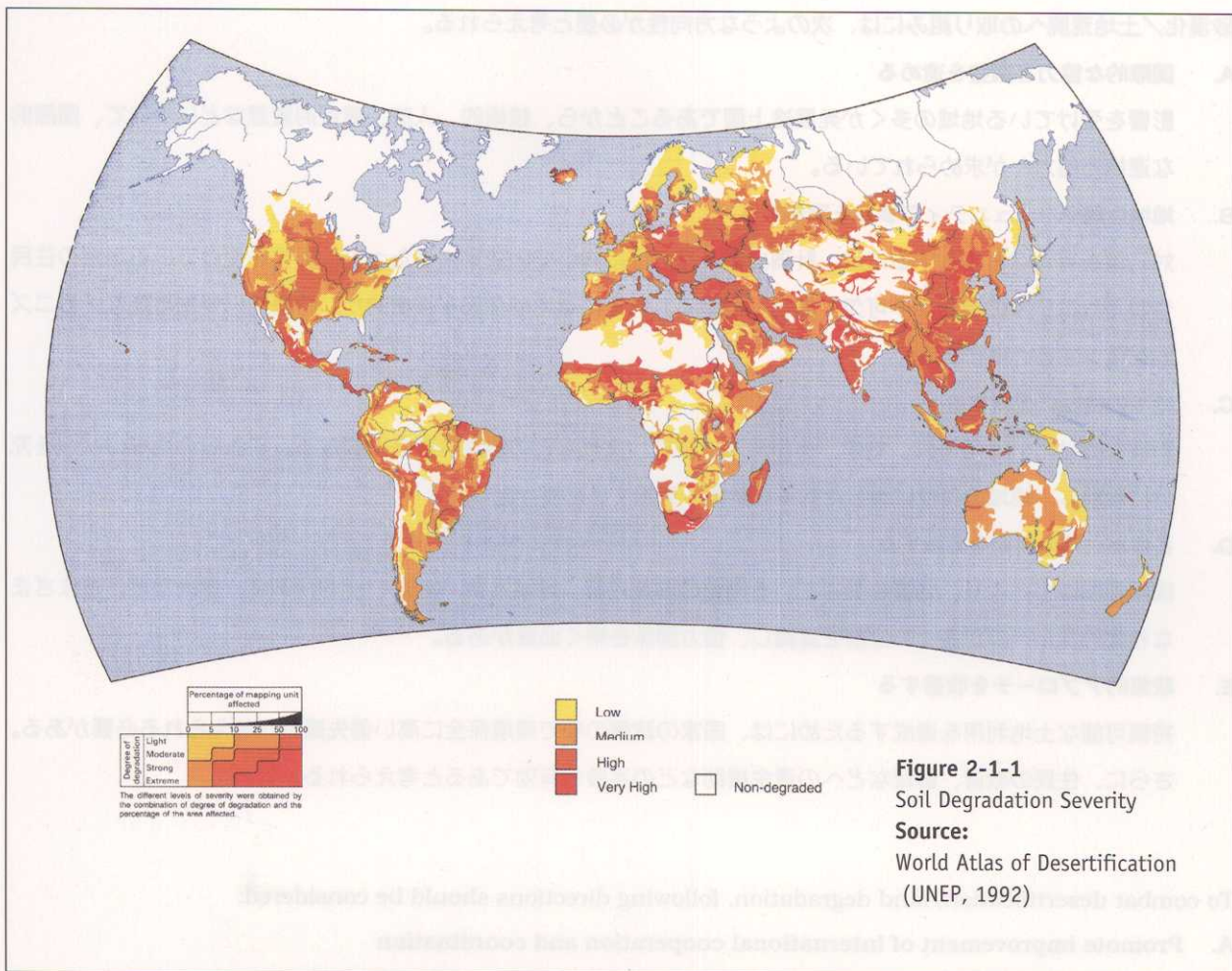


Table 2-1-1 The Areas at Risk

	rangelands	croplands	irrigated land	forest and woodland	ground-water
Sudano-Sahelian Africa	●	●	●	●	●
Southern Africa	●	●	●	●	—
North Africa	●	●	●	●	●
Western Asia	●	●	●	●	●
South Asia	●	●	●	●	—
Asian USSR	✓	✓	✓	✓	?
China, Mongolia	✓	●	✓	●	?
Australia	—	—	●	—	—
Mediterranean Europe	—	●	✓	✓	—
South America	●	●	●	●	●
Mexico	—	●	●	●	●
North America	✓	✓	✓	✓	●
● desertification accelerating — static ✓ improving					

Source: UNEP Environment Brief No.2 "Sands of Change"

砂漠化／土地荒廃への取り組みには、次のような方向性が必要と考えられる。

A. 国際的な協力と調整を進める

影響を受けている地域の多くが発展途上国であることから、技術的、人的、資金的資源などについて、国際的な連携と協力が求められている。

B. 地域住民やコミュニティの参加を確保する

対応策を有効なものとするには、計画立案及び実施についての決定に当たって、影響を受けている地域の住民やコミュニティの参加が不可欠である。従って、対策には地域住民が積極的かつ持続的に参加可能なメカニズムを確保する必要がある。

C. 地域の特性に配慮する

影響を受けている地域は、気候、自然資源、経済、文化などの諸条件が各々異なる。これらの地域の状況を十分に理解し、地域の特性に適した対策を計画・実施する必要がある。

D. 各参加主体の役割を認識する

国際機関はもとより、影響を受けている地域の国家政府、地域社会、NGO、土地所有者、農民など、さまざまな社会的グループが各々の役割を認識し、協力関係を築く必要がある。

E. 政策的アプローチを改善する

持続可能な土地利用を達成するためには、国家の政策の中で環境保全に高い優先順位が与えられる必要がある。さらに、住民の教育、農民などへの資金援助などの手段も有効であると考えられる。

To combat desertification/land degradation, following directions should be considered:

A. Promote improvement of international cooperation and coordination

As most affected countries are developing countries, it is required to improve international cooperation and coordination concerning technical, human, financial resources necessary.

B. Ensure participation of local populations/communities

To make the combat effective, participation of local population/communities to decision making on the design and implementation of response options is essential. Therefore it is necessary to establish a style to ensure positive and sustainable participation of local people.

C. Consider local characteristics

Each affected region has various characteristics such as climate, natural resources, politics, economy and culture. It is necessary to consider those local conditions to implement appropriate response strategies in each region.

D. Identify each role of participant

Not only international bodies but also national government, local communities, NGOs, land owners and farmers should identify their own role and establish good relationship.

E. Improve national policy approaches

A high priority should be given to environmental conservation in national policy approaches, which can result in a sustainable land management. Furthermore improvement of education and financial support for small and poor farmers are also considered to be effective.

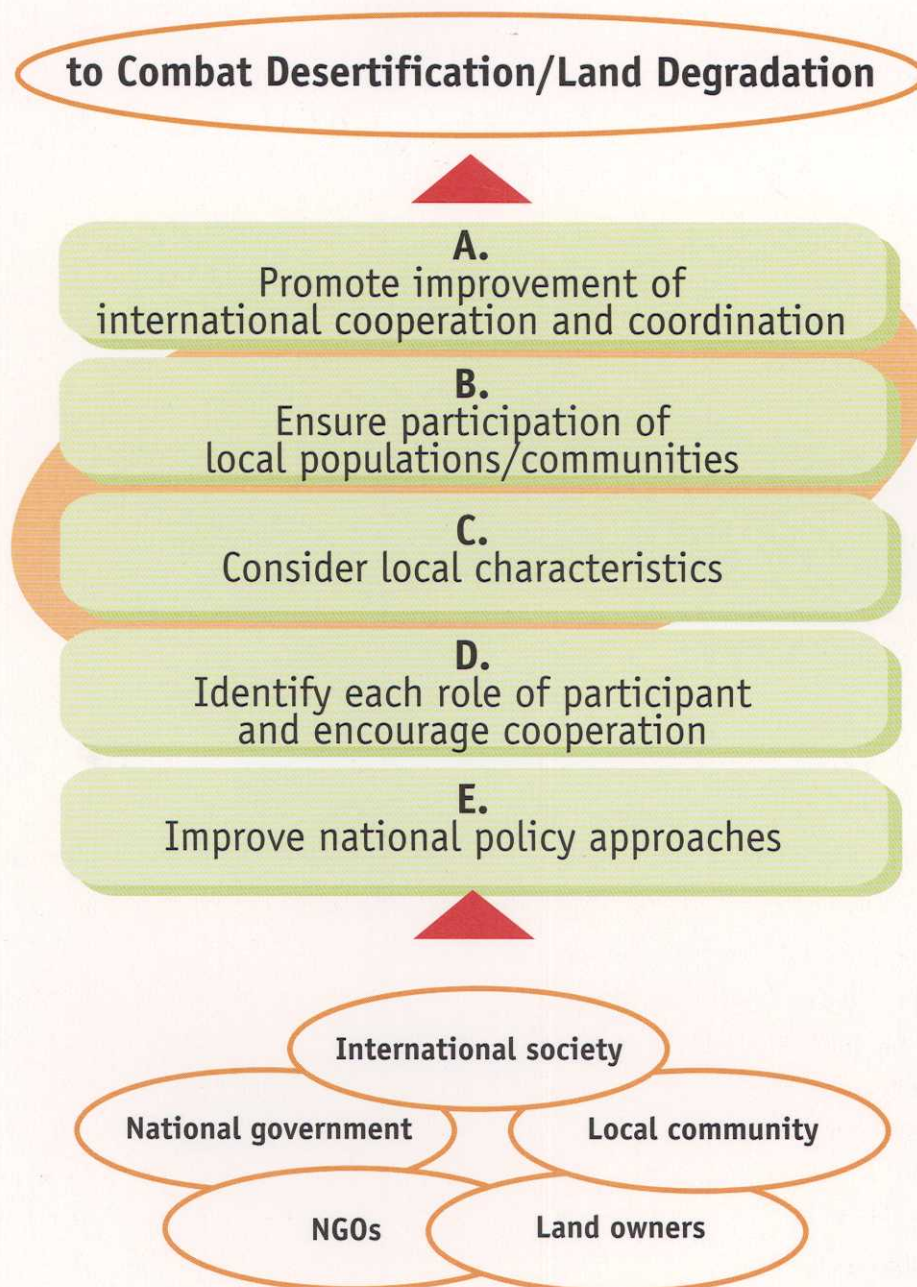


Figure 2-2-1

Required Directions to Combat Desertification/Land Degradation

3.

砂漠化／土地荒廃の定義と概要

Definitions and General Conditions of Desertification/Land Degradation

国際的な定義：

「砂漠化」及び「土地荒廃」には、さまざまな概念が存在し、国際的な定義も変遷してきた。

国連砂漠化会議（UNCOD、1977年）においては、「砂漠化」とは人間活動を主要因とする、乾燥、半乾燥、半湿潤地域における、土地の生産力の減退ないし破壊であるとの合意が得られた。

地球規模土壌劣化評価会議（GLASOD、1990年）においては、「砂漠化」と並んで「土地荒廃」の用語が並記され、評価を行うという観点から、「砂漠化／土地荒廃」とは不適切な人間活動に起因する、乾燥、半乾燥、乾燥半湿潤地域にみられる土地の荒廃であると定義された。

国連環境開発会議（1992年）及び砂漠化防止条約（1994年）では、「砂漠化」とは、乾燥、半乾燥及び乾燥半湿潤地域における種々の要素（気候変動及び人間の活動を含む）に起因する土地の劣化をいう、と定義された。

また同条約では、「干ばつ」及び「土地の劣化」についての定義も示している。

本データブックにおける定義：

本データブックでは、乾燥地域における土地の生産性の劣化が、主として自然と人間活動との相互作用により生じること、及び、その影響が多面かつ長期間にわたる点に注目することから、砂漠化／土地荒廃の二語を併記することとした。

International Definition:

The terms 'desertification' and 'land degradation' have been used with various meanings, for which internationally accepted definitions have evolved over time.

The United Nations Conference on Desertification (UNCOD) in 1977 defined desertification as "the diminution or destruction of the biological potential of land in arid, semi-arid and sub-humid areas mainly due to human activities."

The Global Assessment on Soil Degradation (GLASOD) in 1990 stated that "desertification/land degradation, in the context of assessment, is land degradation in arid, semi-arid and dry sub-humid areas resulting mainly from human activities."

At the United Nations Conference on Environment and Development (UNCED) in 1992 and in the Convention to Combat Desertification in 1994, it was stated that "desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climate variations and human activities."

The Convention also defined drought and land degradation.

Definition in this Databook:

This databook uses both Desertification and Land Degradation to refer to the deterioration in productivity of dryland caused by the interaction between natural and human activities.

United Nations Conference on Desertification (UNCOD, 1977)

"Desertification is the diminution or destruction of the biological potential of land, and can lead ultimately to desert like conditions. It is an aspect of the widespread deterioration of ecosystems, and has diminished or destroyed the biological potential, i.e. plant or animal production, for multiple use purposes at a time when increased productivity is needed to support growing populations in quest of development."

Global Assessment of Desertification (GLASOD, 1990)

"Desertification/land degradation, in the context of assessment, is land degradation in arid, semi-arid and dry sub-humid areas resulting mainly from human activities."

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

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

UNCED/Agenda 21 (1992) & Convention to Combat Desertification (CCD, 1994)

"Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climate variations and human activities."

"Drought means the naturally occurring phenomenon that exist when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalance that adversely affects land resource production system."

"Land degradation means reduction or loss in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as:

soil erosion caused by wind and/or water;

deterioration of the physical, chemical and biological or economic properties of soil; and

long-term loss of natural vegetation

This definition has been internationally negotiated and approved at UNCED as the operational standard for Agenda 21 as well as Convention to Combat Desertification."

Figure 3-1A-1 Changes of Definition of "Desertification"

砂漠化／土地荒廃は、主として乾燥地域に影響を及ぼす。乾燥地域を定義するにはいくつかの方法があるが、最も簡便な方法は、平均的な気候条件における湿度の欠乏状況を示す乾燥度によるものである。

乾燥地域は、通常以下に示すような、平均年間降水量（P）と可能蒸発散量（PET）の比で示される乾燥度指数（AI）で区分される。

PETとは、十分な水分があると仮定した時に、地表及び植生から蒸発散し得る最大の蒸発散量を言う。

全世界の陸域の1/3以上に当たる、61億ha近い地域が乾燥地域である。右ページの表は、最も乾燥地域の面積が広い大陸はオーストラリアであり、全面積の75%を乾燥地域が占めていること、次いでアフリカ（66%）、アジア（46%）と続くことを示している。

全乾燥地域の16%に当たる約1億haは極乾燥地域であり、生物生産性が非常に低く、主としてアフリカに広くみられる。その他の51億haは乾燥地域、半乾燥地域、乾燥半湿潤地域からなる。これらの乾燥地域の約3/4において、何らかの荒廃が生じているとみられている。アフリカにおける影響が最も深刻であるが、南米、インド、西アジア、オーストラリア、さらには欧州地中海地方や北米においても、影響を受けている地域が多くみられる。

Desertification/land degradation most severely threaten the world's drylands. Drylands may be defined in several ways but the simplest way is to use a measure of aridity which represents a lack of moisture in the average climatic conditions.

Drylands can be classified using the Aridity Index (AI), or dryness ratio (P/PET), which is the ratio of the mean annual precipitation (P) and the mean annual potential evapotranspiration (PET).

PET is the maximum amount of moisture which can evaporate from a surface and transpire through vegetation under given atmospheric conditions, assuming there is no limit to the amount of moisture available.

Drylands cover more than 6.1 billion ha of the Earth's surface, more than one third of its land area. The table on the right shows that the driest continent is Australia, which is 75% covered by drylands, followed by Africa (66%) and Asia (46%).

Nearly one billion ha or 16% of the world's total drylands, are naturally hyper-arid deserts, with very low biological productivity. These areas can be mainly found in Africa. The remaining 5.1 billion ha are arid, semi-arid and dry sub-humid areas, part of which have become desert, while other parts are still being degraded by human activities today. It is estimated that about three-quarters of the drylands are already degraded to some degree. While much of Africa is severely affected, so too are many other regions, including much of South America, India, Western Asia, Australia and even Mediterranean regions in Europe, and North America.

Table 3-1B-1 Aridity Zone and Aridity Index

Aridity Zone	Aridity index (AI)	% of world covered
Hyper-arid	$AI < 0.05$	7.5
Arid	$0.05 \leq AI < 0.20$	12.1
Semi-arid	$0.20 \leq AI < 0.50$	17.7
Dry sub-humid	$0.50 \leq AI < 0.65$	9.9
Humid	$AI \geq 0.65$	39.2
Cold		13.6

Source: adopted from World Atlas of Desertification (UNEP, 1992)

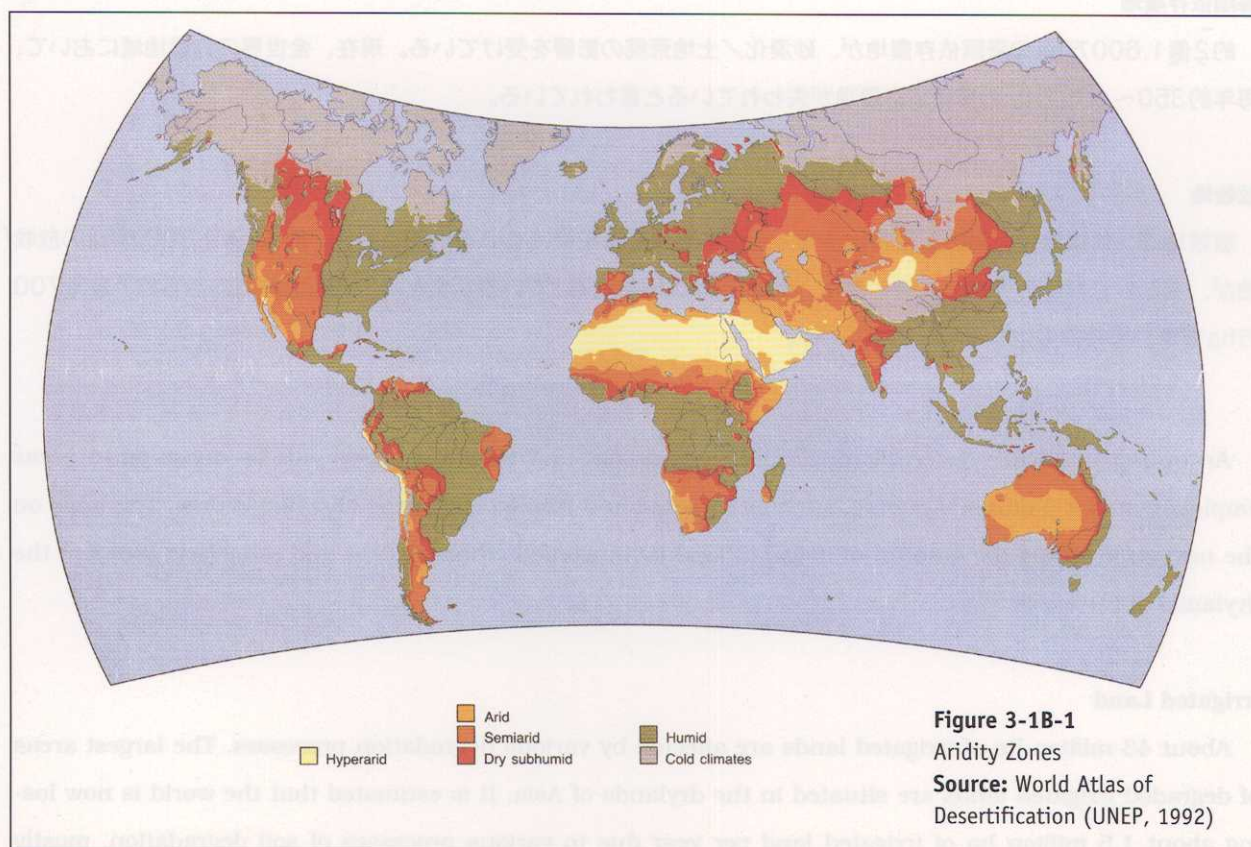


Table 3-1B-2 Aridity Zone by Region (million ha)

Zone	Region						Total
	Africa	Asia	Australasia	Europe	North America	South America	
Hyper-arid	672.0	277.3	0.0	0.0	3.1	25.7	978.1
Arid	503.5	625.7	303.0	11.0	81.5	44.5	1569.2
Semi-arid	513.8	693.4	309.0	183.5	419.4	264.5	2305.3
Dry sub-humid	268.7	352.7	51.3	105.2	231.5	207.0	1294.7
Humid	1007.6	1224.3	218.9	622.9	838.5	1188.1	5100.4
Cold	0.0	1082.5	0.0	27.9	616.9	37.7	1765.0
Total	2965.6	4256.0	882.2	950.5	2190.9	1767.5	13012.7

Source: World Atlas of Desertification (UNEP, 1992)

3-2

砂漠化／土地荒廃の概要

General Conditions of Desertification/Land Degradation

UNEPによると、砂漠化／土地荒廃は、灌漑農地、降雨依存農地、放牧地などの地域において、特に広く見られる現象である。次ページの表は、世界の乾燥地域における灌漑農地（6%）、降雨依存農地（9%）、放牧地（88%）の状況を示す。

灌漑農地

灌漑農地のうち、約4,300万haが砂漠化／土地荒廃の影響を受けている。このうち、最も広範囲に影響を受けている灌漑農地は、アジアの乾燥地域に存在する。現在全世界では、毎年約1,500万haの灌漑農地が、主として塩類化などの土壌荒廃により失われていると言われている。

降雨依存農地

約2億1,600万haの降雨依存農地が、砂漠化／土地荒廃の影響を受けている。現在、全世界の乾燥地域において、毎年約350～400万haの降雨依存農地が失われていると言われている。

放牧地

放牧地は、乾燥地域において最も砂漠化／土地荒廃の影響を受けている地域である。約33億3,300万haの放牧地が、主として植生の劣化による砂漠化／土地荒廃の影響を受けている。また、これらの地域のうち約7億7,700万haでは、土壌の劣化も同時に生じている。

According to UNEP, desertification/land degradation and their processes can be observed in areas employing major land use systems, such as irrigated and rainfed croplands and rangelands. The table on the next page shows the amount of irrigated land (6%), rainfed cropland (9%) and rangeland (88%) in the drylands of the world.

Irrigated Land

About 43 million ha of irrigated lands are affected by various degradation processes. The largest areas of degraded irrigated lands are situated in the drylands of Asia. It is estimated that the world is now losing about 1.5 million ha of irrigated land per year due to various processes of soil degradation, mostly salinization.

Rainfed cropland

Nearly 216 million ha of rainfed croplands are affected by degradation processes. 3.5-4 million ha of rainfed croplands are currently lost every year throughout the world's drylands.

Rangelands

Rangelands are the worst affected dryland areas. About 3,333 million ha of rangelands are affected by degradation, particularly that of vegetation, and some 777 million ha of these lands are also affected by soil degradation.

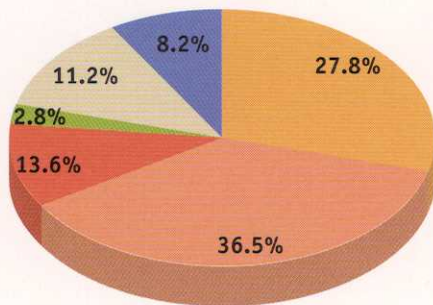


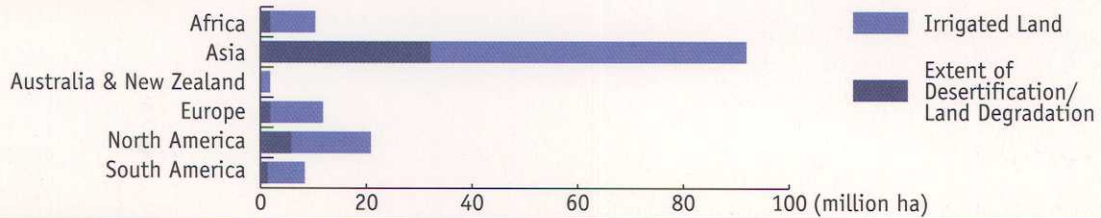
Figure 3-2-1

Global Status of Desertification/Land Degradation in Agriculturally Used Drylands (%)

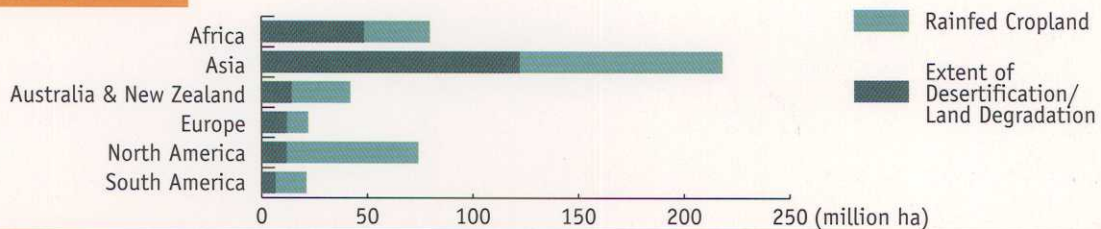
Source:

adopted from Desertification Bulletin, No.20 (1991)

Irrigated Land



Rainfed Cropland



Rangeland

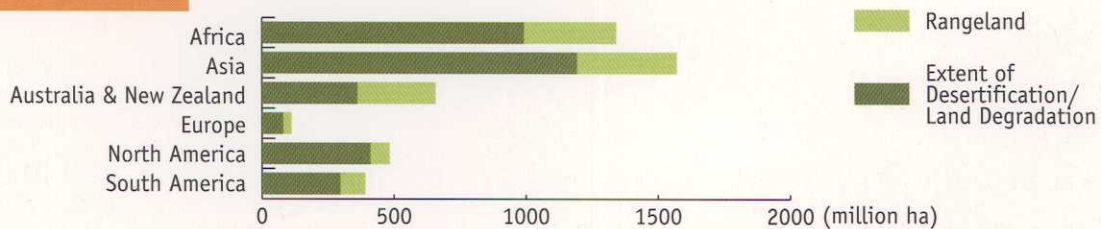


Figure 3-2-2

Land Use and Extent of Desertification/Degradation in Drylands of the World

Source:

adopted from H.E.Dregne: Global Status of Desertification IN: Annals of Arid Zones 30 (3), 1991

4.

砂漠化／土地荒廃の要因と影響

Causes and Impacts of Desertification/Land Degradation

風食による土壌侵食は、土壌粒子が、浮遊、表層のクリープ、サルテーション（浮動、躍動）などの作用を受けて、数cmから数kmに渡って移動することにより生じる。風食の程度は、風が粒子を運ぶ「侵食性」と、土壌表層の風力に対する感受性である「被侵食性」との相互作用により異なる。

風食は、次のような状況と相関がある。

- ・ 降雨
- ・ 高温
- ・ 強風
- ・ 年内の一定の時期に植被がないこと

これらのことから、風食は乾燥地域、半乾燥地域のみならず、より湿度の高い地域であっても、風の強い時期に乾燥もしくは半乾燥地的環境になる地域においては、深刻な問題となっている。

土壌の風食への抵抗性が高い場合であっても、次のような状況の場合には風食の影響を受ける。

- ・ 動物の踏み固めによる影響を受けている。
- ・ 耕作により土壌が弛んでいる。
- ・ 人及び動物の通行により土壌が粉碎されている。
- ・ 農耕及び野火の影響により植生が破壊され、裸地化している。

Soil erosion caused by wind erosion occurs when wind transports soil particles by suspension, surface creep or saltation over distances from a few centimeters to many kilometers. It depends upon two factors: the ability of the wind to carry particles, its "erosivity" and the susceptibility of the soil surface to erosion, its "erodibility".

Wind erosion is greatest under the following conditions:

- scarce rainfall,
- high temperatures,
- high wind velocity, and
- lack of vegetation cover for significant parts of the year.

Accordingly, wind erosion is a serious problem not only in arid and semi-arid areas, but also in moister areas where combinations of arid or semi-arid conditions occur during periods of high wind velocity.

Even soils resistant to wind erosion can be affected if they are

- compacted by trampling of animals,
- loosened by ploughing and tillage,
- broken up by human and animal traffic, and
- exposed to the air due to vegetation destruction.

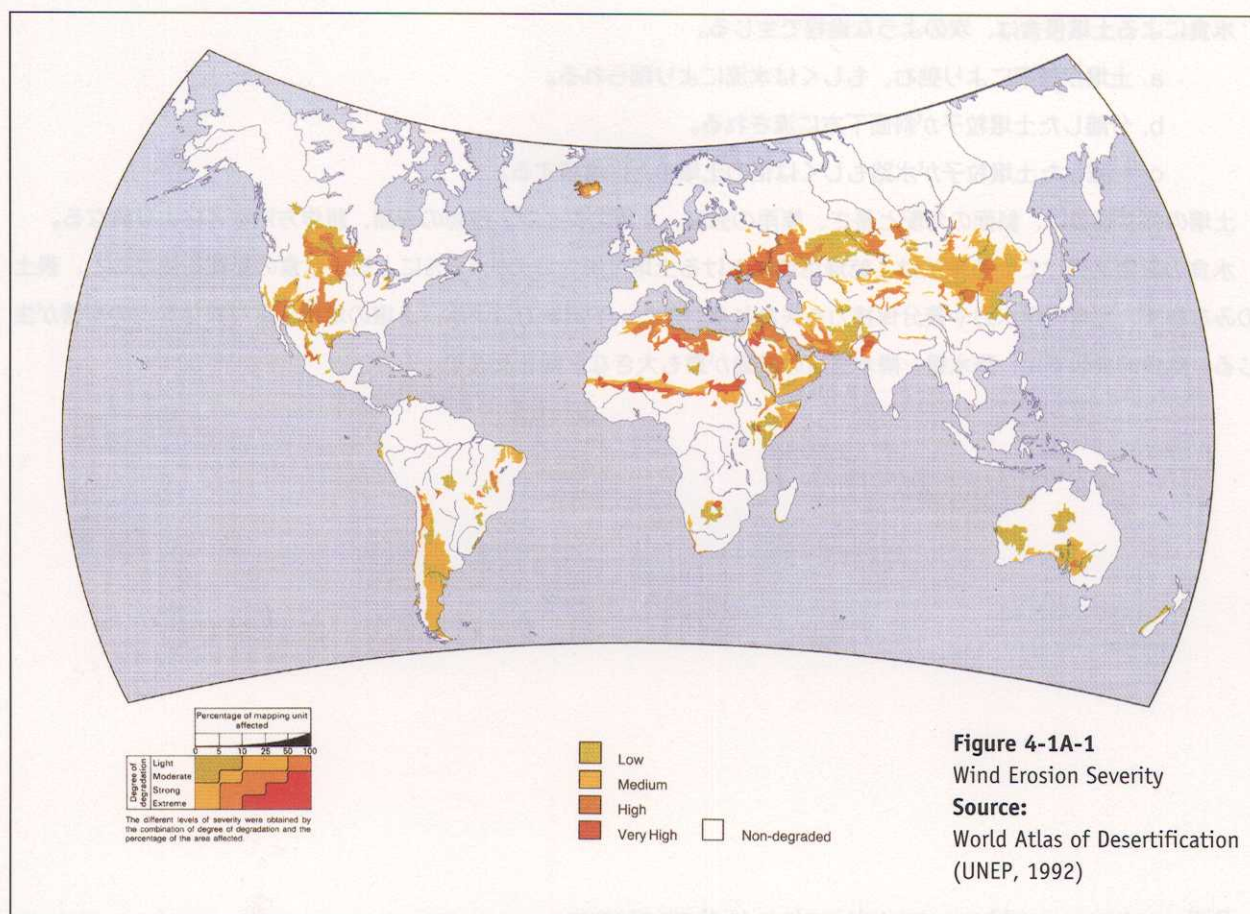


Table 4-1A-1 Degree of Wind Erosion by Region in Susceptible Dryland Areas (million ha)

Degree*	Africa	Asia	Australasia**	Europe	North America	South America	Total
Light	78.1	80.5	15.9	1.3	2.6	18.8	197.2
Moderate	74.2	62.9	0.0	36.6	33.6	8.1	215.4
Strong	6.6	9.7	0.1	0.0	1.6	0.0	18.0
Extreme	1.0	0.1	0.0	0.7	0.0	0.0	1.8
Total	159.9	153.2	16.0	38.6	37.8	26.9	432.4

Source: World Atlas of Desertification (UNEP, 1992)

*Degree:

- Light:** The terrain is suitable for use in local farming systems, but with somewhat reduced agricultural productivity. Restoration to full productivity is possible by modifications of the management system. The original biotic functions are still largely intact.
- Moderate:** The terrain is still suitable for use in local farming systems, but with greatly reduced agricultural productivity. Major improvements are required to restore productivity (such as draining for waterlogged or salinized land, or contour banks for eroded land). The original biotic functions are partially destroyed.
- Strong:** The terrain is not reclaimable at the farm level. Major engineering works are required for terrain restoration. The original biotic functions are largely destroyed.
- Extreme:** The terrain is not reclaimable and impossible to restore. The original biotic functions are completely destroyed. The importance of the land use in question should be noted here. While a moderately degraded soil, for example, may require major structural alterations to restore productivity under one particular land use, for a less demanding land use the alterations required may be less intensive.

**Australasia: Australia, New Zealand and neighboring islands

水食による土壌侵食は、次のような過程で生じる。

- a. 土壌が降雨により弛む、もしくは水流により削られる。
- b. 分離した土壌粒子が斜面下方に流される。
- c. 分離した土壌粒子が水路もしくは他の土壌の上に堆積する。

土壌の侵食速度は、斜面の勾配と長さ、降雨の強度、土壌のタイプ、作物の種類、耕作方法などにより異なる。

水食の影響を受けている地域は、乾燥地域における土壌荒廃地域の約48%に上る。水食の影響を受けると、表土のみならず、土壌の保水力や養分保持力も失われる。また、下流域では洪水、土壌の堆積、富栄養化などの影響が生じる。気候的要因では、降水量、降水強度の変動が最も大きな影響を及ぼす。

Soil erosion caused by water takes place in three stages:

- a. Soil particles are loosened by rainwater or when running water produces a scouring action.
- b. Detached soil particles are washed downhill or downstream.
- c. The detached soil is deposited either in waterways or on top of other soils.

The rate of soil erosion depends on the steepness and the length of the slope, the intensity of rainfall, the type of soil and crop, and tillage methods.

Water erosion affects 48% of the total degraded land area in the susceptible drylands. This kind of erosion results in not only increased loss of topsoil but also loss of water and nutrient storage capacity. It has downstream effects of flooding, siltation and eutrophication. Changes in the frequency and intensity of precipitation are the most important weather-related factors affecting soil erosion.

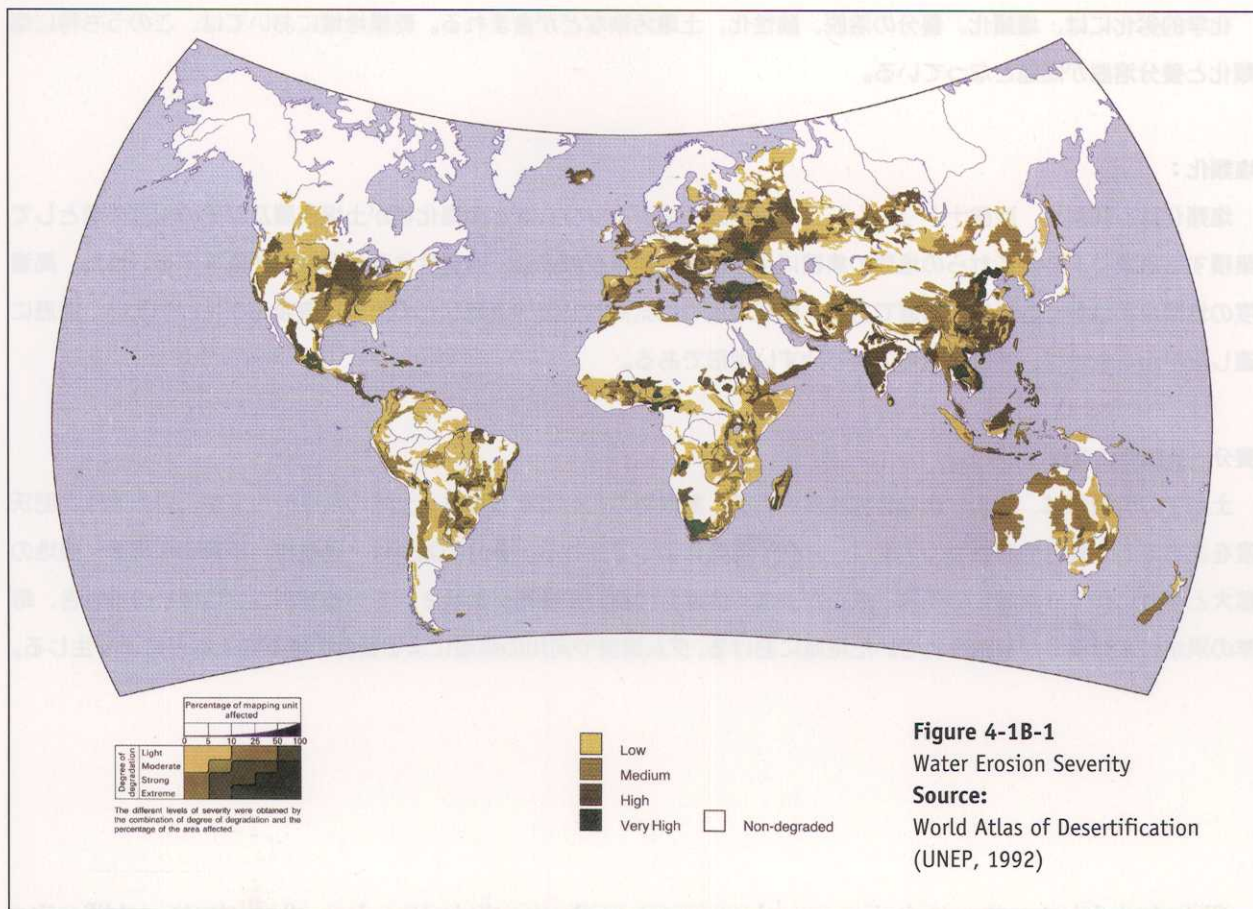


Table 4-1B-1 Degree of Water Erosion by Region in Susceptible Dryland Areas (million ha)

Degree*	Africa	Asia	Australasia**	Europe	North America	South America	Total
Light	28.5	49.6	67.5	6.4	10.3	12.8	175.1
Moderate	36.6	91.2	2.1	38.0	23.9	16.7	208.5
Strong	51.5	16.7	0.0	1.4	4.2	5.2	79.0
Extreme	2.5	0.0	0.0	2.3	0.0	0.0	4.8
Total	119.1	157.5	69.6	48.1	38.4	34.7	467.4

Source: World Atlas of Desertification (UNEP, 1992)

***Degree:**

Light: the terrain is suitable for use in local farming systems, but with somewhat reduced agricultural productivity. Restoration to full productivity is possible by modifications of the management system. The original biotic functions are still largely intact.

Moderate: the terrain is still suitable for use in local farming systems, but with greatly reduced agricultural productivity. Major improvements are required to restore productivity (such as draining for waterlogged or salinized land, or contour banks for eroded land). The original biotic functions are partially destroyed.

Strong: the terrain is not reclaimable at the farm level. Major engineering works are required for terrain restoration. The original biotic functions are largely destroyed.

Extreme: the terrain is not reclaimable and impossible to restore. The original biotic functions are completely destroyed. The importance of the land use in question should be noted here. While a moderately degraded soil for example may require major structural alterations to restore productivity under one particular land use, for a less demanding land use the alterations required may be less intensive.

****Australasia:** Australia, New Zealand and neighboring islands

化学的劣化には、塩類化、養分の溶脱、酸性化、土壌汚染などが含まれる。乾燥地域においては、このうち特に塩類化と養分溶脱が問題となっている。

塩類化：

塩類化は、硫酸塩、炭酸ナトリウム、カルシウム、マグネシウムなどの塩化物が土壌表層及びその付近に塩として集積する現象である。これらの塩類の集積により土壌の間隙が減少し、通気性や養分保持力が低下する。また、高濃度の塩類集積は多くの植物に有害である。乾燥地域では気候的要因や灌漑などのため、塩類化が生じやすい。灌漑に適した平坦な低地は、特に塩類化の生じやすい地形である。

養分・有機物の溶脱：

土壌中の有機物は、さまざまな分解程度の有機・無機物の化合物からなり、土地の潜在的生産性、耕作適性、肥沃度を左右する。養分や有機物の溶脱は、水食や風食によって生じる。養分の減少は、過耕作、不適切な施肥、農地の拡大とそれに伴う自然植生の伐採、表土が少なく大部分の養分が植物に蓄積されているサバンナ地帯での野焼き、毎年の洪水により養分が補給されていた地域における、ダム建設や河川の築堤による養分の補給停止などにより生じる。

Chemical deterioration includes several processes such as salinization, loss of nutrients, acidification and pollution. Salinization and loss of nutrients are particularly important in drylands.

Salinization:

Salinization refers to the surface or near-surface accumulation of salts, mainly chlorides, sulfates and carbonates of sodium, calcium and magnesium. Such salt accumulation reduces the soil pores and the ability to hold air and nutrients. High salt concentrations can be toxic to many plants. Drylands can be susceptible to salinization due to factors such as climate and irrigation. Flat, low-lying areas, which are generally suitable for irrigation, are particularly vulnerable to soil salinization.

Depletion of nutrients or organic matter:

Organic matter in soil is a heterogeneous mixture of living, dead, and decomposing organic and inorganic compounds, and determines potential productivity, suitability for cultivation and fertility. Depletion of nutrients or organic matter can be caused by water erosion or wind erosion. Nutrient loss may also occur through over-cultivation and the improper application of fertilizers; expansion of cultivated area and its intensification causing a reduction of natural vegetation; burning in savanna areas in poor soils, where much of the nutrients are stored in plants rather than in soil; and where the replenishment of soil fertility by annual flooding is prevented by dam construction or flood control structures.

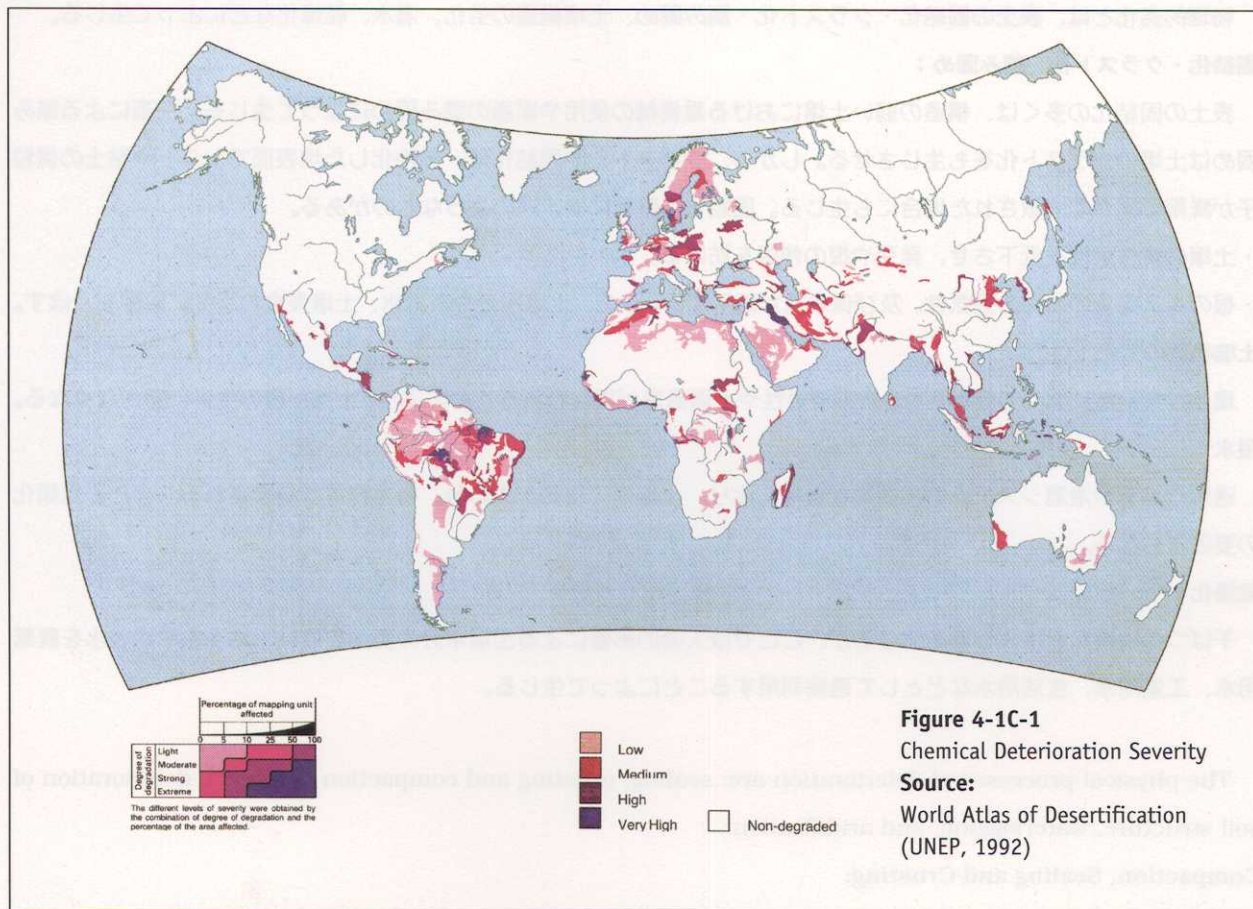


Table 4-1C-1 Degree of Chemical Deterioration by Region in Susceptible Dryland Areas (million ha)

Degree*	Africa	Asia	Australasia**	Europe	North America	South America	Total
Light	10.2	22.2	0.0	1.5	0.3	10.1	44.3
Moderate	10.4	11.1	0.2	2.2	1.3	6.2	31.4
Strong	5.9	16.5	0.0	0.4	0.6	0.7	24.1
Extreme	0.0	0.4	0.4	0.0	0.0	0.0	0.8
Total	26.5	50.2	0.6	4.1	2.2	17.0	100.6

Source: World Atlas of Desertification (UNEP, 1992)

***Degree:**

- Light:** the terrain is suitable for use in local farming systems, but with somewhat reduced agricultural productivity. Restoration to full productivity is possible by modifications of the management system. The original biotic functions are still largely intact.
- Moderate:** the terrain is still suitable for use in local farming systems, but with greatly reduced agricultural productivity. Major improvements are required to restore productivity (such as draining for waterlogged or salinized land, or contour banks for eroded land). The original biotic functions are partially destroyed.
- Strong:** the terrain is not reclaimable at the farm level. Major engineering works are required for terrain restoration. The original biotic functions are largely destroyed.
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****Australasia:** Australia, New Zealand and neighboring islands

物理的劣化とは、表土の固結化・クラスト化・踏み固め、土壌構造の劣化、湛水、乾燥化などによって生じる。

固結化・クラスト化・踏み固め：

表土の固結化の多くは、構造の弱い土壌における重機械の使用や家畜の踏み固めによって生じる。家畜による踏み固めは土壌のクラスト化をも生じさせる。しかし、クラスト化や固結化は、裸地化した地表面でシルトや粘土の微粒子が降雨によって分散された場合にも生じる。固結化の影響には、次のようなものがある。

- ・土壌の耕作適性を低下させ、発芽や根の伸張を妨げる。
- ・根のガス交換のための通気性、及び保水力が低下する。また、土壌水分や表流水、土壌侵食の程度に影響を及ぼす。

土壌構造の劣化：

塩水が蒸発散によって濃縮され、水の浸透性や土壌構造が損なわれることにより、土壌が根の生長に適さなくなる。

湛水：

過剰な灌漑や灌漑システムの不適切な管理により、土壌中の空気が失われ、有害物質が蓄積される。また、塩類化の要因ともなる。

乾燥化：

干ばつの継続などによっても生じるが、ここでは人為的影響による土壌水分の変化を言い、地下水や地表水を農業用水、工業用水、生活用水などとして過剰利用することによって生じる。

The physical processes of deterioration are: sealing, crusting and compaction of topsoil, deterioration of soil structure, waterlogging, and aridification.

Compaction, Sealing and Crusting:

The most common causes of compaction are the use of heavy machinery and trampling by livestock on soils with low structural stability. Livestock trampling can also lead to crusting, but crusting and sealing are mainly caused by the clogging of soil pores by fine grained silt and clay particles dispersed by rain-drop impact. These processes may cause the following impacts:

- They reduce the suitability of arable soil for cultivation, and impede or delay the emergence of seedlings and the penetration of roots.
- Oxygen and carbon dioxide exchange between the root zone and the atmosphere is retarded, and the soil's water infiltration capacity is diminished, affecting soil moisture properties and causing surface runoff and often severe erosion.

Deterioration of soil structure:

This occurs when saline water in the soil is concentrated by evaporation and results in an impermeable, structureless soil which is unfavorable to root development.

Waterlogging:

This results from inadequate irrigation and poorly managed irrigation systems and leads to the loss of the soil's air content and the accumulation of toxic substances. It also causes salinization problems.

Aridification:

Though it also results from continuous drought, aridification is the human-induced change of the soil moisture regime, and may be caused by the lowering of the groundwater level and surface water through excessive consumption of water for agriculture, industry and household use.

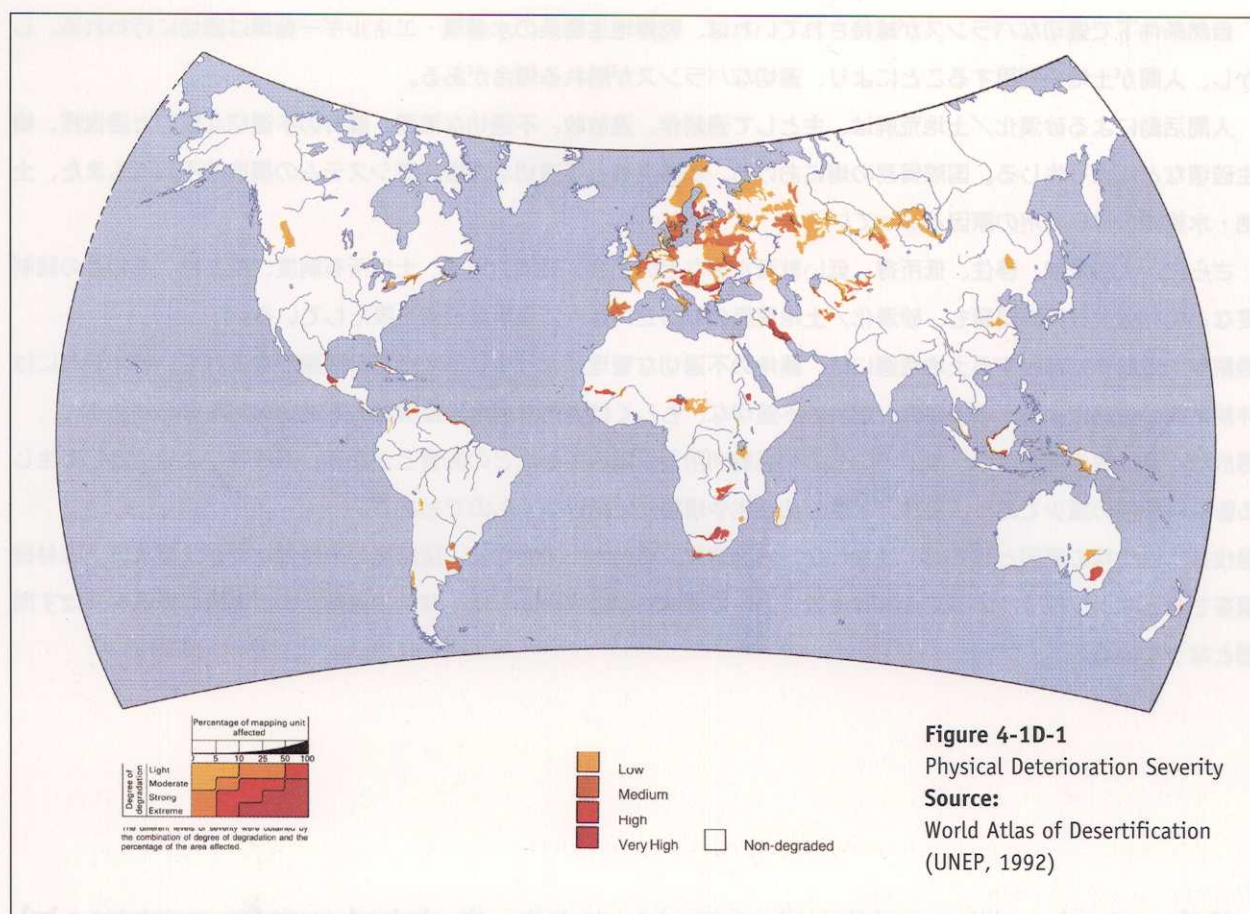


Table 4-1D-1 Degree of Physical Erosion by Region in Susceptible Dryland Areas (million ha)

Degree*	Africa	Asia	Australasia**	Europe	North America	South America	Total
Light	1.2	4.4	0.2	4.8	0.2	0.0	10.8
Moderate	6.0	5.0	0.0	3.8	0.0	0.2	15.0
Strong	6.7	0.2	1.0	0.0	0.8	0.2	8.9
Extreme	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	13.9	9.6	1.2	8.6	1.0	0.4	34.7

Source: World Atlas of Desertification (UNEP, 1992)

***Degree:**

- Light:** the terrain is suitable for use in local farming systems, but with somewhat reduced agricultural productivity. Restoration to full productivity is possible by modifications of the management system. The original biotic functions are still largely intact.
- Moderate:** the terrain is still suitable for use in local farming systems, but with greatly reduced agricultural productivity. Major improvements are required to restore productivity (such as draining for waterlogged or salinized land, or contour banks for eroded land). The original biotic functions are partially destroyed.
- Strong:** the terrain is not reclaimable at the farm level. Major engineering works are required for terrain restoration. The original biotic functions are largely destroyed.
- Extreme:** the terrain is not reclaimable and impossible to restore. The original biotic functions are completely destroyed. The importance of the land use in question should be noted here. While a moderately degraded soil for example may require major structural alterations to restore productivity under one particular land use, for a less demanding land use the alterations required may be less intensive.

****Australasia:** Australia, New Zealand and neighboring islands

自然条件下で適切なバランスが維持されていれば、乾燥地生態系の水循環・エネルギー循環は適切に行われる。しかし、人間が土地を利用することにより、適切なバランスが崩れる場合がある。

人間活動による砂漠化／土地荒廃は、主として過耕作、過放牧、不適切な灌漑、森林の不適切な管理と過伐採、植生破壊などにより生じる。国際貿易の場における、保護主義と不適切な国際経済システムの構造的不均衡もまた、土地・水資源の過剰利用の原因となっている。

さらに、人口増加、移住、低所得、低い教育水準などの社会・経済的問題、土地所有制度、所有権、その他の諸制度などの社会・政策的問題も、砂漠化／土地荒廃のプロセス進行に重要な役割を果たしている。

過耕作：過耕作に起因する土地荒廃には、農地の不適切な管理により生じるすべての問題が含まれている。それには休耕期間の短縮による土壌の疲弊、肥料の不適切な、もしくは過剰な利用、重機械の不適切な利用などがある。

過放牧：過放牧の影響には、植生そのものの過剰利用と、踏み固めなどの影響とがある。過放牧により主として生じる影響は植被の減少であり、風食、水食の加速化や塩類化に結びつくものでもある。

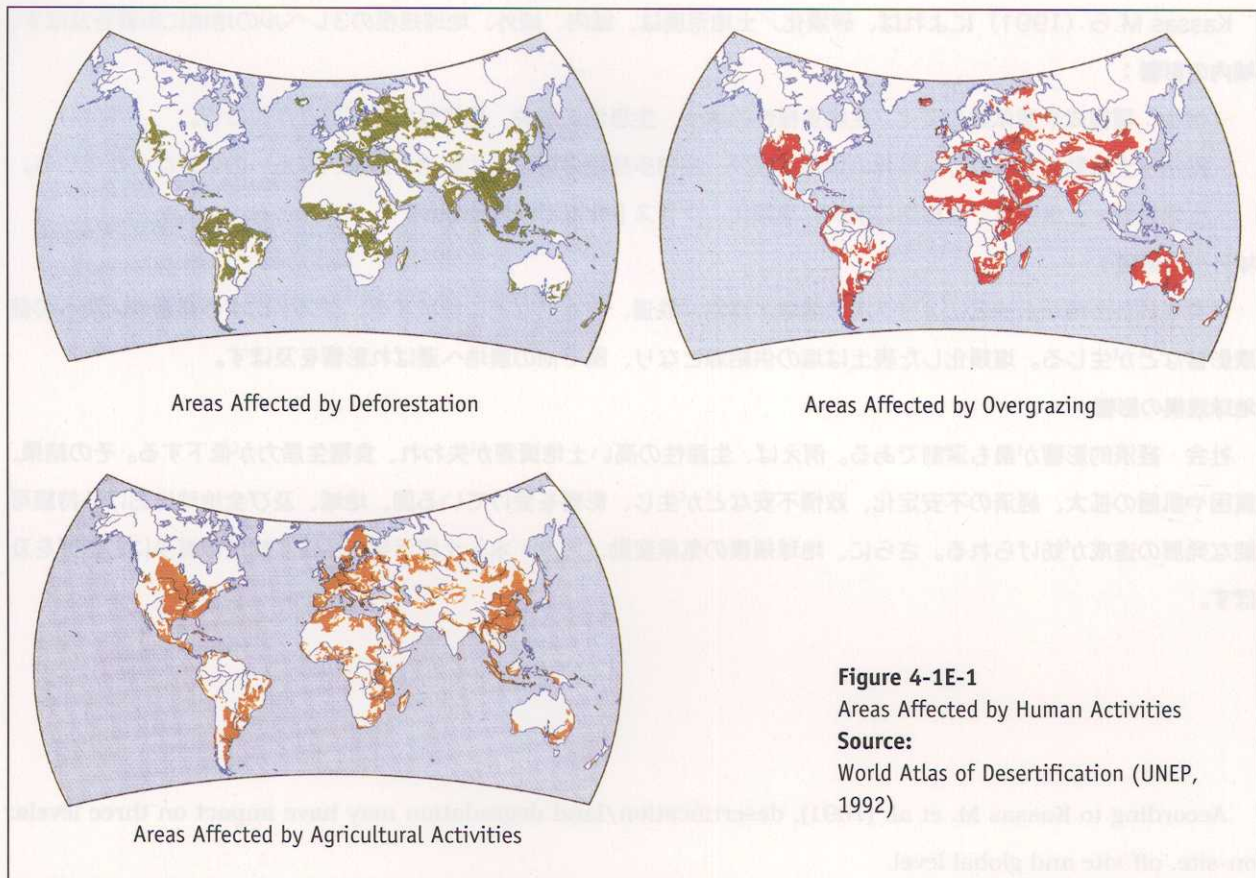
過伐採：過伐採の原因としては、商業伐採、移動耕作、燃料木の需要増加、法制度の未整備などが含まれる。森林破壊をもたらす過伐採は、アジア太平洋地域において右ページの表のように、非常に深刻かつ広範囲に影響を及ぼす問題となっている。

Under natural conditions and through appropriate strategies, the dryland ecosystem maintains a balanced exchange of water and energy, but this equilibrium is often disturbed by human use of land. Degradation mainly results from over-exploitation of land resources through over-cultivation, over-grazing, poor irrigation practices, mismanagement and deforestation and the destruction of woody vegetation. Protectionism and structural imbalances in the international economic system have also contributed to the over-exploitation of land and water resources. Furthermore socio-economic problems such as population growth and migration, low income and educational level as well as socio-political problems such as land tenure, property rights and legislation also play an important role in the desertification process.

Over-cultivation: Activities leading to degradation encompass all aspects of improper agricultural land management. Among these are the shortening of fallow periods in shifting cultivation resulting in soil exhaustion, the improper or excessive use of fertilizers, and the improper use of heavy machinery.

Over-grazing: This includes both the actual overuse of vegetation and other impacts of livestock such as trampling. Overgrazing mainly results in a decrease in the vegetation cover, leading to increased erosion by wind and water, and salinization.

Over-cutting: The major causes of over-cutting include commercial logging, shifting cultivation, increase of fuelwood consumption, and lack of rules and regulations. Over-cutting causing deforestation is the most serious and widespread problem in the Asia-Pacific region as shown in the table on the right page.



Group	Country	Area deforested (1000 ha)	Annual rate of deforestation 1982-1985 (%)
High rate of deforestation with big losses of forest area	Malaysia	255	1.2
	Thailand	252	2.4
	Lao PDR	100	1.2
	Nepal	84	3.9
	Sri Lanka	58	2.1
Low rate of deforestation with big losses of forest area	Indonesia	600	0.5
	India	147	0.2
	Myanmar	105	0.3
	Cambodia	25	0.3
	Papua New Guinea	22	0.1
	Philippines	91	0.7
	Viet Nam	65	0.6

Figure 4-1E-2
Deforestation in Tropical Countries

Source:
UN/ESCAP: State of the Environment in Asia and the Pacific 1990

4-2

砂漠化／土地荒廃の影響

Impacts of Desertification/Land Degradation

Kassas M.ら（1991）によれば、砂漠化／土地荒廃は、域内、域外、地球規模の3レベルの地域に影響を及ぼす。

域内の影響：

- ・ 植物：種構成や個体数の変化、生物多様性の減少、生息地の消失、生産性の低下などが生じる。
- ・ 動物：土壌動物を含む野生動物の個体数減少、生物多様性の減少、生息地の消失、家畜への影響などが生じる。
- ・ 土壌表層：土壌侵食、有機物の消失、塩類化、クラスト化などが生じる。

域外への影響：

侵食された土壌が水や風により下流の農地、道路、鉄道、貯水池などに堆積する。ダストによる家畜や人間への健康影響などが生じる。塩類化した表土は塩の供給源となり、風で他の農地へ運ばれ影響を及ぼす。

地球規模の影響：

社会・経済的影響が最も深刻である。例えば、生産性の高い土地資源が失われ、食糧生産力が低下する。その結果、貧困や飢餓の拡大、経済の不安定化、政情不安などが生じ、影響を受けている国、地域、及び全地球における持続可能な発展の達成が妨げられる。さらに、地球規模の気候変動、大気・水・土壌汚染、生物多様性の減少にも影響を及ぼす。

According to Kassas M. et al. (1991), desertification/land degradation may have impact on three levels: on-site, off-site and global level.

On-site impacts:

- **Flora:** Impacts on flora include changes in structure of species or population, decrease of biodiversity, loss of habitat, reduction of primary productivity, etc.
- **Fauna:** Impacts on fauna include decrease of population of wild animals including soil fauna, biodiversity, habitat, and degradation of livestock, etc.
- **Ground surface:** Impacts on the ground surface include soil erosion, loss of organic matter, salinization, crusting, etc.

Off-site impacts:

Surface deposits are transported by water and wind erosion and pile sediments on downstream sites of productive lands, roads, railways and water reservoirs. Dust affects the health of livestock and people. Salinized surface soils become sources of salt particles and may be wind-carried and affect to other productive farmlands.

Global impacts:

Global socio-economic impacts are serious, such as loss of productive land resources and thus a reduction of global food productivity contributing to the spread of poverty and hunger. Desertification/land degradation cause economic instability and political unrest, hindering the achievement of sustainable development in countries and regions affected and, therefore, in the world as a whole. Moreover, they contribute to global climate change, water, air and soil pollution, and the loss of biodiversity.



Photo 4-2-1
Wind erosion hazards causing sand dunes and sand drifts (*Dechu*) - a threat to land degradation (Jodhpur, India)



Photo 4-2-2
Industrial effluents - seepage of pollution through porous sandy soils affects soil fertility (Jodhpur, India)



Photo 4-2-3
Sand movements affects infrastructure such as railways due to aerodynamic process (Barmer, India)



Photo 4-2-4
Overexploitation of gypsum has created permanent waste-lands - desertification caused by mining at Jamsar (Jodhpur, India)



Photo 4-2-5
Gullies and ravines caused by water erosion and desertification hazards (Jhunjhunu, India)



Photo 4-2-6
Weathering and overgrazing has exposed base rocks and caused land degradation (Jhunjhunu, India)

Source:

Monitoring Desertification and Establishment of Natural Resources Data Base for Selected Northern Districts (ICAR)

5.

国際的な取り組み

International Activities

1974年の国連総会において、砂漠の拡大を抑止し、影響を受けている発展途上国を支援し、経済発展を保証するため、国際社会は具体的かつ迅速な手段を講じる必要がある、との勧告がなされた。この勧告に従い、砂漠化／土地荒廃防止のための国際的な取り組みとして、国連砂漠化会議（UNCOD）が組織された。地球レベル、地域レベル、及びローカルレベルでの研究・諮問に基づき、本会議では、世界の多くの乾燥地域において、生物生産性の漸減と人間の生活レベルの低下とが生じていることが認識された。

砂漠化／土地荒廃は地球規模の問題であり、全大陸において広範な土地と多くの人口に影響を及ぼしていることを受けて、UNCODは砂漠化防止行動計画（PACD）を採択した。本行動計画は、同年の国連総会において主要な国際的プログラムとして承認された。

行動計画には、以下の3つの基本原則がある：

- ・ 砂漠化プロセスの阻止
- ・ 生態学的に健全かつ生産的な土地利用の確立
- ・ 砂漠化の影響を受けているコミュニティの社会・経済的進歩

PACDの勧告は非常に広い範囲の問題をカバーするものであり、住民、政府、地域及び準地域の諸組織、国際的なコミュニティの参加を求めている。

PACDの勧告には、右ページに示したようなものがある。

In 1974, the United Nations General Assembly recommended that the international community undertake concrete and speedy measures to stem the spread of deserts and to assist the developing countries affected by the phenomenon to ensure the economic development of the areas affected. A decision of the General Assembly initiated international actions to combat desertification/land degradation and to convene a United Nations Conference on Desertification (UNCOD). On the basis of preceding extensive global, regional and local studies and consultations, the Conference noted the progressive decrease of biological productivity and decline of human living conditions in many arid regions of the world.

Concluding that desertification/land degradation was global and adversely affecting large areas and populations on all continents, UNCOD adopted the Plan of Action to Combat Desertification (PACD), which was endorsed by the United Nations General Assembly that same year as one of its major world programmes. There are three principles for action:

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

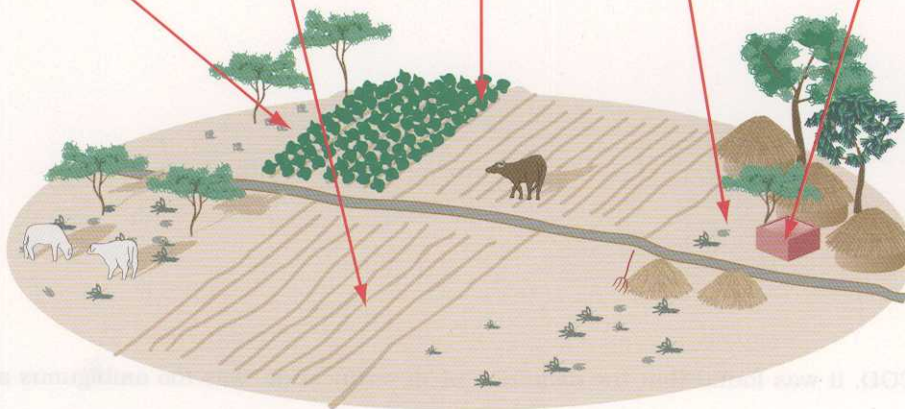
The recommendations contained in PACD are very wide-ranging and call for action from the public, governments, sub-regional and regional institutions and the international community.

The specific recommendations of PACD include those indicated on the right page.

PACD recommendations were:

Preventive, Corrective and Rehabilitation Measures

2. To develop and introduce appropriate, improved agricultural and pastoral technologies that are socially and environmentally acceptable and economically feasible.
3. To establish adequate communication infrastructure and sufficient processing and marketing facilities.
4. To develop appropriately available water resources and to introduce improved water management systems.
5. To reclaim for productive use or to protect effectively for natural rehabilitation, as appropriate, severely desertified lands.
1. To introduce improved land use systems.



Supporting Measures

6. To establish or to strengthen, as appropriate, the national institutional capabilities for implementing PACD.
7. To launch nationally a major sustained anti-desertification awareness/training campaign.
8. To introduce a "loop model" into the existing or newly established extension services.
9. To finalize the operative large-scale local and national assessment of the current status of desertification.
10. To develop and adopt appropriate national legislation and new environmentally sound and development-oriented land use policies and introduce these institutionally.
11. To develop and introduce effective national insurance schemes against recurrent drought and famine.

Figure 5-1-1

Specific Recommendations of PACD

Source: Status of desertification and implementation of the United Nations Plan of Action to Combat Desertification (UNEP, 1991)

UNCOD以降、「砂漠化」という言葉の定義があまり明確ではないこと、そのため、砂漠化とは即ち「砂漠」の拡大であるとの、誤った解釈がなされるようになってきたことが認識されるようになった。

1990年に、UNEPは砂漠化／土地荒廃評価の現状と方法に関する「地球規模土壌劣化評価会議 (GLASOD)」を開催した。ここには砂漠化／土地荒廃に関する多くの専門家が参加した。

GLASODの会議においては、評価という観点から砂漠化／土地荒廃についての新たな定義が定められた。即ち、「不適切な人間活動に起因する乾燥、半乾燥、乾燥半湿潤地域にみられる土地の荒廃である」との定義である。

また、UNEPは国際土壌情報センター (ISRIC) と協力し、オランダにおいて1990年に土壌荒廃図を作成した。これは1992年にUNEPから刊行された「世界砂漠化地図」の基礎資料となったものでもある。さらに、土壌荒廃に関する2つのデータベースが整備されている。1つは地球規模のものであり、もう一つはアフリカに関するデータである。これらの中には土壌劣化の種類、程度、早さ及び要因がより詳細に示されている。

After the UNCOD, it was found that the definition of 'desertification' was too ambiguous and that misunderstandings occurred between the terms 'desertification/land degradation' and 'expansion of desert'.

In 1990, UNEP held a meeting for Global Assessment on Soil Degradation (GLASOD) to assess the status of and methodologies concerning desertification/land degradation. Many specialists and consultants on desertification/land degradation participated in the meeting.

At this meeting, new definitions of land degradation and desertification were adopted: "Desertification/land degradation, in the context of assessment, is land degradation in arid, semi-arid and dry sub-humid areas resulting mainly from human activities."

UNEP, in collaboration with the International Soil Reference and Information Centre (ISRIC) in the Netherlands, produced data on soil degradation and maps in 1990 to be used in preparation of the World Atlas of Desertification (UNEP, 1992). Two soil degradation databases were prepared: one is of global extent; the other, which is more detailed, is specific to Africa. Variables mapped include soil degradation type, extent, rate and causes.

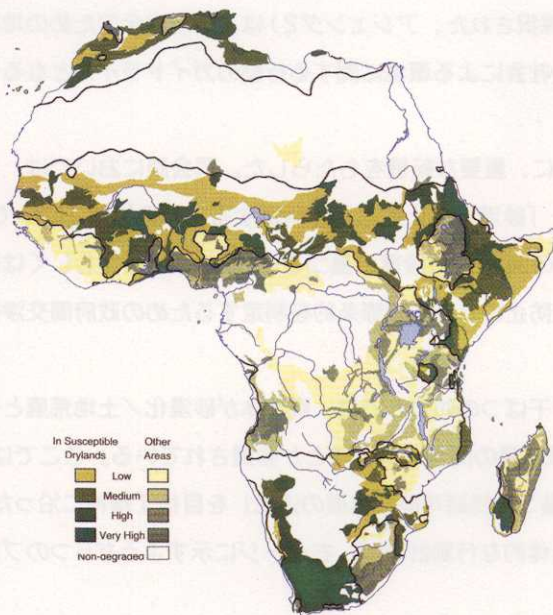


Figure 5-2-1
Water Erosion Severity

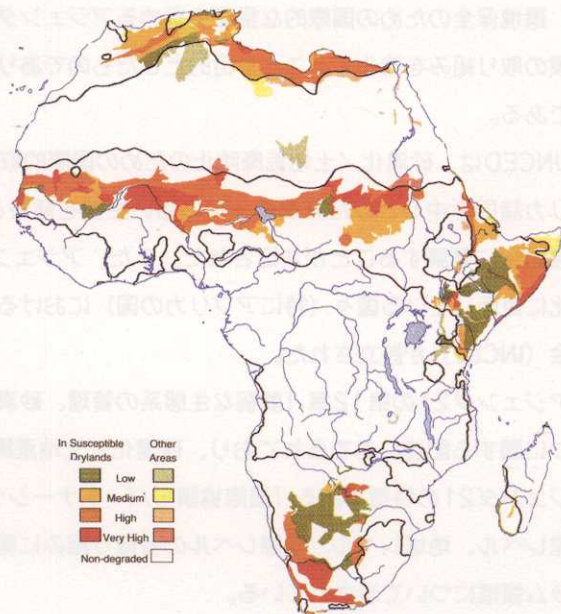


Figure 5-2-2
Wind Erosion Severity

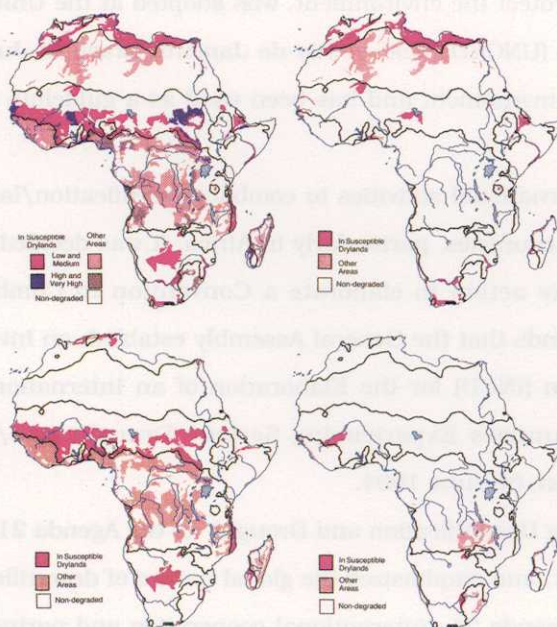


Figure 5-2-3
Chemical Deterioration Severity (upper left),
Salinization (upper right),
Loss of Nutrients (lower left),
Acidification (lower right)

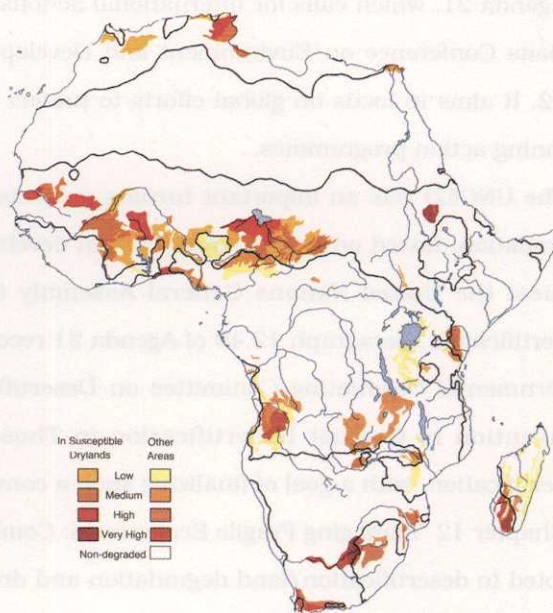


Figure 5-2-4
Physical Deterioration Severity

Source:
World Atlas of Desertification (UNEP, 1992)

1992年6月、ブラジルのリオデジャネイロにおいて開催された国連環境開発会議（UNCED：地球サミット）では、環境保全のための国際的な措置を求めるアジェンダ21が採択された。アジェンダ21は、環境保全のための地球規模の取り組みを強化することを目的としたものであり、国際社会による環境に関する行動のガイドラインとなるものである。

UNCEDは、砂漠化／土地荒廃防止のための国際的取り組みに、重要な転機をもたらした。同会議においては、アフリカ諸国を中心とした発展途上国の強い主張を背景として、「砂漠化防止条約」を制定するための措置について、国連総会に要請することが決定された。また、アジェンダ21の第12.40段落に基づき、「深刻な干ばつもしくは砂漠化に直面している国々（特にアフリカの国）における砂漠化防止のための国際条約を制定するための政府間交渉委員会（INCD）」が設立された。

アジェンダ21の第12章「脆弱な生態系の管理、砂漠化及び干ばつの防止」では、章全体が砂漠化／土地荒廃と干ばつに関する記述にあてられており、砂漠化／土地荒廃が地球規模の問題であることが強調されている。ここでは、アジェンダ21の特徴である「国際協調・パートナーシップに基づく持続可能な発展の達成」を目指す精神に沿った、国家レベル、地域レベル、国際レベルの各取り組みに関する具体的な行動計画が、右ページに示すような6つのプログラム領域について示されている。

Agenda 21, which calls for international actions to protect the environment, was adopted at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil in June 1992. It aims to focus on global efforts to protect the environment and has been used as a guideline for planning action programmes.

The UNCED was an important turning point for international activities to combat desertification/land degradation. Based on strong requests from developing countries, particularly in Africa, it was decided to request the United Nations General Assembly to take action to elaborate a Convention to Combat Desertification. Paragraph 12.40 of Agenda 21 recommends that the General Assembly establish an Intergovernmental Negotiating Committee on Desertification (INCD) for the Elaboration of an International Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, with a goal of finalizing such a convention, by June 1994.

Chapter 12 "Managing Fragile Ecosystems: Combating Desertification and Drought" of the Agenda 21 is devoted to desertification/land degradation and drought, and emphasizes the global nature of desertification/land degradation. According to the basic idea of Agenda 21, 'international cooperation and partnership arrangement for the achievement of sustainable development', this Chapter contains detailed recommendations for actions at national, regional and international levels in six specific programme areas, as shown on the right page.

AGENDA 21

Chapter 12 of Agenda 21: actions at national, regional and international levels in six specific programme areas

- a) Strengthening the knowledge base and developing information and monitoring systems for regions prone to desertification and drought, including the economic and social aspects of these ecosystems;
- b) Combating land degradation through inter alia intensified soil conservation, afforestation and reforestation activities;
- c) Developing and strengthening integrated developing programmes for the eradication of poverty and promoting of alternative livelihood systems in areas prone to desertification;
- d) Developing comprehensive anti-desertification programmes and integrating them into national development plans and national environmental planning;
- e) Developing comprehensive drought-preparedness and drought-relief schemes, including self-help arrangements, for drought-prone areas and designing programmes to cope with environmental refugees;
- f) Encouraging and promoting popular participation and education, focusing on desertification control and management of the effects of drought.

AGENDA 21

Other references and recommendations concerning land degradation

Paragraph 4.3: Poverty and environmental degradation are closely interrelated....

Paragraph 4.4: Measures ...must take fully into account the current imbalances in the global patterns of consumption and production.

Paragraph 4.5: Special attention should be paid to the demand for natural resources generated by unsustainable consumption and to the efficient use of those resources consistent with the goal of minimizing depletion and reducing pollution.

Paragraph 4.6: ... underlining the importance of pursuing economic objectives that take full value of natural resource capital...

Paragraph 14.34: Inappropriate and uncontrolled land uses are a major cause of land degradation and depletion of land resources....

Paragraph 14.35: ... A systematic approach is needed for identifying land uses and production systems that are sustainable in each land and climate zone, including the economic, social and institutional mechanisms necessary for their implementation.

Paragraph 14.5: Land degradation is the most important environmental problem affecting extensive areas of land both in developed and developing countries....

Figure 5-3-1

Recommendations Concerning Desertification/Land Degradation in Agenda 21

Source: Earth Summit, Agenda 21 - The United Nations Programme of Actions from RIO

5-4 国連砂漠防止条約 United Nations Convention to Combat Desertification (UNCCD)

アジェンダ21の勧告に従い、国連総会は「深刻な干ばつまたは砂漠化に直面している国々（特にアフリカの国）における砂漠化防止のための国際条約を制定するための政府間交渉委員会（INCD）」を設立した。

砂漠化防止条約は、特にアフリカ地域を中心とした、深刻な干ばつまたは砂漠化を経験している国々に対して、すべてのレベルにおける効果的な行動を推進し、国際的な協力とパートナーシップのもとに、アジェンダ21に準じた統合的アプローチの枠組みの中で、被影響地域における持続可能な発展の達成に資することを目的としている。

条約の最も重要な点は、国家・準地域及び地域における砂漠化防止行動計画の策定である。これらの行動計画は、各国政府が資金提供者、地域住民及びNGOとの緊密な協力により策定することとされている。また、科学的・技術的手段の確立が不可欠である。

1994年6月に、「深刻な干ばつまたは砂漠化に直面している国々（特にアフリカの国）における砂漠化の防止のための国際連合条約」が採択され、批准国が50ヶ国に達した1996年9月27日の90日後、1996年12月26日に発効した。本条約には1997年1月15日現在、120ヶ国が署名、62ヶ国が批准している。

According to the recommendation of Agenda 21, the United Nations General Assembly established the Intergovernmental Negotiating Committee for the Elaboration of an International Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (INCD).

The objective of this convention is to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in the African region, through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas.

The core of the convention is the development of national and sub-regional/regional action programs to combat desertification. These action programs are to be developed by national governments in close cooperation with donors, local populations and NGOs. Another essential element is the establishment of scientific and technological measures.

The committee finalized negotiations for the convention by June 1994. The United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa was adopted then, and consists of main texts, annexes for four regions, a resolution on urgent action for Africa and a resolution on interim arrangements. It entered into force on December 26, 1996, on the 90th day after the 50th country had ratified on September 27, 1996. It was signed by 120 countries and ratified by 62 countries until January 15, 1997.

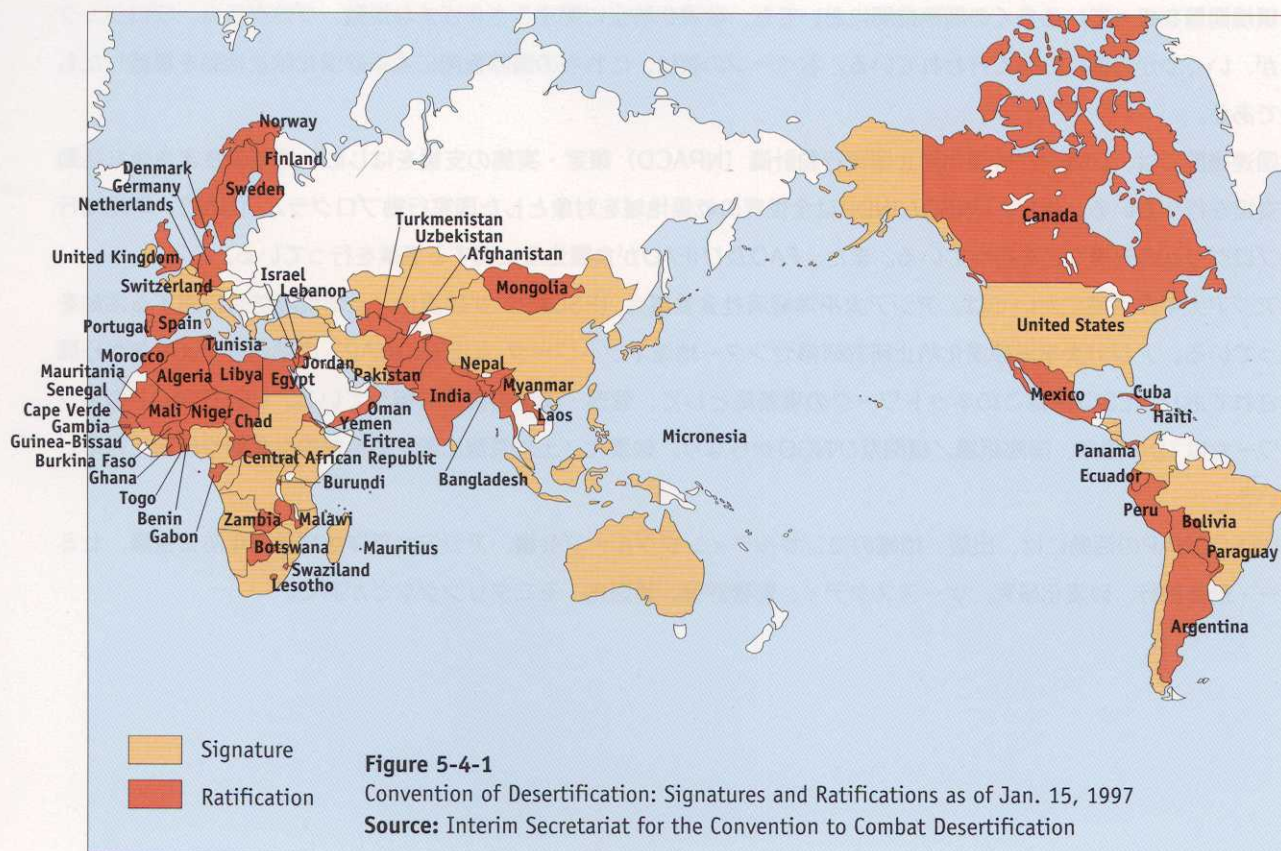


Table 5-4-1 Structure of the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa

Convention (Preamble and 40 Articles)

Annex I: Regional Implementation Annex for Africa (19 Articles)

Annex II: Regional Implementation Annex for Asia (8 Articles)

Annex III: Regional Implementation Annex for Latin America and the Caribbean (7 Articles)

Annex IV: Regional Implementation Annex for the Northern Mediterranean (10 Articles)

Resolution on Urgent Action for Africa

Resolution on Interim Arrangements

Source: UNEP (1995)

環境問題を扱っている多くの国際機関においても、砂漠化防止に関するさまざまな活動、プログラム、プロジェクトが、いくつかの国において行われている。右ページの表は、これらの国際機関による砂漠化防止活動を概観したものである。

国連機関では、UNEPが砂漠化防止国家行動計画（NPACD）策定・実施の支援をはじめ、地域のさまざまな活動の支援を行っている。また、UNSO/UNDPは全世界の乾燥地域を対象とした国家行動プログラム（NAP）、準地域行動プログラムの支援などを行っている。また、FAO及びIFADが食糧生産に関する事業を行っている。

アジア太平洋地域においては、アジア太平洋経済社会委員会（ESCAP）が砂漠化／土地荒廃防止に関する活動を行っている。アジア太平洋砂漠化防止研究研修センター地域ネットワーク（DESCONAP）の活動が1988年から開始されており、ESCAPはこのネットワークの事務局として、管理・調整の責務を担っている。DESCONAPのネットワークは19の国家、国際組織／機関及びNGOからなり、砂漠化／土地荒廃に関する全般的な問題や課題に対応している。

DESCONAPの活動には、出版、地域のコンサルティンググループ会議、アジア太平洋地域砂漠化防止会議、セミナー・研修旅行、砂漠化研究、ケーススタディ、影響評価、地図化、モニタリングなどがある。

Many international organizations dealing with environmental problems also conduct activities, programmes and projects to combat desertification in several countries. The table on the right page provides an overview of some of these activities.

Among UN organizations, UNEP supports the establishment and implementation of National Plans of Action to Combat Desertification (NPACD), and other regional activities. UNSO/UNDP work for all dry-lands of the world to support National Action Programmes (NAP), Sub-regional Action Programmes, and other activities. FAO and IFAD support food production projects.

In Asia and the Pacific region, the Economic and Social Commission for Asia and the Pacific (ESCAP) carries out several activities in the field of desertification/land degradation control. The Regional Network of Research and Training Centres on Desertification Control in Asia and the Pacific (DESCONAP) has been operational since 1988. ESCAP serves as secretariat of this network and is responsible for its management and coordination. The DESCONAP network consists of 19 countries, international organizations/agencies and NGO's and deals with a whole range of problems and issues on desertification/land degradation.

DESCONAP activities are as follows: publications, regional consultative group meetings, regional meetings on desertification control in the Asia and Pacific region, regional seminars/study tours, desertification studies, case studies, assessment, mapping, monitoring and other activities.

Table 5-5-1 Organizations to Combat Desertification/Land Degradation

UN Organizations

FAO	support assessment, monitoring, forecasting and improvement of land use, in cooperation with UNEP and other international/regional organizations
IFAD	implement projects for food security and financial support
UNEP	support for: establishment and implementation of National Plan of Action to Combat Desertification (NPACD), regional activities and networks, training, development of methodologies, assessment, monitoring, and publications
UNESCO	case studies, MAB/IPAL in cooperation with UNEP, capacity building projects such as FAPIS and RCS-Sahel
UNIDO	financial support for technology development, such as alternative energy
UNSO/UNDP	work as 'Office to Combat Desertification and Drought', for all drylands of the world to support National Action Programme (NAP), Sub-regional Action Programmes, education, networking, information exchange, and development of funding mechanisms
WB	financial support to the Plan to Combat Desertification
WFP	vegetation and soil conservation measures for food security
WMO	research on climatological and hydrological factors, estimation / drought early warning system, technology transfer, and capacity building

International Organizations

IUCN	Sahel Programme to develop natural resource management method, support for conservation and monitoring of biodiversity
OSS	technological improvement and networking for monitoring, development of tools to support decision making, in cooperation with other organizations and international programmes

Sub-regional Organizations

CILSS, IGADD, SADC, UMA	integrated management of natural resources and sustainable socio-economic development
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Regional Organization

DESCONAP	support for regional assessment including socio-economic aspects, consultation service, capacity building, technology transfer, promotion of education and local participation in cooperation with NGOs, CBOs and mass media in Asia and the Pacific region
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Source: Workshop of the Panel of Selected Experts on Desertification Control in Asia and the Pacific (ESCAP, 1995) /Sustainable Development and the Environment, FAO Policies and Actions: Stockholm 1972 - Rio 1992 (FAO, 1992) /Symposium on Land Degradation and Poverty (IFAD, 1996) /Reflections on Past Experience - National Environmental Strategies: Lessons for Follow-up to the International Convention to Combat Desertification (OSS, 1995) / Status of Desertification and Implementation of the United Nations Plan of Action to Combat Desertification (UNEP, 1991) /National Desertification Funds - In the context of The United Nations Convention to Combat Desertification. A Concept Paper on Possible Scope and Operational Modalities. (UNSO, 1995) /Dictionary for Global Environment (Environment Agency of Japan, 1990)

NGOは、砂漠化防止活動を最も効率的に推進してきた組織である。NGOの活動の特徴は、小規模な地域密着型のプロジェクトを、積極的な住民参加により進めていくことであり、これまでにさまざまな成功例が報告されている。砂漠化防止を推進するには、NGOの参加が不可欠のものとして認識されている。右ページの地図は、アフリカにおいて砂漠化防止活動を行っている主要なNGOの所在地と活動領域を示している。

砂漠化防止に関する代表的なNGOのひとつである国際環境連絡センター（ELCI）は、環境と開発に関する活動を行っているNGOの地球規模のネットワークである。ELCIの本部はケニアのナイロビにあり、107ヶ国、850の団体がメンバーとなっている。75%以上のメンバーは発展途上国のNGOである。ELCIの活動目的は、以下のようなのである。

1. 草の根レベルで活動を行っているグループのコミュニケーションの促進及び情報と技術の共有
2. NGOや草の根組織と国家もしくは国際的な組織との、より規模の大きい、かつ効率的なコミュニケーションを可能にするメカニズムの確立

ELCIの活動領域は、ネットワークの構築、メンバーの獲得と能力向上、調査・報告、渉外、情報交換、及び出版の6種類に分類される。各々の内容を右ページの表に示す。

ELCIの活動資金は、UNEP、UNDP、CIDA、IDRC、オランダなどの機関や国家から財政的支援を受けている他、メンバーからの会費、寄付金、出版物の売り上げが充てられている。

NGOs have been the most effective agencies carrying out activities to combat desertification. Characteristics of NGO activities include the promotion of small scale, locally-based projects with the active participation of residents. Many successful cases have been reported. It is recognized that the participation of NGOs is indispensable to combat desertification. The map on the right page indicates the offices and activities of the main NGOs combating desertification in Africa.

The Environment Liaison Centre International (ELCI), one of the main NGOs acting to combat desertification, is a global network of NGOs and community groups working on environment and development issues. ELCI has its headquarters in Nairobi, Kenya and a membership of 850 organizations in 107 countries. Over 75% of the members are organizations in developing countries. The objectives are:

1. fostering communication and sharing of information and skills between groups working at the grassroots level;
2. developing mechanisms whereby there is greater and more effective communication between the NGO/grassroots sector and the governmental/inter-governmental sector.

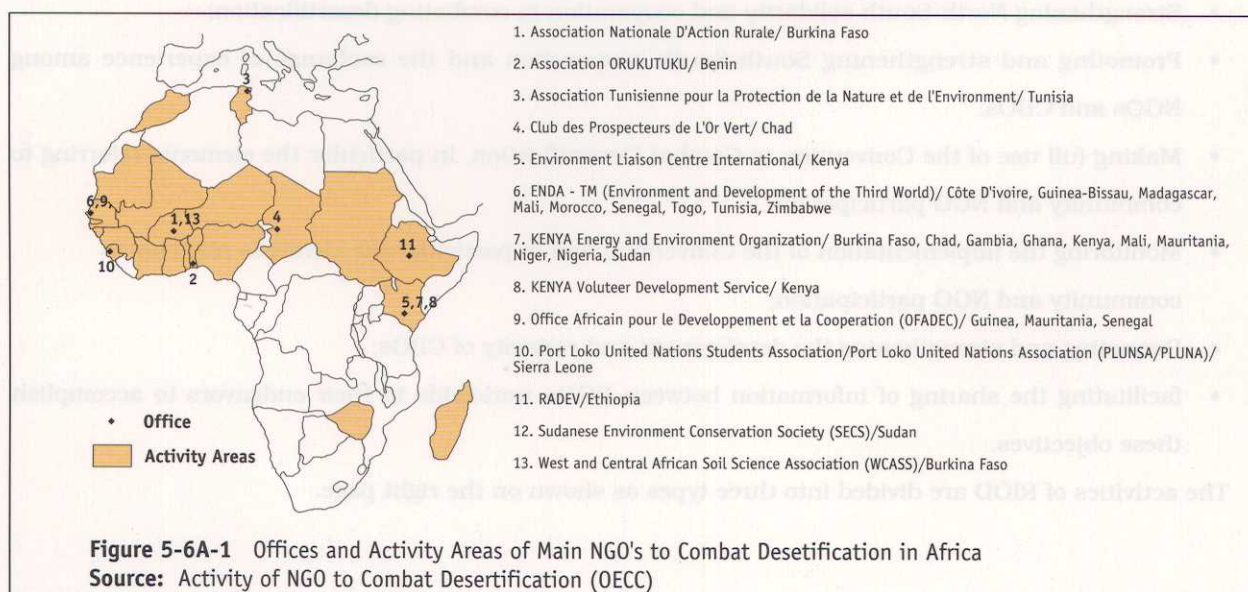
ELCI works in six areas: issue-based networks, constituency development and capacity building, research and documentation, external relations, center for environment and development information exchange, media and publications. Each issue is shown in the table on the right page.

Financial support comes from several donors, including CIDA, the Netherlands, IDRC, UNEP and UNDP, as well as funds raised through membership fees, subscriptions, and publication sales.

Table 5-6A-1 Programme Areas of the Environment Liaison Centre International (ELCI)

Issue-based Networks (IBN Unit)	fostering networks of groups working on - VO code of conduct and ethics - Convention on Desertification - Women in Environment and Development - Bio-cultural diversity - "Roots of life" - models of sustainable agriculture
Constituency Development and Capacity Building (CD/CB Unit)	provides services and liaison with members, and runs programmes aimed at strengthening individual organizations, such as training programmes and exchange; manage also ECO-Volunteer and SOLED programmes
Research and Documentation Unit (RDU)	ensures that proper research and documentation functions are in place; gathers information required to determine ELCI's proper response; monitors the effectiveness and impact of programmes in order to learn from success and failures
External Relation Unit (ERU)	responsible for fostering strong working relationships with ELCI's peers; works directly with inter-governmental agencies, international NGO's, donors and the scientific/academic community
Centre for Environment and Development Information Exchange (CEDIE)	gathers, organizes, re-packages and disseminates information on world-wide community-level action for the environment and development through maintaining an active information processing system, database on NGO's, training resources, other information resources, and a bibliographic database; operating a substantial library of periodicals and books; and maintaining communication systems such as E-mail, and linkages to UN information systems
Media and Publication Unit (MPU)	promote grassroots actions through public and alternative media channels (EcoForum, WedNews,...)

Source: Environment Liaison Centre International (ELCI) - A Profile



1994年、パリにおいて開催された第5回INCD会合において、ここに参加したNGOは、砂漠化に関する活動を行っているコミュニティレベルの組織（CBO）を含む、NGOの国際的なネットワークを設立することを決定した。このネットワークはRIOD（砂漠化NGO国際ネットワーク）と呼ばれている。RIODはCBOやNGO間の情報の共有や、地球規模の協力行動のための機会の提供を行っている。国際的ネットワークとしてのRIODの目的は以下のようなものである。

- ・ 砂漠化とその影響について、南と北の国々（途上国と先進国）において一般の意識の向上を図る。
- ・ 砂漠化防止のために南北間の連携と協力を強化する。
- ・ 南－南協力（途上国間協力）の推進と強化を図り、NGO、CBO間の蓄積の交換を行う。
- ・ 砂漠化防止条約、特にコミュニティとNGOの参加に関する部分を最大限に活用する。
- ・ 砂漠化防止条約の実施状況、特にコミュニティとNGOの参加に関する部分についての監視を行う。
- ・ CBOの発展と能力向上を推進・強化する。
- ・ これらの目的達成のため、世界各国のNGO間の情報の共有に資する。

RIODの活動は、右ページに示すような3種類に分類される。

At the fifth session of the INCD held in Paris in 1994 the participating NGOs decided to establish an international network for NGOs, including Community Based Organizations (CBOs), working in the field of desertification, called RIOD (Réseau International d' ONG sur la Désertification). RIOD promotes the sharing of information and the coordination of action globally between CBOs and NGOs.

The objectives of this international network are:

- Raising awareness, in the North and in the South, on desertification and its effects;
- Strengthening North-South solidarity and cooperation in combating desertification;
- Promoting and strengthening South-South cooperation and the exchange of experience among NGOs and CBOs;
- Making full use of the Convention to Combat Desertification, in particular the elements referring to community and NGO participation;
- Monitoring the implementation of the Convention and in particular the elements referring to community and NGO participation;
- Promoting and strengthening the development and capacity of CBOs;
- facilitating the sharing of information between NGOs worldwide in their endeavors to accomplish these objectives.

The activities of RIOD are divided into three types as shown on the right page.

Table 5-6B-1 Three Different Types of Activities of RIOD

Core activities

These are the activities needed at minimum to make RIOD work as a communication mechanism. The core activities require collective fundraising.

Lobby activities at the international level

These are the NGO lobby activities at all formal meetings that result from the Convention. Also these activities require collective fundraising.

Joint network activities

These are activities such as awareness raising, media and lobby campaigns, exchange of information, monitoring, capacity building, etc. in which CBOs and NGOs can collaborate, thanks to the communication mechanism that has been put in place. The joint network activities do not require collective fundraising.

What is needed is that RIOD participants:

- communicate to each other the activities they have planned or fundraised for already; and
- work out ways to collaborate and to avoid double work.

Source: RIOD, The International NGO Network on Desertification and Drought (1994)

Table 5-6B-2 RIOD Focal Points

Global Focal Point	Regional Focal Points	Sub-regional/National Focal Points
Environment Liaison Centre International	Africa ENDA - TM	Central Africa Confederation des ONG d'Environnement et de Developpement de l'Afrique Centrale (CONGAC) West Africa A.V.D. North Africa ENDA Inter-Arabe Eastern & Southern Africa Uganda Women Tree Planning Movement Anglophone West Africa Nigerian Environmental Study Action Team (NEST)
	Asia SCOPE, Society for Conservation and Protection of Environment	East Asia Haribon Fundation for the Conservation of Natural Resources, Inc. West Asia RSCN
	South America Consejo Andino De Manejo Ecologico	South America South Comite Nacional pro Defensa de la Fauna y Flora (CODEFF)
	Canada & US Solidarite Canada Sahel	
	Australia The Wilderness Society Australian Conservation Foundation Arid Lands Coalition Environment Centre NT	
	Europe Both Ends	France Sahel Defis

Source: RIOD, The International NGO Network on Desertification and Drought (1994)

6.

砂漠化／土地荒廃のケーススタディ

Case Studies on Desertification/Land Degradation

砂漠化防止条約政府間交渉委員会（INCD）の活動を支援するため、アフリカのいくつかの準地域及び国家において、右ページに示すようなケーススタディが実施された。これらのケーススタディは、砂漠化に関する国際専門家パネル（IPED）の提唱するミニマムデータセットを用いて砂漠化の影響程度を判断し、行動計画策定に資することを目的として行われたものである。

ミニマムデータセットは、調査対象地域において最低限調査すべき項目を、以下のようにまとめたものであり、各国の状況を比較検討する際の共通の指標として活用することが可能である。しかし、その定量的・客観的基準、測定方法等については、まだ確定してはいない。また、地域固有の性格を評価するためには、別途何らかの固有的指標が必要であると考えられる。

気候変数：アルベド、降雨、気温、湿度、風速、砂嵐

土壌・水変数：地下水、表流水、風食、水食、塩類化、浸水、土壌固化・固結

植生変数：植物種構成、樹木生物量、飼料生物量、絶滅動植物種

土地利用変数：土地利用システム、土地所有システム、土地利用変化、播種地の構成、主要農作物の収量、家畜種構成及び頭数、家畜による圧力

社会経済変数：人口、人口変化、季節／年ごとの移住、小児／成人死亡率、寿命、罹病状況、一人当たり収入、収入分布、収入源、主要食糧の市場価格、エネルギーの利用可能性及び価格

Several case studies were carried out to support the work of the INCD in some sub-regions and nations in Africa as shown on the right page. These case studies aimed to apply the “Minimum Data Set” proposed by the International Panel of Experts on Desertification (IPED) as follows, to assess the degree of desertification impact and help create national action plans to combat desertification.

The Minimum Data Set is a list of research items to be studied in each region examined, and can be applied as a common indicator for comparative study among affected countries. However, quantitative and objective standards and methodologies for measurement are not yet firmly established. Moreover, some specific indicators will be needed to assess local characteristics.

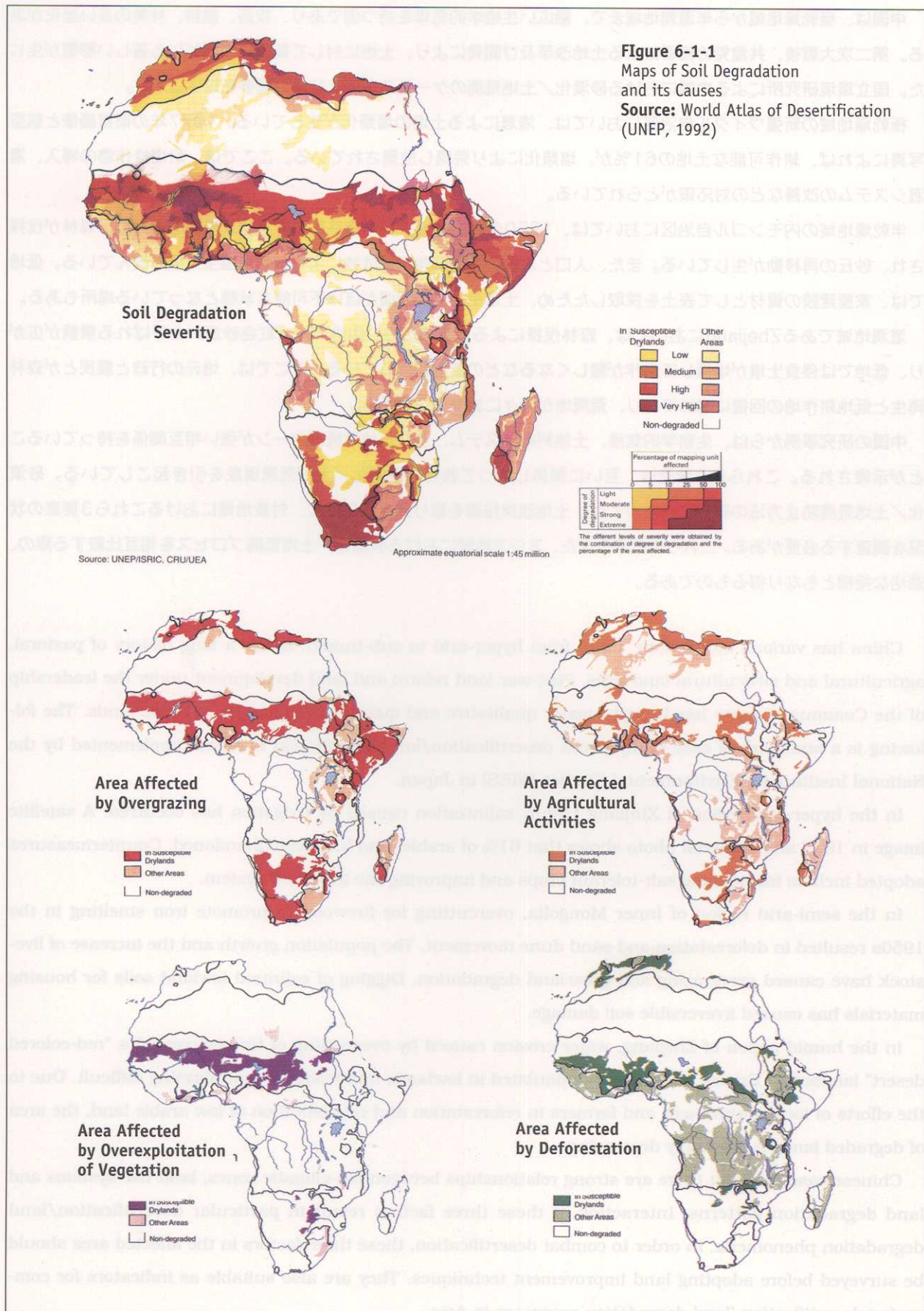
Climate variables: Albedo, rainfall, air temperature, air humidity, wind velocity, dust storms

Soil and water variables: Groundwater, major surface waters, wind erosion, water erosion, soil salinization, waterlogging, soil compaction and sealing

Vegetation variables: Plant species composition, woody biomass, fodder biomass, disappeared plant and animal species

Land-use variables: Land-use system, land-tenure system, changes in land use, structure of sown areas, yield of major staple crops, composition and number of livestock, animal pressure

Socio-economic variables: Human population, population changes, seasonal and annual human migration, infant and adult mortality rates, length of life, human disease status, per capita income, income distribution, sources of income, market prices of key food stuffs, energy availability and prices



中国は、極乾燥地域から半湿潤地域まで、幅広い生物学的気候を持つ国であり、牧畜、農耕、林業の長い歴史がある。第二次大戦後、共産党の指導による土地改革及び開発により、土地に対して質的にも量的にも著しい影響が生じた。国立環境研究所による中国における砂漠化／土地荒廃のケーススタディ結果の概要を以下に示す。

極乾燥地域の新疆ウイグル自治区においては、灌漑による土壌の塩類化が生じている。1977年の衛星画像と航空写真によれば、耕作可能な土地の61%が、塩類化により荒廃し放棄されている。ここでは、耐塩性作物の導入、灌漑システムの改善などの対応策がとられている。

半乾燥地域の内モンゴル自治区においては、1950年代に推進された製鉄用の薪炭材大量採取のため、森林が伐採され、砂丘の再移動が生じている。また、人口と家畜の増加に伴う過放牧による草地の植生荒廃も進んでいる。低地では、家屋建設の資材として表土を採取したため、土壌生産力の回復がほぼ不可能な状態となっている場所もある。

湿潤地域であるZhejiangにおいては、森林伐採による水食のため、山地では「紅色砂漠」と呼ばれる景観が広がり、低地では侵食土壌が堆積して耕作が難しくなるなどの影響が生じている。ここでは、地元の行政と農民とが森林再生と低地耕作地の回復に努めており、荒廃地が徐々に減少しつつある。

中国の研究事例からは、生物学的気候、土地利用システム、及び土地荒廃パターンが強い相互関係を持っていることが示唆される。これらの3要素は、互いに関係し合って独特な砂漠化／土地荒廃現象を引き起こしている。砂漠化／土地荒廃防止方法の研究に当たっては、土地改良技術を取り入れる以前に、対象地域におけるこれら3要素の状況を調査する必要がある。これらの要素はまた、アジア地域における砂漠化／土地荒廃プロセスを相互比較する際の、適切な指標ともなり得るものである。

China has various bio-climatic zones from hyper-arid to sub-humid. It has a long history of pastoral, agricultural and silvicultural land uses. Post-war land reform and land development under the leadership of the Communist party has brought major qualitative and quantitative changes to these lands. The following is a summary of case study about desertification/land degradation in China implemented by the National Institute for Environmental Studies (NIES) in Japan.

In the hyper-arid region of Xinjiang Uygur, salinization caused by irrigation has occurred. A satellite image in 1977 and an aerial photo shows that 61% of arable land has been abandoned. Countermeasures adopted include introducing salt-tolerant crops and improving the irrigation system.

In the semi-arid region of Inner Mongolia, overcutting for firewood to promote iron smelting in the 1950s resulted in deforestation and sand dune movement. The population growth and the increase of livestock have caused overgrazing and grassland degradation. Digging of salinized lowland soils for housing materials has caused irreversible soil damage.

In the humid region of Zhejiang, water erosion caused by overcutting of forests created a "red-colored desert" landscape. Eroded soils have accumulated in lowlands and made lowland farming difficult. Due to the efforts of local government and farmers in reforestation and rehabilitation of low arable land, the area of degraded lands is gradually decreasing.

Chinese cases suggest there are strong relationships between bio-climatic zones, land use systems and land degradation patterns. Interaction of these three factors result in particular desertification/land degradation phenomena. In order to combat desertification, these three factors in the affected area should be surveyed before adopting land improvement techniques. They are also suitable as indicators for comparing desertification/land degradation processes in Asia.

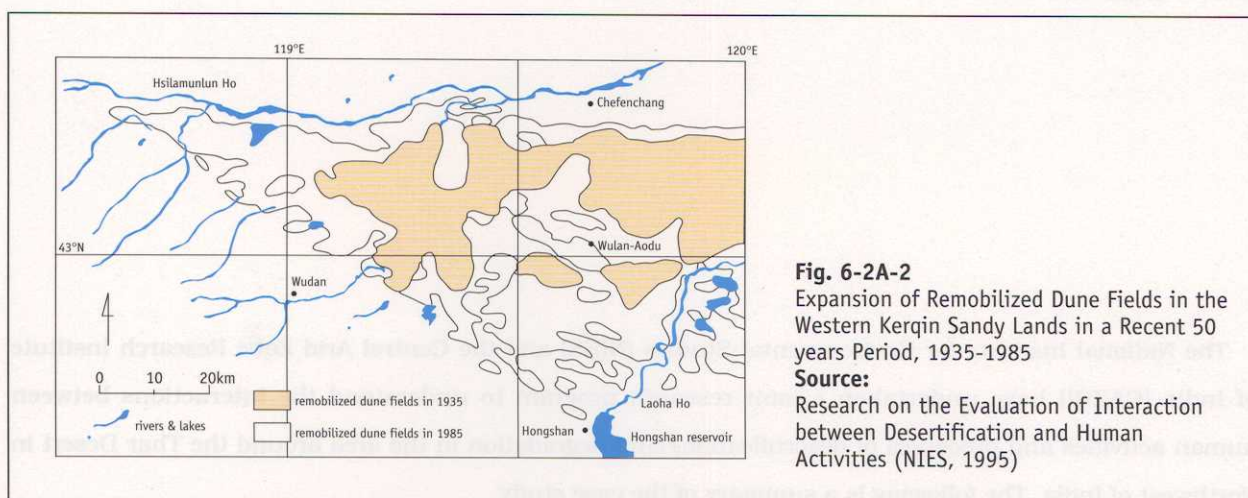
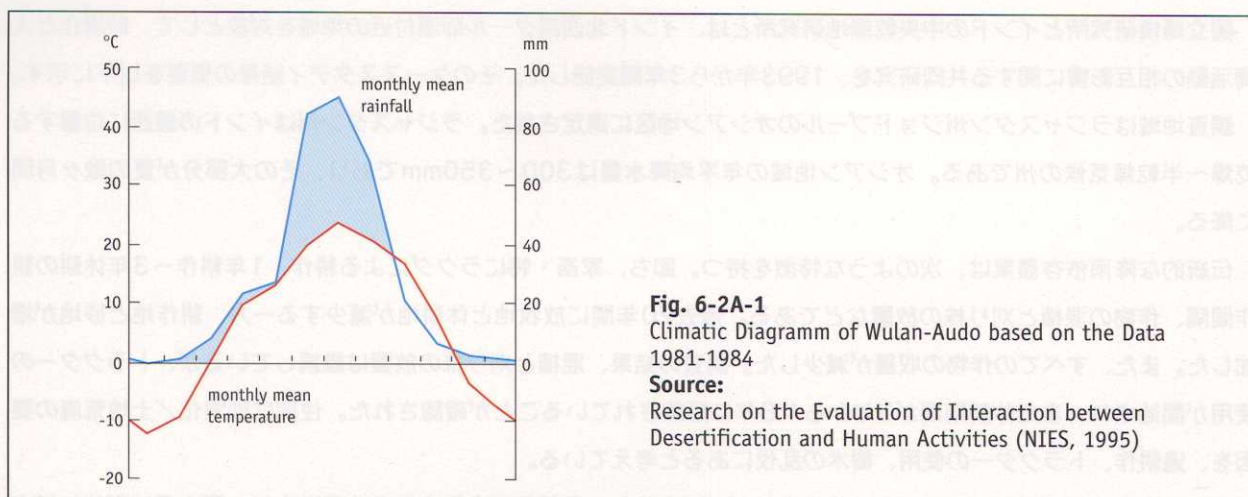


Table 6-2A-1 Surviving Rate and Growing State of *Pinus sylvestris mongolia* under Different Site Conditions

Location	Site condition			Measure for planting	Seeding age (yr.)	Spacing (m)	Growing situation after 3yr		
	Land forms	Soil	Water table (m)				Preserve rate (%)	Mean height (m)	Mean stem diameter (cm)
Southwest sand dune	Moving sand dune	Othro-psamment	3.0	Grassed grid	3	2x1	34	36	1.7
Southwest sand dune	Moving sand dune	Othro-psamment	2.0	Culture sack	3	2x1	77	39.5	2.0
Southwest sand dune	Wind erosion pit	Othro-psamment	1.7	Grassed grid	3	1x1.5	62	63.5	2.6
Southwest sand dune	Land among sand dune	Plagpsam-ment	1.2	Planting with clod	6-7	4x4	71	198.0	3.6
South part of Metro. Station	Lower marsh meadow	Plagpsam-ment	1.2-1.5	Ditching 0.5m depth	3	2x2	61	76	3.1

Source: Research on the Evaluation of Interaction between Desertification and Human Activities (NIES, 1995)

6-2 B. インド India

国立環境研究所とインドの中央乾燥地研究所とは、インド北西部タール砂漠付近の地域を対象として、砂漠化と人間活動の相互影響に関する共同研究を、1993年から3年間実施した。そのケーススタディ結果の概要を以下に示す。

調査地域はラジャスタン州ジョドプールのオシアン地区に選定された。ラジャスタン州はインドの最西に位置する乾燥～半乾燥気候の州である。オシアン地域の年平均降水量は300～350mmであり、その大部分が夏の数ヶ月間に降る。

伝統的な降雨依存農業は、次のような特徴を持つ。即ち、家畜・特にラクダによる耕作、1年耕作－3年休耕の耕作間隔、作物の混植と刈り株の放置などである。過去20年間に放牧地と休耕地が減少する一方、耕作地と砂地が増加した。また、すべての作物の収量が減少した。調査の結果、混植と刈り株の放置は継続しているが、トラクターの使用が開始され、また休耕期間が3年から1.8年に短縮されていることが確認された。住民は砂漠化／土地荒廃の要因を、過耕作、トラクターの使用、樹木の乱伐にあると考えている。

もう一つの重要な要因として、人口圧の増加が挙げられる。保健及び食物条件の改善により、死亡率は劇的に減少したが、家族計画は全世帯の27%のみでしか実行されていない。

The National Institute for Environmental Studies (NIES) and the Central Arid Zone Research Institute of India (CAZRI) have undertaken a joint research program to understand the interactions between human activities and processes of desertification/land degradation in the area around the Thar Desert in Northwest of India. The following is a summary of the case study.

Rajasthan is the most western state of India and has an arid to semi-arid climate. The test sites were selected in the administrative sub-unit of Osian, located in the Jodhpur district of arid western Rajasthan. The region of Osian has an average annual precipitation of 300 to 350 mm, which mostly falls in the summer months.

Characteristics of traditional rainfed agriculture in this region include plowing by livestock, particularly by camels, one year of cultivation and three years of fallow, mixed cropping, and leaving the stubble in the field. During the last 20 years, grazing land and fallow land areas have decreased, while land area under various crops and sand has increased. All crop yields have decreased. According the survey, mixed cropping and leaving the stubble in the field are still being practiced, but tractors are used and the fallowing period has decreased from 3 years to 1.8 years. Villagers perceived the main causes of desertification/land degradation to be over-cultivation, use of tractors, and indiscriminate cutting of trees.

Another important factor is the increasing population pressure. The death rate has drastically decreased through improvements in health care and food. However, family planning measures are only practiced by 27% of the households.



Photo 6-2B-1
Irrigated area



Photo 6-2B-3
Tramping by livestock
near a well



Photo 6-2B-2
Sand dune moved a few
meters in two years



Photo 6-2B-4
Tank used to carry water by
camel daily

国立環境研究所によるカザフスタンにおける砂漠化／土地荒廃のケーススタディ結果の概要を以下に示す。

カザフスタンにおける主な砂漠化／土地荒廃は、塩類化である。中央アジア及び北アジア地域には、2億ha以上、即ち地球上の塩類集積土壌の約20%を占める塩類土壌が存在する。

年間降水量が約100mmのみであることから、農業を行うには水資源の確保が不可欠である。旧ソビエト連邦では、中央アジアに大規模な灌漑設備を導入し、綿花、水稻、大麦、アルファルファの栽培を推進した。その結果、アラル海では近年急激な水位の低下、水質の悪化が生じており、周辺の農耕地では塩類化が生じている。また周辺住民への健康被害の原因ともなっている。カザフスタンでは、灌漑農地の約60～70%が塩類化の影響を受け、生産性が30～33%低下しているといわれている。

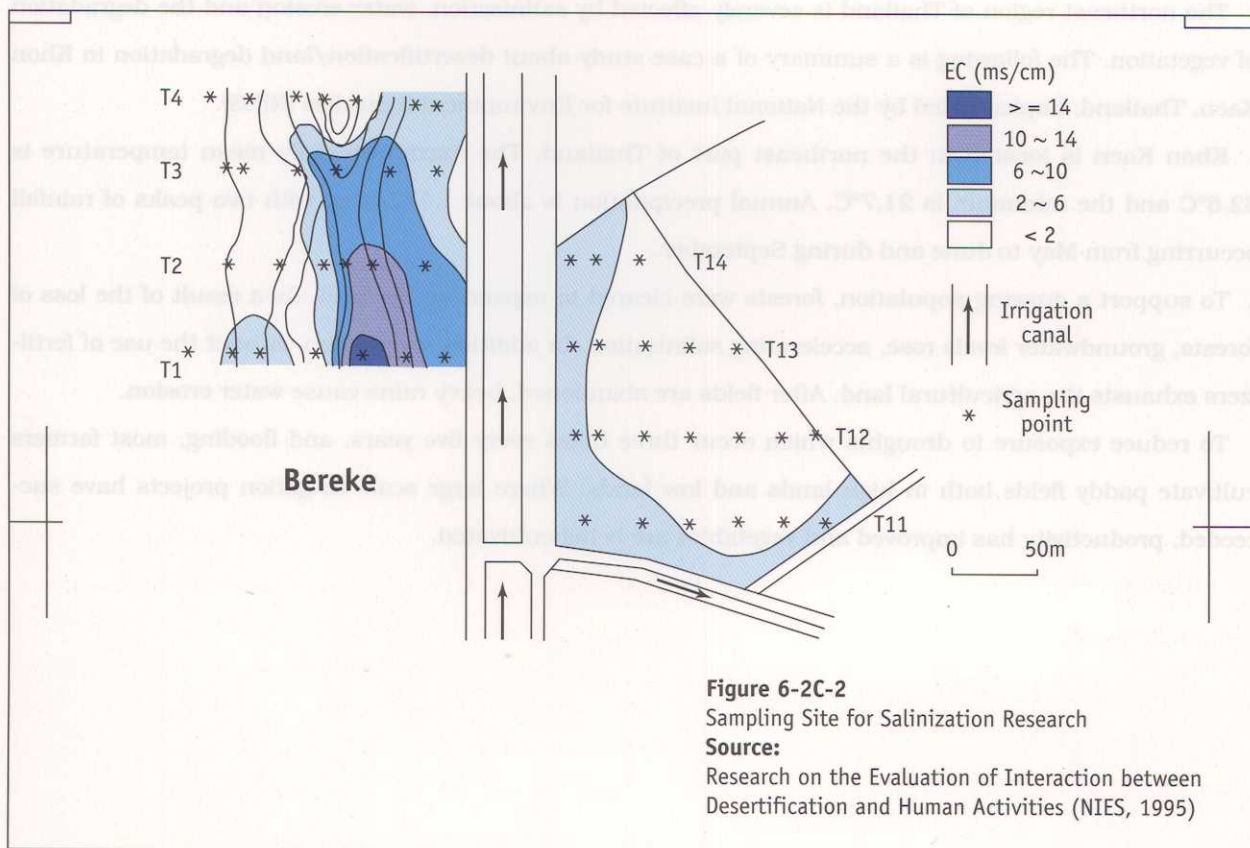
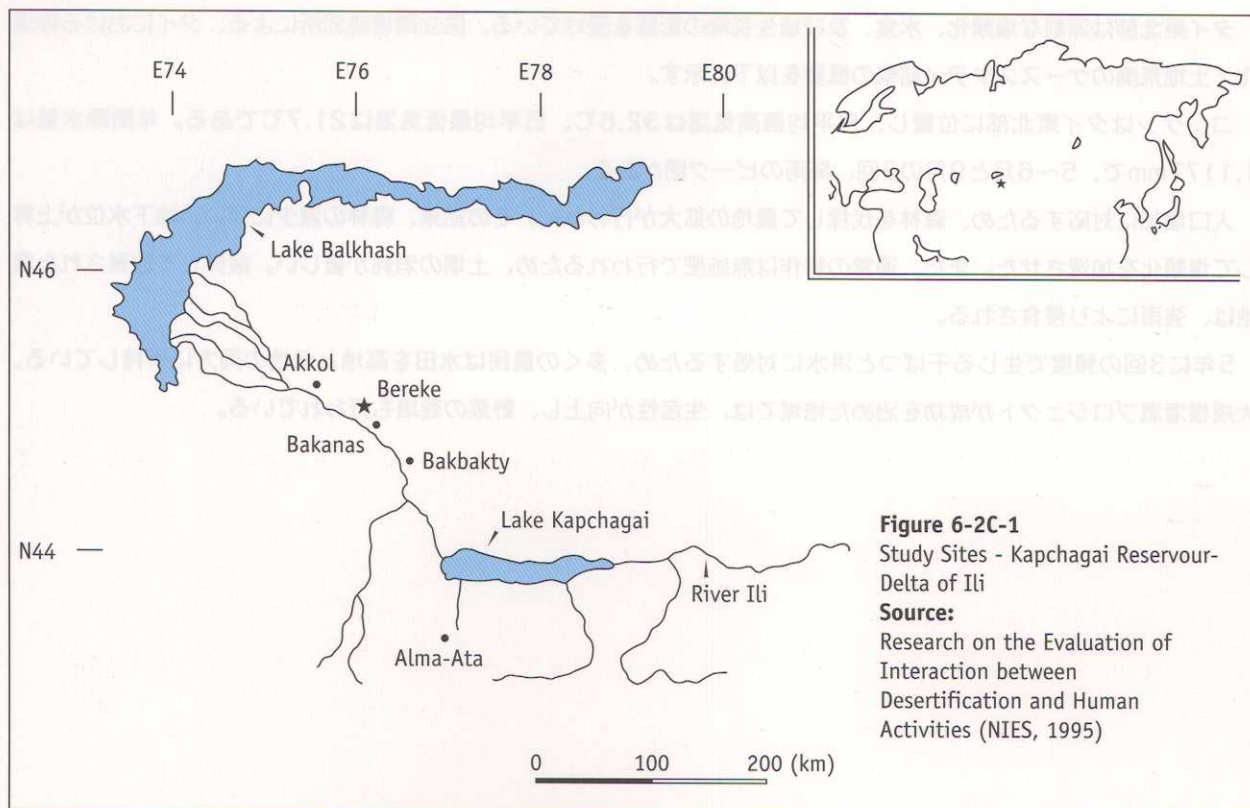
カザフスタンのベレケを対象としたケーススタディでは、塩類は灌漑用水ではなく土壌中から供給されていることが確認された。不適切な灌漑設備、及び不十分な維持管理のために灌漑水が漏水し、大麦、アルファルファ、トウモロコシの畑地において塩類化を生じさせている。

The following is a summary of a case study about desertification/land degradation in Kazakhstan implemented by the National Institute for Environmental Studies (NIES).

The main factor in desertification/land degradation in Kazakhstan is salinization. In Central and Northern Asia more than 200 million ha of saline soil exist, accordingly for about 20% of the world's saline soil.

Since annual precipitation is only about 100 mm, the handling of water resources is critical for agriculture in the region. The former Soviet Union introduced large scale irrigation into the Central Asia region to produce cotton, rice, barley and alfalfa. As a result, water levels and water quality of the Aral Sea dropped rapidly in recent years. Surrounding arable land suffered from salinization, causing health problems for people around the lake. In Kazakhstan about 60 to 70% of irrigated land is severely affected by salinization, reducing agricultural production by 30 to 33%.

According to the case study at Bereke in Kazakhstan, salt is introduced from the soil rather than from irrigation water. Poor infrastructure and inappropriate management of irrigation canals caused leakage of water, adversely affecting crops such as barley, alfalfa and corn.



タイ東北部は深刻な塩類化、水食、及び植生荒廃の影響を受けている。国立環境研究所による、タイにおける砂漠化／土地荒廃のケーススタディ結果の概要を以下に示す。

コンケンとはタイ東北部に位置し、日平均最高気温は32.6℃、日平均最低気温は21.7℃である。年間降水量は1,117mmで、5～6月と9月の2回、降雨のピーク期がある。

人口増加に対応するため、森林を伐採して農地の拡大が行われた。その結果、森林の減少に伴い、地下水位が上昇して塩類化を加速させた。また、通常の耕作は無施肥で行われるため、土壌の消耗が著しい。疲弊して放棄された農地は、強雨により侵食される。

5年に3回の頻度で生じる干ばつと洪水に対処するため、多くの農民は水田を高地と低地の両方に所持している。大規模灌漑プロジェクトが成功を治めた地域では、生産性が向上し、野菜の栽培も行われている。

The northeast region of Thailand is severely affected by salinization, water erosion and the degradation of vegetation. The following is a summary of a case study about desertification/land degradation in Khon Kaen, Thailand, implemented by the National Institute for Environmental Studies (NIES).

Khon Kaen is located in the northeast part of Thailand. The maximum daily mean temperature is 32.6°C and the minimum is 21.7°C. Annual precipitation is about 1,177 mm, with two peaks of rainfall occurring from May to June and during September.

To support a growing population, forests were cleared to expand arable land. As a result of the loss of forests, groundwater levels rose, accelerating salinization. In addition, cultivation without the use of fertilizers exhausts the agricultural land. After fields are abandoned, heavy rains cause water erosion.

To reduce exposure to droughts which occur three times every five years, and flooding, most farmers cultivate paddy fields both in high lands and low lands. Where large scale irrigation projects have succeeded, productivity has improved and vegetables are being cultivated.

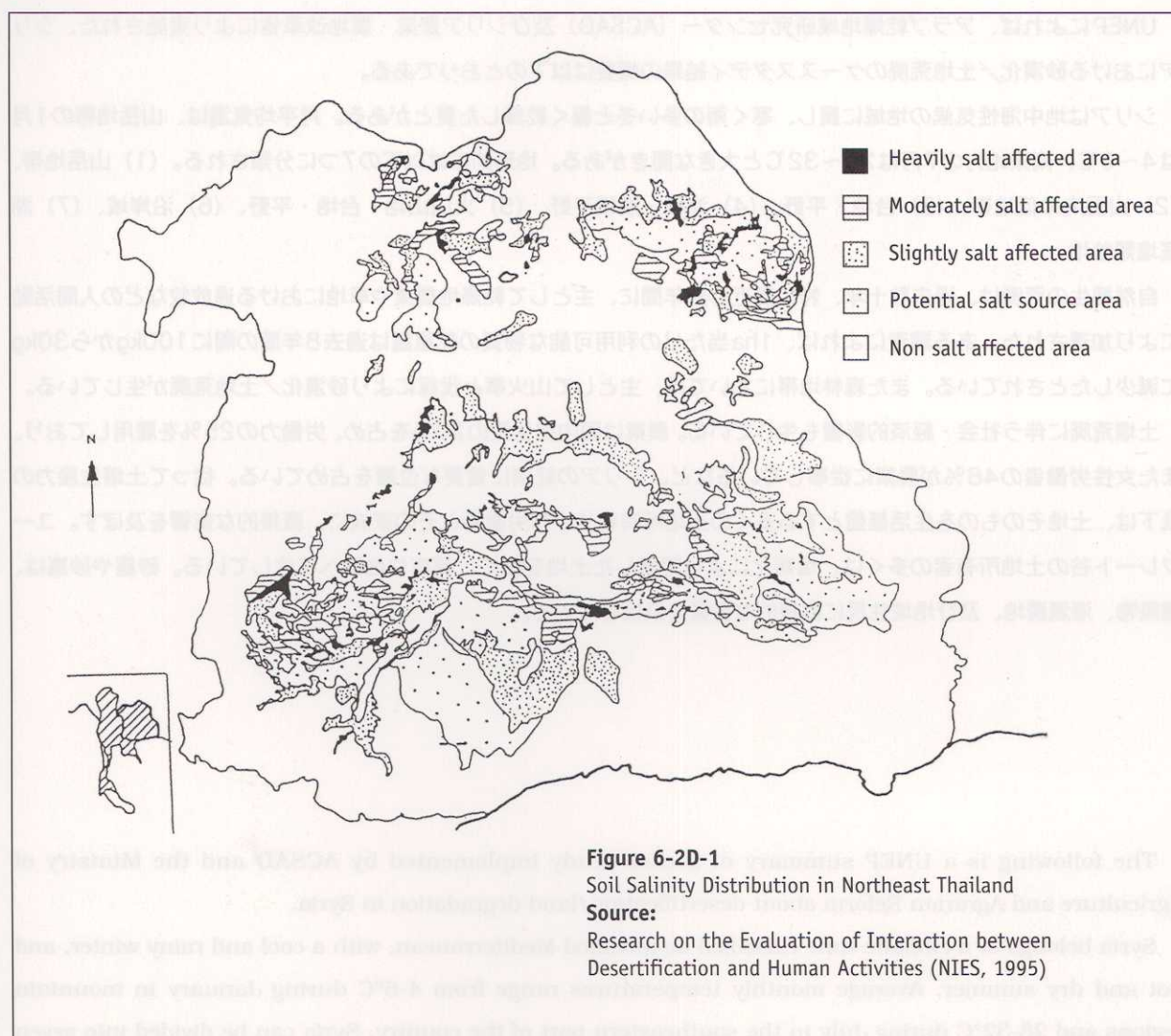


Table 6-2D-1 Fuelwood Consumption in the Northeast Thailand

Source of Fuelwood	Percentage of Consumption
Collection	
Forest area (more than 5km away)	26.9
Forest area (less than 5km away)	14.6
Household areas	35.7
Neighboring areas	21.4
Sub-total	98.6
Purchased	
Within village	0.2
Outside village	0.2
Retailers	1.0
Sub-total	1.4
TOTAL	100.0

Source: Research on the Evaluation of Interaction between Desertification and Human Activities (NIES, 1995)

UNEPによれば、アラブ乾燥地域研究センター（ACSAD）及びシリア農業・農地改革省により実施された、シリアにおける砂漠化／土地荒廃のケーススタディ結果の概要は以下のとおりである。

シリアは地中海性気候の地域に属し、寒く雨の多い冬と暑く乾燥した夏とがある。月平均気温は、山岳地帯の1月は4～6℃、南東地方の7月は26～32℃と大きな開きがある。地形的には以下の7つに分類される。(1) 山岳地帯、(2) 山岳内の低地帯、(3) 台地・平野、(4) 沖積・崩積平野、(5) 火山山地・台地・平野、(6) 沿岸域、(7) 湖底塩類盆地。

自然植生の荒廃は、過去数十年、特に最近の数年間に、主として乾燥地農業や草地における過放牧などの人間活動により加速された。ある調査によれば、1ha当たりの利用可能な物質の乾重量は過去8年間の間に100kgから30kgに減少したとされている。また森林地帯においては、主として山火事と伐採により砂漠化／土地荒廃が生じている。

土壌荒廃に伴う社会・経済的影響も生じている。農業は国内総生産の20%を占め、労働力の25%を雇用しており、また女性労働者の48%が農業に従事しているなど、シリアの経済に重要な位置を占めている。従って土壌生産力の低下は、土地そのものを生活基盤とする多くの土地所有者や小作労働者とその家族に、直接的な影響を及ぼす。ユーフラート谷の土地所有者の多くは、塩類化により荒廃した土地を捨て、都市や他国へ移住している。砂塵や砂嵐は、建築物、灌漑農地、及び地域住民に直接的な影響を及ぼしている。

The following is a UNEP summary of a case study implemented by ACSAD and the Ministry of Agriculture and Agrarian Reform about desertification/land degradation in Syria.

Syria belongs to a climatic zone classified as modified Mediterranean, with a cool and rainy winter, and hot and dry summer. Average monthly temperatures range from 4-6°C during January in mountain regions and 26-32°C during July in the southeastern part of the country. Syria can be divided into seven major physiographic regions: (1) mountains region; (2) depressing inside or bordering the mountains; (3) plateaus and plains; (4) alluvial and colluvial plains; (5) volcanic mountains, plateaus and plains; (6) littoral plains; and (7) local lacustrine-saline basins.

Degradation of the natural vegetation has accelerated during the last few decades, especially recent years, mainly due to human activities such as dryland farming and overgrazing in rangeland areas. A systematic survey revealed that in some rangeland areas the amount of available dry matter was declined from 100 kg/ha to 30 kg/ha over a period of eight years. Main causes of the degradation in the forest areas are fire and land clearing.

There are several socio-economic impacts resulting from soil degradation in Syria. Agriculture plays a very important role in the Syrian economy, contributing about 20% of gross national output and employing 25% of the workforce, including 48% of the total female workforce of the country. Decreasing soil productivity has direct effect on land holders and agricultural workers since land is the main source of life for many families. In the Euphrates valley, many land holders have left their degraded land because of the salinization and migrated to large cities or abroad. Blowing dust and dust storms affect all types of structures, crop production in irrigated areas, and the population itself.

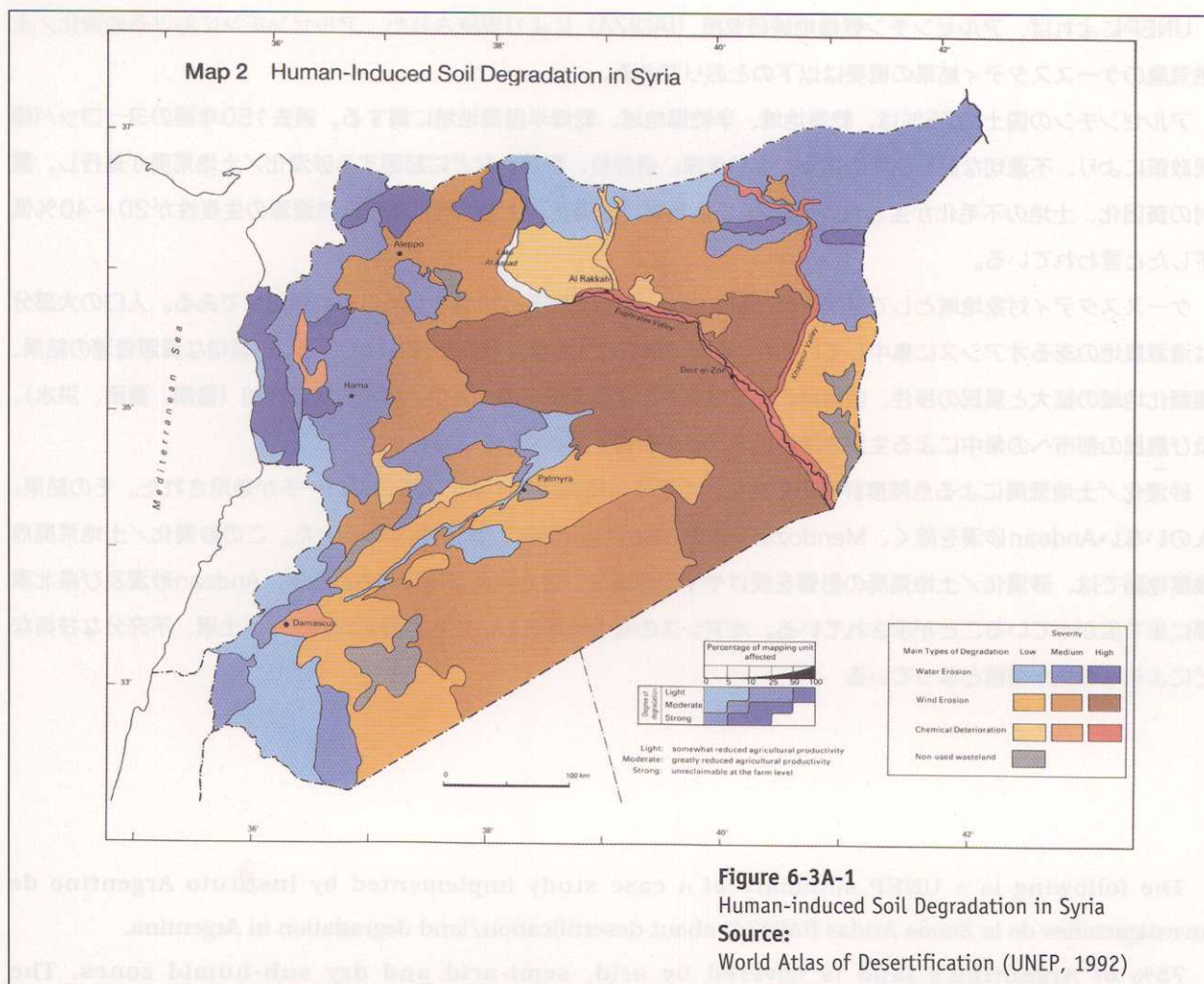


Table 6-3A-1 The Main Types of Soil Degradation in Syria

Erosion Type	Area
Water erosion (least harmful type in the recent past)	a) coastal mountain: vulnerable to water erosion due to naturally steep and long slopes; shallow soil cover; high average rainfall; frequent rain storms; covered by dense forest; human-induced forest clearing (fires) b) mountain areas in arid and semi-arid regions: natural vegetative cover has been largely destroyed for decades; removing of forest cover c) regions of plateaus and plains: the least affected by human -induced water erosion due to rainfall erosivity in dry areas and high structural stability in the more rainy areas
Wind erosion (most prominent soil degradation type)	a) plains of southern Mesopotamia: soil degradation started when mechanized cultivation of rainfed barley was introduced in the 1950's; flat topography; erosive potential of wind is obvious (16-25 m/s in September); fine texture of the top soil b) Bichri Mountain and the surrounding areas: rainfall average 150mm/year; using improper agricultural practices (rainfed barley cultivation); serious destruction of the shrubby cover by tillage; high soil erodibility due to weak soil structure and the prevailing coarse texture
Salinization	a) Euphrates valley: earliest human agricultural activities were started; largest irrigated area today; large scale irrigation by using diesel irrigation pumps (1940s~); misuse of irrigation water, accompanied by the absence of drainage system, led to a rise of groundwater level and salt accumulation within root layers by evapotranspiration b) Near Rakka: irrigation of land located mainly within the second Euphrates terrace since 1970, insufficient and improper drainage

Source: World Atlas of Desertification (UNEP, 1992)

UNEPによれば、アルゼンチン乾燥地域研究所 (IADIZA) により実施された、アルゼンチンにおける砂漠化／土地荒廃のケーススタディ結果の概要は以下のとおりである。

アルゼンチンの国土の75%は、乾燥地域、半乾燥地域、乾燥半湿潤地域に属する。過去150年間のヨーロッパ植民政策により、不適切な穀物生産の拡大、森林伐採、過放牧、野焼きなどに起因する砂漠化／土地荒廃が進行し、農村の貧困化、土地の不毛化が生じた。IADIZAによれば、砂漠化／土地荒廃により自然資源の生産性が20～40%低下したと言われている。

ケーススタディ対象地域として選定されたMendoza県は、76%が乾燥もしくは半乾燥地域である。人口の大部分は灌漑農地のあるオアシスに集中しているが、乾燥地域では大規模な牧畜が行われている。不適切な資源管理の結果、塩類化地域の拡大と農民の移住、放牧地の生産性低下による環境容量の減少、自然災害の増加（雪崩、豪雨、洪水）、及び農民の都市への集中による生活水準の低下などの影響が生じている。

砂漠化／土地荒廃による危険度評価のために、ここでは地図学的手法によるアプローチが適用された。その結果、人のいないAndean砂漠を除く、Mendoza県全域において広範囲に渡る劣化がみられた。この砂漠化／土地荒廃危険度地図では、砂漠化／土地荒廃の影響を受けやすい地域は、最も脆弱な地域のみならず、Andean砂漠及び県北東部にまで広がっていることが示されている。オアシスの灌漑地域においても、農耕に適さない土壌、不十分な技術などによる塩類化が問題となっている。

The following is a UNEP summary of a case study implemented by Instituto Argentino de Investigaciones de la Zonas Aridas (IADIZA) about desertification/land degradation in Argentina.

75% of Argentina's land is covered by arid, semi-arid and dry sub-humid zones. The desertification/land degradation process has accelerated in the last 150 years due to European immigration, and unsound policies promoting natural resource extraction through expansion of crops, deforestation, overgrazing, and field burning, which resulted in the impoverishment and marginalization of the rural population. According to IADIZA, desertification/land degradation led to a loss of natural resource productivity of between 20% and 40%.

The province of Mendoza was selected as the study area, with 76% of the area being arid and semi-arid. The human population is largely concentrated in oases where irrigated land is farmed. In the drylands livestock raising is extensive. Negative impacts resulting from the unsound management of resources are expansion of saline areas; decreased carrying capacity of the grazing lands due to loss of productivity; increased frequency of natural disasters (avalanches, torrential rains and floods); and the exodus of rural people to cities, where they live under poorer conditions.

A cartographic methodological approach was used for desertification/land degradation hazard assessment as shown on the right page. Except for the uninhabited Andean desert region, the entire territory of the Mendoza province showed widespread land degradation. The map indicates that areas highly prone to desertification/land degradation not only coincide with the most fragile areas, but also stretch over the whole Andean region and northeastern area. Due to expansion of crop farming onto unsuitable soils using inappropriate techniques, salinization is a problem in the irrigated areas of oases.

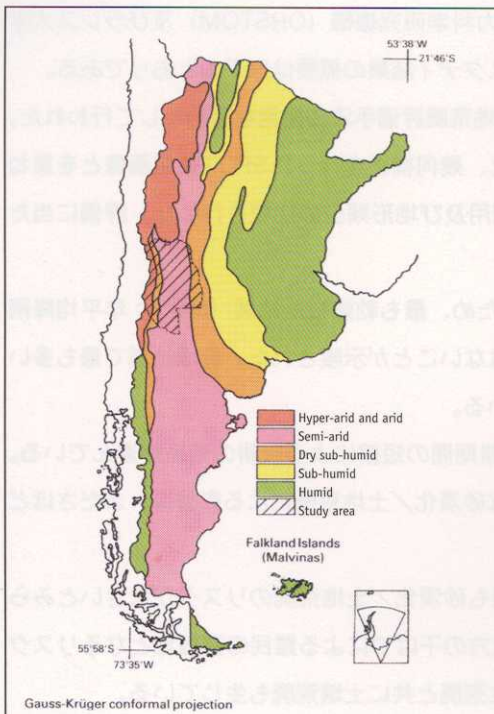


Figure 6-3B-1
Argentine Bioclimatic Zones and
Location of Case Study Area
Source:
World Atlas of Desertification (UNEP, 1992)

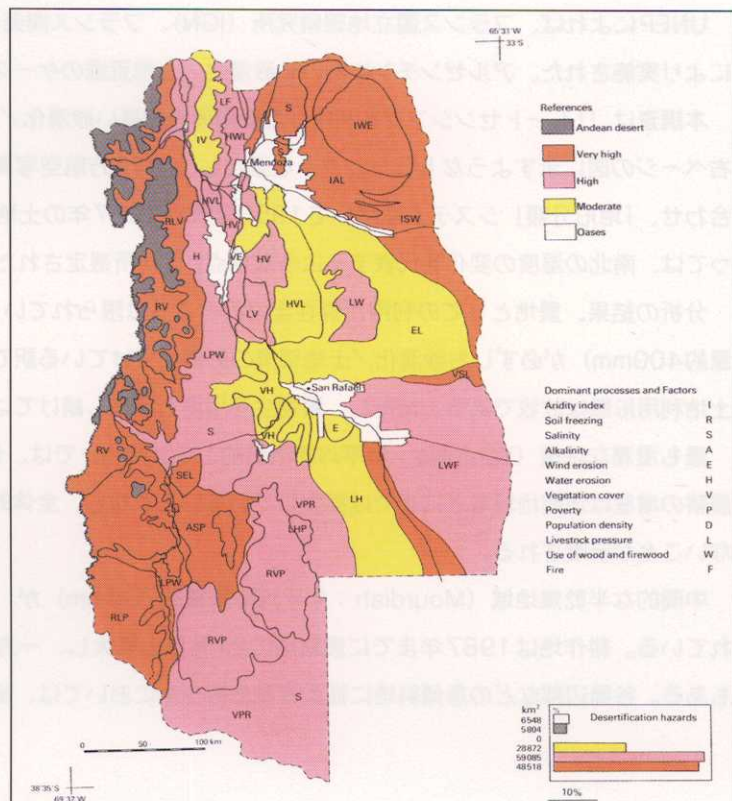


Figure 6-3B-3
Desertification/Land Degradation Hazards in Mendoza, Argentine
Source:
World Atlas of Desertification (UNEP, 1992)

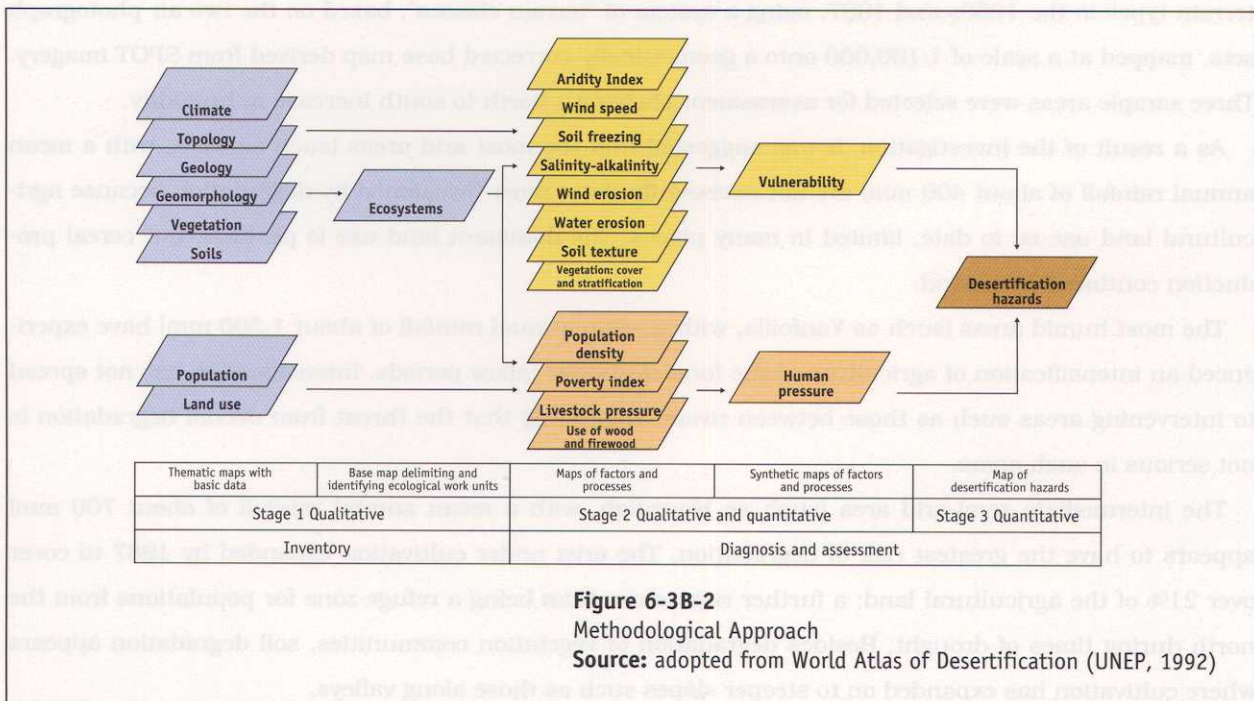


Figure 6-3B-2
Methodological Approach
Source: adopted from World Atlas of Desertification (UNEP, 1992)

UNEPによれば、フランス国立地理研究所 (IGN)、フランス開発協力科学研究機構 (ORSTOM) 及びランス大学により実施された、アルゼンチンにおける砂漠化／土地荒廃のケーススタディ結果の概要は以下のとおりである。

本調査は、リモートセンシングを利用した費用効果の高い砂漠化／土地荒廃評価手法の開発を目的として行われた。右ページの図に示すようなトランセクトを選定し、1/10万航空写真と、幾何補正を行ったSPOT衛星画像とを重ね合わせ、「地形分類」システムを用いて1950年代と1987年の土地利用及び地形類型の比較を行った。評価に当たっては、南北の湿度の変化を代表するような地点が3ヶ所選定された。

分析の結果、農地としての利用が現在までのところは限られているため、最も乾燥した地域 (Nara : 年平均降雨量約400mm) が必ずしも砂漠化／土地荒廃の影響を受けている訳ではないことが示唆された。乾燥地域で最も多い土地利用形態は放牧である。ただし、穀物生産用地も増加し続けてはいる。

最も湿潤な地域 (Yanfolila : 年平均降雨量約1,300mm) では、休耕期間の短縮による農耕の増産が進んでいる。農耕の増産は河間地域などにまでは拡大していないことから、全体的な砂漠化／土地荒廃による影響は、まださほどないことが示唆される。

中間的な半乾燥地域 (Mourdiah : 年平均降雨量約700mm) が、最も砂漠化／土地荒廃のリスクが大きいとみられている。耕作地は1987年までに農耕地の21%以上拡大し、一方北方の干ばつによる難民の避難地となるリスクもある。谷周辺部などの急傾斜地に拡大された耕作地においては、植生荒廃と共に土壌荒廃も生じている。

The following is a UNEP summary of a case study implemented by French National Geographic Institute (IGN), ORSTOM and the University of Reims.

This study aimed to develop a cost-effective methodology for the assessment of desertification using remote sensing. As shown in Figures on the right page, a transect was selected to compare land use and terrain types in the 1950s and 1987, using a system of "terrain classes", based on the two air photograph sets, mapped at a scale of 1:100,000 onto a geometrically-corrected base map derived from SPOT imagery. Three sample areas were selected for assessment showing a north to south increase in humidity.

As a result of the investigation, it was suggested that the most arid areas (such as Nara, with a mean annual rainfall of about 400 mm) are not necessarily those most threatened by degradation because agricultural land use is, to date, limited in many places. The dominant land use is pastoral, but cereal production continues to expand.

The most humid areas (such as Yanfolila, with a mean annual rainfall of about 1,300 mm) have experienced an intensification of agriculture in the form of shorter fallow periods. Intensification has not spread to intervening areas such as those between rivers, suggesting that the threat from overall degradation is not serious in such areas.

The intermediate semi-arid area (such as Mourdiah, with a mean annual rainfall of about 700 mm) appears to have the greatest risk of degradation. The area under cultivation expanded by 1987 to cover over 21% of the agricultural land: a further risk comes from being a refuge zone for populations from the north during times of drought. Besides degradation of vegetation communities, soil degradation appears where cultivation has expanded on to steeper slopes such as those along valleys.

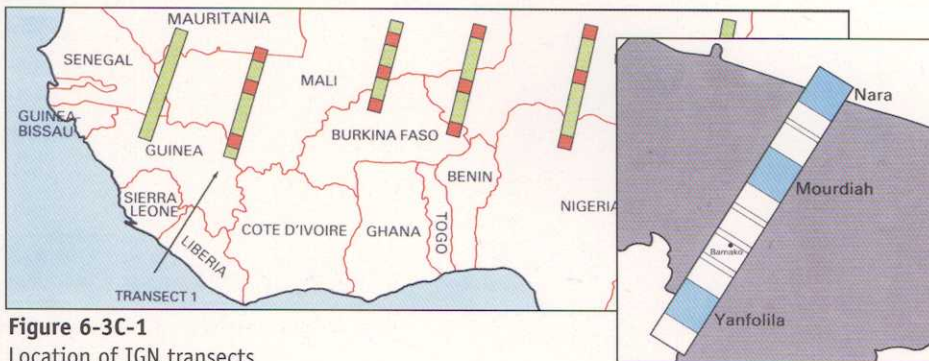


Figure 6-3C-1
Location of IGN transects

Figure 6-3C-2
Transect 1 with Location of Three SPOT Images

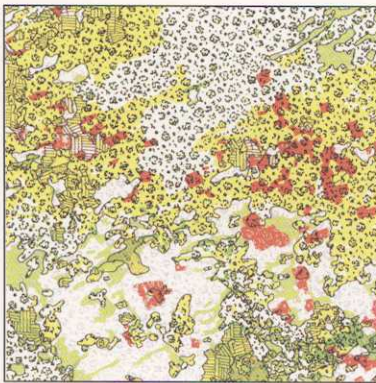


Figure 6-3C-3
Land Use Change,
Nara, 1957-1987

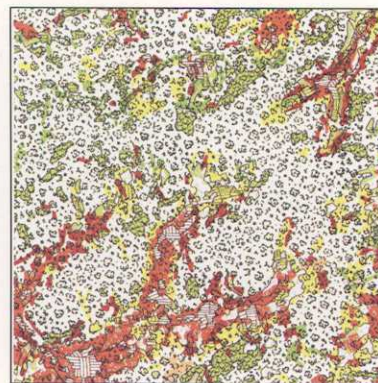


Figure 6-3C-4
Land Use Change,
Mourdiah, 1952-
1987

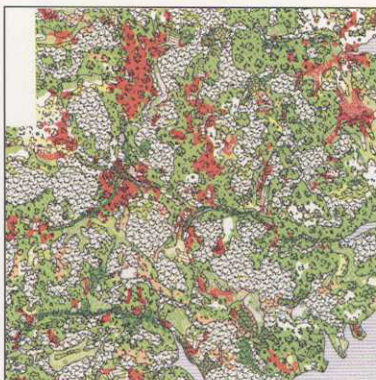


Figure 6-3C-5
Land Use Change,
Yanfolila, 1957-
1987

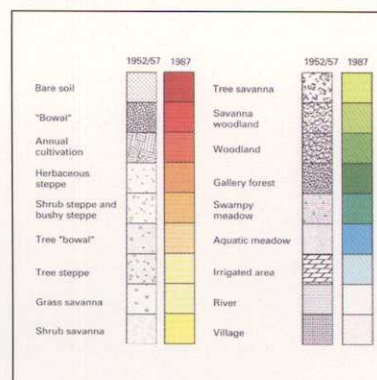


Figure 6-3C-6
Legend of Figure 6-
3C-3~5

Source:
World Atlas of Desertification (UNEP, 1992)

Table 6-3C-1 Data on Agricultural Land Use in Nara, Mourdiah and Yanfolila as a Percentage of Area in the Interpreted Zone

		Nara %	Mourdiah %	Yanfolila %
Crops of 1950s	C1	4.1	6.4	4.3
Crops of 1987	C2	7.3	15.2	10.6
Agricultural land including the crops for the 1950s	T1	28	65	73
Agricultural land including the 1987 crops	T2	55	71	72
Proportion of crops for the year in relation to agricultural land	C1/T1	14.7	9.9	5.9
	C2/T2	13.3	21.4	14.8

Source: World Atlas of Desertification (UNEP, 1992)

7.

砂漠化／土地荒廃対策

Response Strategies to Combat Desertification/Land Degradation

7-1 砂漠化／土地荒廃対策の事例 Examples of Response Strategies

砂漠化／土地荒廃の生じる過程において、最も大きな影響を及ぼすものは人間活動である。従って、適切な農業システムの導入、過放牧や過耕作の中止、砂丘の固定化、防風林帯の設置、植林、水・土壌の保全などの手段を通して、人間による土地利用を改善することにより、砂漠化／土地荒廃を防止することが可能である。右ページに示したように、ローカルレベルの砂漠化／土地荒廃防止に成果を上げた技術例がある。ここでは、右ページの図に示すような8つの手法が用いられている。

1. 森林再生
2. ガリー沿いの植樹
3. 三日月工法による植栽
4. 急傾斜地の階段工法
5. 等高線耕作工法
6. 表流水流去防止工法
7. 防砂・防風帯の植樹
8. 砂丘の固定

この他、人口増加や森林伐採、不適切な資源利用などの人間活動に関する対策も必要である。トレーニングを通して地元組織の自助努力の向上や能力開発を図り、森林管理、水利用、土地利用のあり方を改善するような方法も求められている。また、情報交換、環境教育、観測手法などの果たす役割も重要である。

Human activity is the most important factor in the desertification/land degradation process. For this reason this process can be controlled and reversed by human actions to improve land use, such as introducing appropriate farming systems, halting over-grazing and over-cultivation, stabilizing sand dunes, providing wind breaks and shelter belts, planting trees and improving soil and water conservation. The examples on the right page shows of techniques that have been successful at the local level. The figure on the right page shows eight ways to prevent desertification:

1. reforestation
2. plant trees along gullies
3. grow tree crops on eyebrow terraces
4. terrace steep land
5. cultivate along the contour
6. build bunds to control the run-off of surface water
7. plant shelter belts and windbreaks
8. stabilize sand dunes

In addition, measures are needed to deal with population growth and human activities such as deforestation and resource mis-management. Measures should be taken to improve the management of forests, water and land by boosting responsibility and capability of local organizations through training. Information exchange, environmental education and observation methods play important roles in carrying out actions to combat desertification.

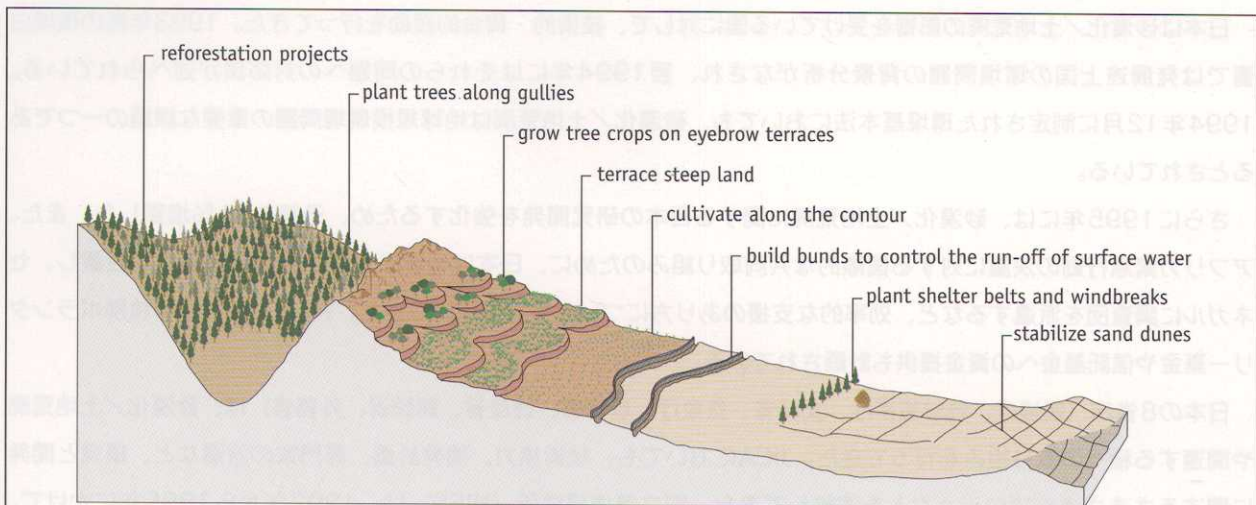


Figure 7-1-1

Eight Ways to Prevent Desertification

Source:

UNEP Environment Brief No.2 "Sands of Change"

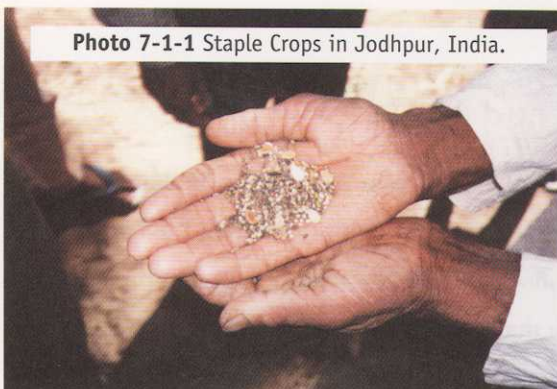


Photo 7-1-1 Staple Crops in Jodhpur, India.

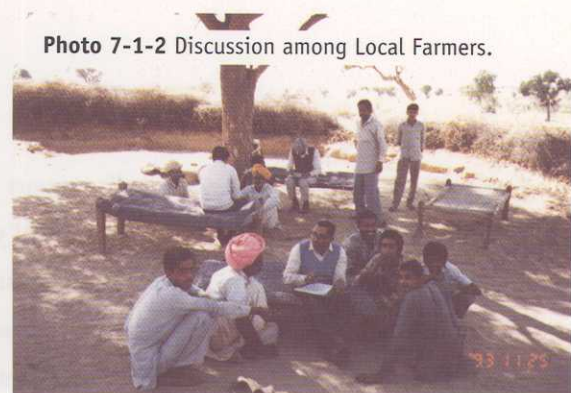


Photo 7-1-2 Discussion among Local Farmers.



Photo 7-1-3 Irrigation ditch.



Photo 7-1-4
Water Tank of a Village.

日本は砂漠化／土地荒廃の影響を受けている国に対して、技術的・資金的援助を行ってきた。1993年度の環境白書では発展途上国の環境問題の背景分析がなされ、翌1994年にはそれらの問題への対応策が述べられている。1994年12月に制定された環境基本法においても、砂漠化／土地荒廃は地球規模環境問題の重要な課題の一つであるとされている。

さらに1995年には、砂漠化／土地荒廃に関する日本の研究開発を強化するため、予算を21%増額した。また、アフリカ緊急行動の決議に対する国際的な共同取り組みのために、日本は環境庁やJICAが検討委員会を設置し、セネガルに調査団を派遣するなど、効率的な支援のあり方について検討を続けてきた。さらに、INCDの特別ボランティア基金や信託基金への資金提供も計画されている。

日本の8省庁（環境庁、科学技術庁、文部省、気象庁、農水省、通産省、建設省、外務省）は、砂漠化／土地荒廃や関連する種々の取り組みを行ってきた。JICAにおいても、技術協力、開発計画、専門家の派遣など、環境と開発に関するさまざまなプロジェクトを実施してきた。国立環境研究所（NIES）は、1992年から1995年にかけて、アジア及びアフリカ地域を対象として「砂漠化と人間活動の相互影響評価に関する研究」を3年計画で実施してきた。アジア地域の調査対象国である中国、インド、カザフスタン、タイの4ヶ国についての共同研究結果の概要は、前述の第6章に示されている。

Japan offers financial and technical support to countries suffering from desertification/land degradation. The White Paper on Environment in fiscal year 1993 included an attempt to analyze the background of environmental problems in developing countries and in fiscal year 1994 took a look at problems and measures to combat them. Desertification is also one of the major global environmental issues covered in the Basic Environment Plan adopted by the Cabinet in December 1994.

Japan increased its budget to strengthen national efforts related to desertification, mainly in the field of research and development, by 21% in fiscal year 1995. As a specific effort for international cooperation responding the resolution on Urgent Actions for Africa, Environment Agency and JICA established a committee, dispatched a survey mission to Senegal and continued seeking ways to offer effective assistance. They are also planning to make an additional financial contribution to the INCD Special Volunteer Fund and Trust Fund.

Eight ministries and agencies in Japan (including EA, STA, MOE, JAM, MAF, MITI, MOC, and MOFA) have been dealing with desertification/land degradation and related problems. JICA has conducted various environment and development cooperation programmes such as project type technical cooperation, development studies, and dispatching of experts. The National Institute for Environmental Studies (NIES) implemented a three year research programme entitled "Evaluation on Interaction between Desertification and Human Activities" from 1992 to 1995 in Asia and Africa. In Asia, it was implemented as a cooperative study with China, India, Kazakhstan and Thailand.

Table 7-2A-1 Activities of Japanese Government

Environment Agency (EA)

- Evaluation on interaction between desertification and human activities
- Study of Comprehensive approach to combat desertification

Science and Technology Agency (STA)

- Japan-China joint study on desertification mechanism

Ministry of Education, Science and Culture (MOE)

- Sino-Japanese cooperation programme on the atmosphere-land surface processes experiment in the Heika River Basin (HEIFE)
- Activities in Universities-
- Regeneration of agro-forest-ecosystems in Subsaharan Africa
- Environmental change and land degradation/desertification in Subsaharan Africa
- Study on food production and its socio-economic background on Africa
- Basic study on desertification control in Northwest China
- Environment and economy restoration project in Khazakhstan, Central Asia
- Japan-Italy joint study on slope erosion and debris-transport

Japan Meteorological Agency (JMA)

- Japan-China joint study on desertification mechanism
- Evaluation on interaction between desertification and human activities

Ministry of Agriculture, Forestry and Fisheries (MAFF)

- Basic study on environmental protection for combating desertification
- Establishment of technical guideline for forest rehabilitation in desertified areas
- Study on water behaviour and soil characteristics in arid regions
- Analysis of variation in grassland resources, and development of technique for their prevention in the arid and semi-arid zone of Africa
- Global environment and agricultural resource management
- Dynamic behaviour of soil erosion, degradation and development of techniques for prevention of erosion in tropical farmland
- Study on planning sustainable agricultural development for Africa
- Establishment of sustainable agricultural technology by improvement of agro-environment in the marginal dryland area

Ministry of International Trade and Industry (MITI)

- Research and development of water holding substances for arid region
- Project on biological CO₂ Fixation on a desert area

Ministry of Construction (MOC)

- Global Super-project

Ministry of Foreign Affairs (MAF)

see JICA

Source: Kadamura, H: Desertification Control and Related Activities in Japan, Paper presented at the 7th Meeting of the International Panel of Experts on Desertification (IPED), Geneva, 12-16 December, 1994

Table 7-2A-2 JICA Activities

Forestry projects:	reforestation, social forestry, management and control of natural forest; desertification control activities, research and training, assistance of socio-economic development, support and guidance to Japanese private enterprises which are involved in development projects, Grant Aid Scheme for expenditures, "Green Corps Units" project teams of Japanese young volunteers
Agricultural projects:	to increase food production and keep production level and also to contribute both to improvement of farmers living standards and conservation of the environment through development of rural areas
Integrated projects:	Rehabilitation of the area affected by drought through Master Plan; Construction of wells and irrigation structures; Providing of construction material (Niger, 1990-1992) as well as planning a agricultural development program and studying irrigated agriculture by groundwater pumped up using solar energy and by rational use of running water (Mali, 1991-1995)

Source: Kadamura, H: Desertification Control and Related Activities in Japan, Paper presented at the 7th Meeting of the International Panel of Experts on Desertification (IPED), Geneva, 12-16 December, 1994

7-2 B. 日本のNGOによる取り組み Activities by Japanese NGOs

砂漠化／土地荒廃防止に当たって最も重要な点は、「ボトムアップアプローチ」の確実な実施である。右ページに挙げた日本のNGOの活動のいくつかは、乾燥、半乾燥、乾燥半湿潤地域における砂漠化／土地荒廃問題に関する取り組みにおいて、このアプローチを適用した活動の好例を示している。

日本のNGOの活動には、地球環境基金などの国家予算や基金の援助も適用される。また、日本のNGOに限らず外国のNGOも、小規模ではあるがODAによる援助の適用を受けることが可能である。インド、ガーナ、ジンバブエ、南アフリカなどのNGOが、これらの資金援助を受けて活動を行った。

日本には砂漠化／土地荒廃の影響を受けている乾燥地域や半乾燥地域が存在しないため、砂漠化／土地荒廃問題の重要性に関する一般の意識を向上させることは決して容易ではない。しかし、日本が国際社会の一員として、その国力と世界からの期待とに見合う責務を果たすためには、より一層の積極的な活動が必要とされている。

It has been pointed out that the most important way to combat desertification/land degradation is to support 'bottom-up approaches.' Several activities being carried out by Japanese NGOs shown in the table on the right provide good examples of this approach, related to desertification/land degradation problems in arid, semi-arid and dry sub-humid regions.

Support for Japanese NGO activities can include public funds and/or grant aid. Some activities are sponsored by the Japan Fund for the Global Environment. Foreign NGOs can also receive small-scale grant aid, such as NGOs in India, Ghana, Zimbabwe and South Africa which have received this type of aid from Japan's Official Development Assistance (ODA) for their activities.

As Japan does not have any arid- and semi-arid areas suffering desertification/land degradation, it is not easy to increase public awareness about the importance of these problems. However, as a member of the international community, Japan should actively strive to do so in a way that reflects its stature and the expectations of the world.

Table 7-2B-1 Activities by Japanese NGO's.

NGO	established	Objective	Country
Action for Greening Sahel	1991	Desertification control and assisting local populations to increase food self-sufficiency	Chad
The African Education Found (AEF)	1987	Tree planting	Kenya
Africa-Japan Forum	1994	Information collection and exchange, reinforcing domestic NGO's and public awareness; Information collection, assistance to programmes for self-reliance, and promotion of South-South cooperation; Proposals for improving social environment, participation in international meetings, and information exchange	all African countries
The Africa Tree Center Support Group (ATCSG)	1987	Support for reforestation and self-sufficiency	South Africa
Association pour Cooperation l'Autogestion Rural en Afrique de l'Ouest (CARA)	1990	Assistance for improving living conditions, health care, education and desertification control	Mali
Association Sahel	1987	Desertification control	Mali
Center for Global Action	1988	Desertification control	Zambia, Egypt
Desert Development Institute Japan (DDIJ)	1971	Contribution to the development of desert countries through desertification control and greening	United Arab Emirates, Egypt
Green Sahel Fund, Osaka	1990	Tree-planting	Senegal
The Institute of Cultural Affairs (ICA, Japan)	1970	Improvement of living conditions of rural population	India, Mexico, Zambia
Japan Green Desert Association	1984	Tree-planting	China, Egypt, Brazil
Japan International Volunteer Center (JVC)	1980	Environmental rehabilitation of degraded lands by Comprehensive Regional Development Project using an integrated participatory approach	Ethiopia, Thailand
Organization for Industrial, Spiritual & Cultural Advancement-International	1961	Tree-planting, coordination of environmental activities	worldwide
Sumiyaki no kai (Charcoal Making Society)	1985	Technological assistance for improving charcoal production	China, Indonesia, Kenya, etc.
International Development Center of Japan (quasi NGO)	1971	International cooperation in the management of global environment and agricultural resources; development policy formulation	worldwide

Source: Kadomura, H: Desertification Control and Related Activities in Japan, Paper presented at the 7th meeting of the International Panel of Experts on Desertification (IPED), Geneva, 12-16 December, 1994.

略語一覽

Acronyms and Abbreviations

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Acronyms and Abbreviations

ACSAD	Arab Centre for the Study of Arid Zones and Dry Lands
ADALCO	African Deserts and Arid Lands Committee (AMCEN)
AGFUND	Arab Gulf Programme for United Development Organization
AI	Aridity Index
ALECSO	Arab League Educational, Cultural and Scientific Organization
AMCEN	African Ministerial Conference on the Environment
ANGOLO	Asian NGO Coalition for Agrarian Reform and Rural Development
ATCSG	Africa Tree Center Support Group
AVHRR	Advanced Very High Resolution Radiometer
BAPMoN	Background Air Pollution Monitoring Network
CBO	Community Based Organization
CEFIGRE	International Training Centre for Water Resources Management
CIDIE	Committee of International Development Institutions on the Environment
CGIAR	Consultative Group on International Agricultural Research
CILSS	Permanent Interstate Committee for Drought Control in the Sahelian Zone
CIAT	Centro Internacional de Agricultura Tropical
CIFOR	Center for International Forestry Research
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo
CIP	Cento Internacional de la Papa
COMIDES	Interstate Committee of Ministers on Desertification
CRU	Climate Research Unit
DC/PAC	Desertification Control Programme Activity Centre
DDIJ	Desert Development Institute Japan
DESCON	Consultative Group on Desertification
DESCONAP	Desertification Control in Asia and the Pacific
DOEM	Designated Officials for Environmental Matters
EA	Environment Agency
ECA	Economic Commission for Africa
ECB	Environment Coordination Board
ECE	Economic Commission for Europe
ECG	Ecosystem Conservation Group
ECLAC	Economic Commission for Latin America and the Caribbean
ECOSOC	Economic and Social Council
ECOWAS	Economic Commission of West African States
EEC	European Economic Community
ELCI	Environment Liason Centre International
EMASAR	Ecological Management of Arid and Semi-Arid Rangelands

EMINWA	Environmentally Sound Management of Inland Waters
ESCAP	Economic and Social Commission for Asia and the Pacific
ESCWA	Economic and Social Commission for Western Asia
FAO	Food and Agriculture Organization of the United Nations
GATT	General Agreement on Tariffs and Trade
GBPNA	Transnational Green Belt Project in North Africa
GCM	General Circulation Model
GEF	Global Environmental Facility
GEMS	Global Environmental Monitoring System
GIS	Geographic Information System
GLASOD	Global Assessment on Soil Degradation
GRID	Global Recourse Information Data Base
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GVI	Global Vegetation Index
IAEA	International Atomic Energy Agency
IAWGD	Inter-Agency Working Group on Desertification
IBPGR	International Board for Plant Genetic Resources
ICA	Institute of Cultural Affairs
ICASALS	International Centre for Arid and Semi-Arid Land Studies
ICIPE	International Centre of Insect Physiology and Ecology
ICIV	Institut de la Carte Internationale de la Végétation
ICRAF	International Council for Research in Agroforestry
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
ICSU	International Council of Scientific Unions
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IGADD	Inter-Governmental Authority on Drought and Development
IIMI	International Irrigation Management Institute
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
ILRAD	International laboratory for Research on Animal Diseases
INCD	Intergovernmental Negotiation Committee for the Elaboration on the International Convention to Combat Desertification in Those Countries Experiencing Serious Drought, Particularly in Africa
INIBAP	International Network for the Improvement of Banana and Plantain
IRRI	International Rice Research Institute
ISNAR	International Service for National Agriculture Research

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Acronyms and Abbreviations

IIED	International Institute for Environment and Development
ILO	International Labour Organization
IPAL	Integrated Programme on Arid Lands
ILRAD	International Laboratory for Research on Animal Diseases
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environmental Conservation Association
ISRIC	International Soil Reference and Information Centre
ISSS	International Society of Soil Sciences
IUCN	International Union for Conservation of Nature and Natural Recourses
IVCJ	Japan International Volunteer Center
JICA	Japan International Cooperation Agency
MAB	Man and the Biosphere Programme
MAFF	Ministry of Agriculture, Forestry and Fisheries
MARC	Monitoring and Assessment Research Centre, University of London
MITI	Ministry of International Trade and Industry
MOC	Ministry of Construction
MOE	<i>Ministry of Education</i>
MSDN	International Mircobial Strain Data Network
MSS	Multi-Spectral Scanner
NDVI	Normalized Difference Vegetation Index
NEAP	National Environmental Action Plan
NGO	Non-governmental Organization
NIES	National Institute for Environmental Studies
NAP	National Action Programme (to Combat Desertification)
NPACD	National Plan of Action to Combat Desertification
OAU	Organization of African Unity
ODA	Official Development Assistance/Aid
OECD	<i>Organization for Economic Cooperation and Development</i>
OSS	Sahara and Sahel Regional Observatory Programme
PACD	Plan of Action to Combat Desertification
PET	potential evapo-transpiration
RIOD	Reseau international d' ONG sur la Desertification
ROA	Regional Office for Africa
SADC	Southern African Development Community (former SADCC)
SADCC	Southern African Development Coordination Conference
SCOPE	Scientific Council on Problems of the Environment
SCOPE	Society for Conservation and Protection of Environment

STA	Science and Technology Agency
UN	United Nations
UNCOD	United Nations Conference on Desertification
UNDP	United Nations Development Programme
UNDRO	United Nations Office of the Disaster Relief Coordinator
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNU	United Nations University
WARDA	West Africa Rice Development Association
WHO	World Health Organization
WMO	World Meteorological Organization
WRI	World Research Institute
WWF	World Wide Fund for Nature