
United Nations Environment Programme

Environmental Images

By Essam El-Hinnawi

United Nations Environment Programme UNEP

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Foreword

People have fled turmoil since the beginning of time. But now increasing numbers are on the move, seeking sanctuary from the turmoil created by use and abuse of their land and by natural disasters.

These people are the millions fleeing the droughts of northern Africa, the victims of Bhopal and the thousands made homeless by the Mexico earthquake. They are environmental refugees.

The post-World War II definition of refugees, as persecuted individuals, has been widened by the United Nations to embrace whole groups of people fleeing from dangerous circumstances. This book describes why more and more people are vulnerable to dangerous environmental circumstances — drought, desertification, flood, cyclone, earthquake and the aftermath of war.

The vulnerable are the poor, most of whom are in the third world. They are the people who crowd flood-prone river valleys, who live in slums precariously perched on city hillsides, who abandon arid land when their cattle have grazed the last blade of grass.

Forced to leave their homes, they roam until they can return or settle for good in urban slums and other communities where the often meagre facilities are already taxed.

Better management of the environment — better housing, land management and conservation — will reduce the vulnerability of environmental refugees to natural and man-made disasters. But before solutions can be developed, the international community has to recognise the problems. The story *Environmental refugees* tells is one which must now be listened to.

Mostafa K. Tolba
Executive Director
United Nations Environment Programme

Preface

This is a booklet about people — a special category of people. It is about environmental refugees — those who had to leave their habitat, temporarily or permanently, because of a potential environmental hazard or disruption in their life-supporting ecosystems.

This booklet is written for the policy-makers and the educated public to show them that people are both origin and victim of the actions that lead to environmental disruption and degradation. No attempt has been made here to discuss in detail the different ecosystems or the interactions between these and the reader should refer to the UNEP book "The World Environment: 1972-1982" for such discussion.

In the preparation of this booklet, I received a great deal of information from UNEP, UNDRO, UNHCR, The International Red Cross, UNICEF, WFP, Earthscan and many other institutions. To all of them, I should like to express my thanks and gratitude.

I am particularly indebted and grateful to Dr. M.K. Tolba, Executive Director of UNEP, for his continuous support and advice, and to Dr. M. Hashmi of the State of Environment Unit, UNEP, Nairobi, for his wholehearted co-operation in the course of the preparation of this manuscript.

Essam El-Hinnawi
Research Professor
National Research Centre
Cairo

"Of thirty ways to escape danger, running away is best"
An old Chinese proverb

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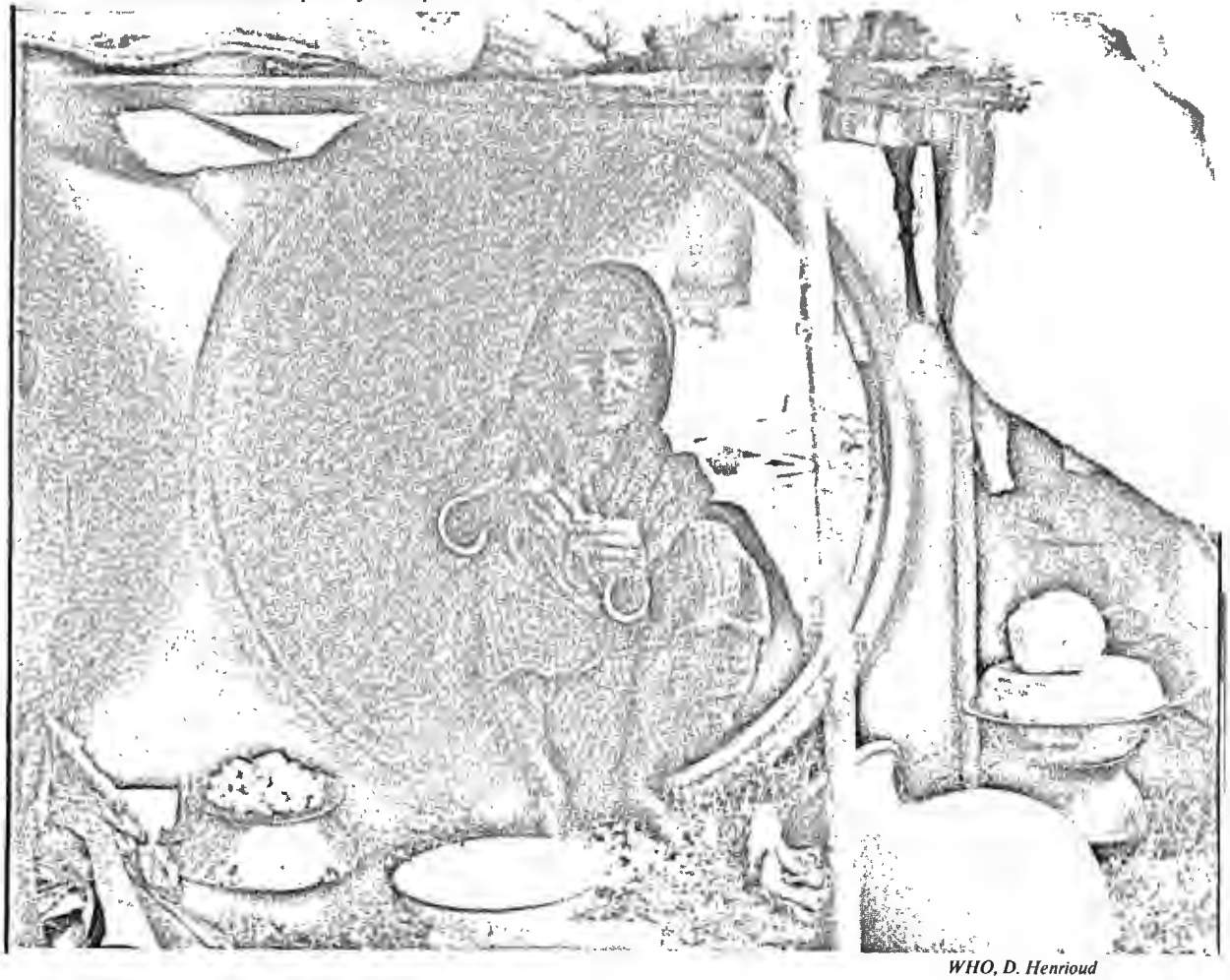
The United Nations Conference on the Human Environment convened in Stockholm in 1972 declared that: "A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well-being depend. Conversely, through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes".

In other words, there was general recognition that environmental concerns should not be a barrier to development but should be a part of the process, as development that is environmentally sound is also likely to be enduring and to avoid unforeseen and unwelcome side effects. "Ecodevelopment"—a word coined to describe this process of ecologically-sound development, a process of positive management of the environment for human benefit—emerged as a central theme during the Stockholm Conference.

This Indian woman lives in a water pipe. "Sheer lack of development may degrade the quality of life more than the adverse environmental impacts of development."



WHO, D. Henrioud

During the last ten years, the studies and discussions carried out by different expert groups and institutions on the relationship between environment and development have led to a marked elaboration of our perception of environmental issues and our understanding of the complex relationship between people, resources, environment and development. It is now recognized that where poverty is widespread and large numbers of people do not have adequate food, shelter, health care, education or proper employment, sheer lack of development may degrade the quality of life more than the adverse environmental impacts of development. The grinding and pervasive poverty in the developing nations has been referred to as the "pollution of poverty", while the widespread neglect of the environment and the erosion of social values in the developed nations has been described, in its advanced state, as the "pollution of affluence". It is also now generally accepted that development is a multi-dimensional concept, encompassing not only the economic and social aspects of national activity but also those related to population, the use of natural resources and the environment.

Historically, natural resources have been exploited without restraint. They were considered inexhaustible because many had the capability for self-generation. However, it has recently been realized that the process of self-generation is slow and complicated. And if some natural resources are over-exploited, the stock will rapidly decrease, leading ultimately to the complete destruction of the resources on which people depend for sustenance.

Therefore, one of the most fundamental problems confronting us today is how to meet the basic needs and requirements of all people on earth without simultaneously destroying the resource base—the environment—from which ultimately these needs have to be met. Hence an understanding of the interrelationship between environment and development is essential for the successful implementation of any strategy for the protection and management of the environment. Similarly, for development strategies to be sustainable long-term, they must explicitly recognize the opportunities and constraints provided by the environment. "New" approaches to development or "alternative-style development" should be followed to achieve optimum compatibility between environment and development.

Although the public's attitude towards the environment has changed considerably since the Stockholm Conference, people remain more concerned about pollution than about natural resource degradation or the necessity for conservation. Public awareness of environmental hazards is initiated mainly by "trigger events". Only when a severe earthquake or cyclone causes massive damage in a country, or when drought affects a whole region driving millions of people to flee and causing tremendous human suffering, do the policy-makers and the public become alert to such environmental hazards and their consequences. But awareness is one thing and action another. And action should aim at teaching people—irrespective of their level of education—that "prevention is better than cure". Loss of topsoil, largely as a result of inadequate agricultural practices, and the removal of tree and shrub cover leads to a continuous reduction in food production. If the deterioration of soil continues, people become vulnerable to famine. How much wiser if we could teach people to conserve their soil in the first place.

Refugees

There is no comprehensive international definition of a "refugee". The United Nations 1951 Convention Relating to the Status of Refugees, as amended by the 1967 Protocol Relating to the Status of Refugees, defines a refugee as a person who "owing to well-found fear of being persecuted for reasons of race, religion,

nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country". The United Nations Convention of 1951 was formulated in the specific context of post-war Europe, when millions of displaced people affected by boundary shifts and changes of governments existed in legal limbo (Newland, 1981). The Convention sought to define the rights of these individuals and the obligations of States that found themselves hosts to refugees for whom return to their own countries would probably entail a prison sentence—if not a death warrant. The task was conceived as a one-time obligation: the Convention as written applied only to victims of "events occurring before 1 January, 1951", and nations were given the option of applying its provisions only to Europe. Once the refugees of the Second World War were taken care of, it was thought the job would be finished.

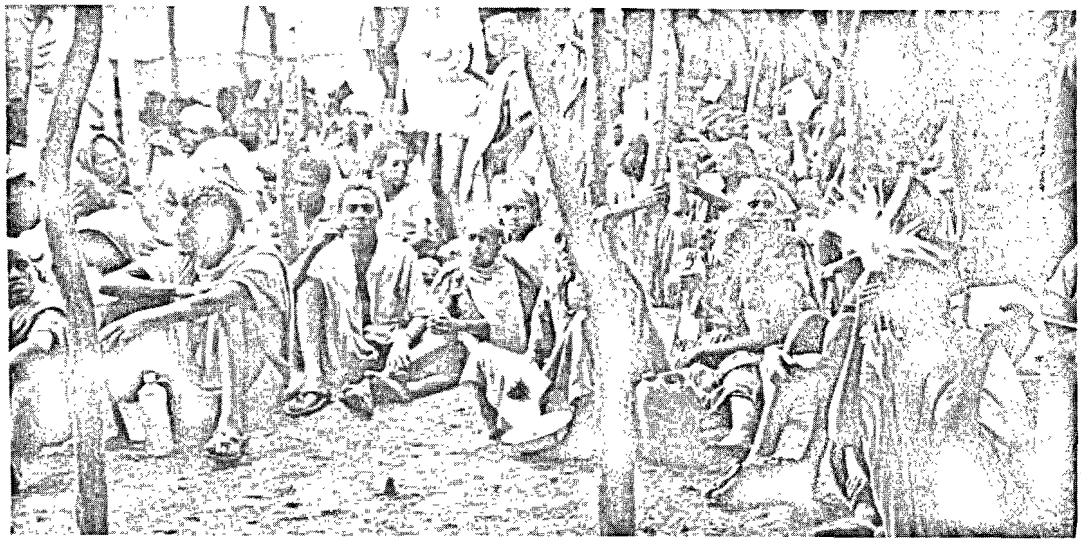
The limits of time and geography incorporated in the 1951 Convention eventually proved serious constraints on the world's ability to deal collectively with refugee problems. New situations kept arising that generated additional refugees. Since the Second World War, the vast majority of refugees have originated in Africa, Asia and Latin America. The 1967 Protocol extended the scope of the Convention by eliminating the provision that only victims of pre-1951 events were covered and by removing the geographic limitation except where ratifiers of the Convention specifically chose to retain it.

The definition of a refugee now extends beyond the persecuted individual to whole groups of people fleeing from dangerous circumstances. An important instrument in accomplishing this was the Organization of African Unity's Convention on Refugees, adopted by the OAU in 1969. The OAU agreement incorporated the earlier definition of a refugee and added to it "every person who, owing to external aggression, occupation, foreign domination or events seriously disturbing public order in either part or the whole of his country of origin or nationality, is compelled to leave his place of habitual residence in order to seek refuge in another place outside his country of origin or nationality".

The technical and sometimes tiresome question of who is and who is not a refugee has enormous significance for the displaced people themselves. The answer determines the degree of support and protection the individuals receive as well as the long-term resolution of their plight. Recently, along with recognizing groups of refugees, the United Nations has authorized the United Nations High Commissioner for Refugees to assist people who are displaced within their own country's borders (Newland, 1981).

The United Nations and OAU definitions of refugees are, necessarily, legalistic ones. Neither the U.N. nor any of its member nations accord refugee status to people who flee from intolerable economic conditions, unless these conditions are a direct product of war. The same is true for people displaced by natural hazards.
In 1983 the Ford Foundation classified "alien" populations into four general categories: refugees—aliens generally recognized as having fled from persecution or civil strife; migrants—alien workers, generally unskilled, and individuals seeking to join family members, whose presence in a given country may be legal, illegal or undocumented; asylum seekers—aliens whose refugee status has not been determined; and a group that falls into the grey area between these categories made up of safe-haven seekers—aliens seeking a temporary safe-haven from civil strife or natural disasters.

There has been an increasing number of refugees as defined by the U.N. in recent years. The Brandt Commission (1980) estimated that between 1977 and 1979 worldwide an average of 2,000 to 3,000 people became refugees each day.



UNHCR, M. Vanappelghem

Ethiopian refugees wait for medical help at Wad Kowli camp in eastern Sudan. "The definition of a refugee now extends beyond the persecuted individual to whole groups of people fleeing from dangerous circumstances."

According to the U.N. High Commissioner for Refugees, the numbers of refugees in the world increased from about 2.5 million in 1970 to 7.5 million in 1980. The Ford Foundation gave a figure of 10 million refugees in 1982.

The definition of a refugee is constantly evolving. Every conflict or other reason that uproots people is the product of a unique set of political, economic, geographical, social and environmental circumstances. Accordingly, the framework that allows the international community to deal adequately with the displaced people is being constantly stretched to fit particular cases.

Environmental refugees

In a broad sense, all displaced people can be described as environmental refugees, having been forced to leave their original habitat (or having left voluntarily) to protect themselves from harm and/or to seek a better quality of life. However, for the purpose of this book, environmental refugees are defined as those people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life. By "environmental disruption" in this definition is meant any physical, chemical and/or biological changes in the ecosystem (or the resource base) that render it, temporarily or permanently, unsuitable to support human life. According to this definition, people displaced for political reasons or by civil strife and migrants seeking better jobs purely on economic grounds are not considered environmental refugees.

There are three broad categories of environmental refugees. First, there are those who have been temporarily displaced because of an environmental stress. Once the environmental disruption is over and the area rehabilitated to its original state, they return to their habitat. This is usually the situation with populations, displaced by natural hazards such as earthquakes or cyclones or an environmental accident (for example, an industrial accident that created temporary environmental disruption). The second category of environmental refugees

UN, John Isaac

On the move in Chad. "The main reason for their migration is that the resource base in their original habitat has deteriorated to such a degree that it can no longer meet their basic needs."

comprises those who have to be permanently displaced and re-settled in a new area. They are displaced because of permanent changes, generally man-made, that affect their original habitat—in the case of the establishment of huge dams, for example, and the associated man-made lakes. The third category of environmental refugees consists of individuals or groups of people who migrate from their original habitat, temporarily or permanently, to a new one within their own national boundaries, or abroad, in search of a better quality of life. The main reason for their migration is that the resource base in their original habitat has deteriorated to such a degree that it can no longer meet their basic needs. In this case migration depends mainly on the refugees' perception of the change and their ability to cope with its consequences. For example, share-croppers and small-holders whose lands are being waterlogged and salinized, and who cannot afford the capital investment necessary to reclaim them, often give up their holdings and migrate to nearby urban centres in search of other jobs. Migrants from areas hit by drought initially exploit urban resources only during crisis; they envision returning to their villages once environmental conditions improve. Only when drought continues for several consecutive years, raising doubts in their minds about the future productivity of their home areas, do migrants plan to remain in or seek new ways of earning their living.

Each of the above-mentioned categories of environmental refugees create a number of environmental, socio-economic and cultural problems. These problems affect the natural physical environments of the areas to which the refugees migrate. They also affect the quality of life of the refugees themselves and of the inhabitants of the areas to which they migrate.

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[illegible] vents called "natural disasters" are killing more and more people each year and driving increasing numbers from their homes. The people most affected by such hazards are the third world poor: Figure 1 shows that the regions most prone to natural disasters are mostly located in the developing countries.

A 1984 report by the Swedish Red Cross entitled "Prevention Better than Cure" used data from the League of Red Cross and Red Crescent Societies and also the United States Office for Foreign Disaster Assistance lists to compare average annual disasters on a decade by decade basis. The report showed a sharp jump in disasters from the 1960s to the 1970s. The disasters which increased included floods, tropical cyclones, drought and earthquakes (Table 1). A great many more people died each year in disasters during the 1970s than during the 1960s. The number of people affected each year also increased (Table 1).

If the number of people killed in each disaster is compared with the income of the country involved, a steep rise in mortality is shown as income decreases (Fig. 2). Low- and middle-income countries are more affected by natural disasters than high-income countries. This is mainly due to higher population densities among the poor, inadequate shelter and degraded environmental conditions.

Both Tokyo, Japan, and Managua, Nicaragua, are prone to earthquakes. But the people of Tokyo are far less vulnerable to injury by earthquakes than those of Managua because Tokyo has strictly enforced building codes, zoning regulations, earthquake training and communications systems. In Managua,

Fig. 1: Natural hazards, regions at higher risk (after Wijkman and Timberlake, 1984)

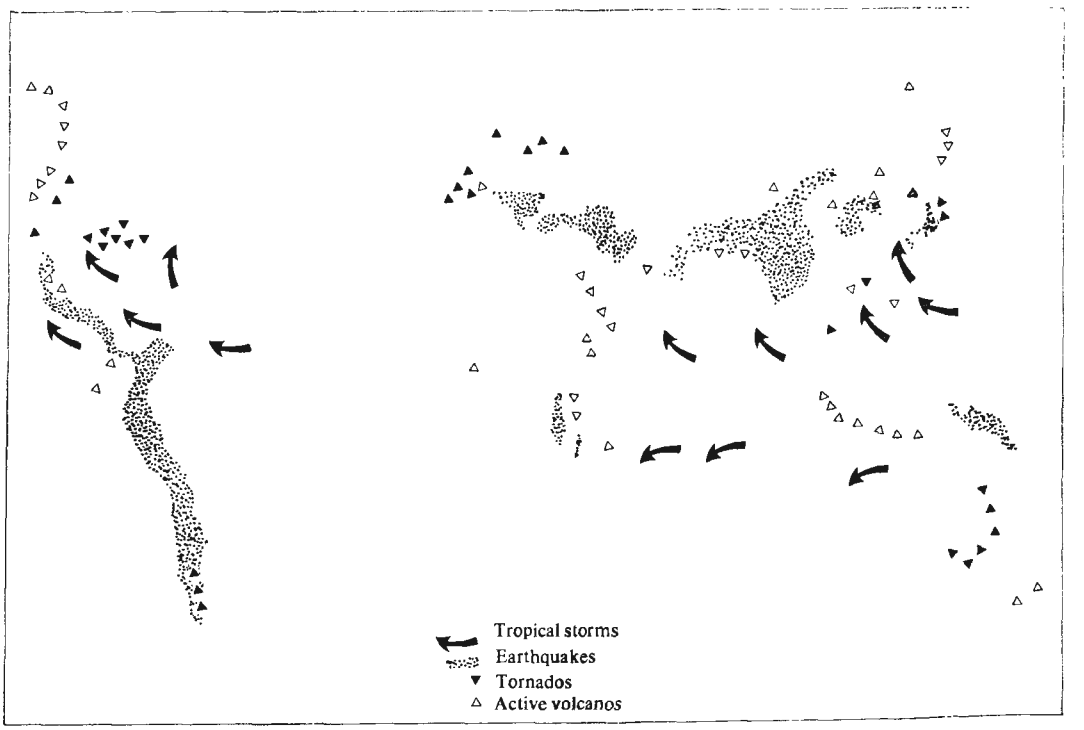


Table 1: Natural disasters in the 1960s and 1970s
(modified after Wijkman and Timberlake, 1984)

I. *Number of recorded natural disaster events each year*

	1960s	1970s
Drought	5.2	9.7
Flood	15.1	22.2
Tropical cyclone	12.1	14.5
Earthquakes	6.9	8.3
	39.3	54.7

II. *Number of people killed each year in disasters*

	1960s	1970s
Drought	1,010	23,110
Flood	2,370	4,680
Tropical cyclone	10,750	34,360
Earthquakes	5,250	38,970
	19,380	101,120

III. *Number of people affected each year by disasters*

	1960s	1970s
Drought	18,500,000	24,400,000
Flood	5,200,000	15,400,000
Tropical cyclone	2,500,000	2,800,000
Earthquakes	200,000	1,200,000
	26,400,000	43,800,000

where many still live in top-heavy, mud-brick houses on hillsides, the people are very vulnerable.

This difference is shown by a list of disaster events and fatalities from 1960 to 1980 (Table 2). Japan suffered 43 earthquakes and other disasters and lost 2,700 people or 63 deaths per disaster. Peru suffered 31 disasters with 91,000 dead or a colossal 2,900 dead per disaster.

The poor countries which suffer such heavy death tolls and the frequent displacement of people are those countries in which environmental degradation is proceeding

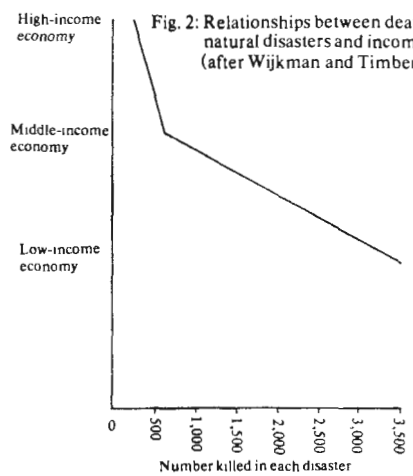


Fig. 2: Relationships between deaths through natural disasters and income (after Wijkman and Timberlake, 1984)

Table 2: Number of people killed in disasters in low-and middle-income countries, compared to high-income countries
(after Wijkman and Timberlake, 1984)

	Number of disaster events 1960 to 1981	Number of people killed
Low-income economy		
Afghanistan	12	540
Bangladesh	63	633,000
Burma	26	1,500
Chad	14	2,300
China	20	247,000
Ethiopia	16	103,000
Gambia	11	200
Haiti	17	6,400
India	96	60,000
Laos	11	400
Madagascar	13	420
Mali	13	540
Mozambique	13	1,100
Nepal	19	2,900
Niger	12	320
Pakistan	21	7,400
Somalia	11	19,000
Sri Lanka	18	1,900
Sudan	11	310
Tanzania	12	590
Upper Volta	16	870
Vietnam	22	8,800
Middle-income economy		
Algeria	20	3,800
Argentina	17	650

continued

Table 2 continued:

	Number of disaster events 1960 to 1981	Number of people killed
Bolivia	21	530
Brazil	39	4,100
Chile	17	8,000
Colombia	26	1,800
Costa Rica	16	70
Dominican Rep.	10	3,300
Ecuador	21	640
Greece	15	190
Honduras	13	8,400
Hong Kong	10	680
Indonesia	59	17,000
Iran	38	48,000
Malaysia	10	310
Mauritius	11	20
Mexico	37	2,600
Morocco	18	13,000
Nicaragua	17	106,000
Panama	11	100
Peru	31	91,000
Philippines	76	17,000
Senegal	16	70
South Africa	11	830
South Korea	27	2,900
Thailand	10	1,300
Turkey	33	12,000
Yugoslavia	14	1,500
High-income economy		
Italy	24	6,700
Japan	43	2,700
Spain	12	1,900

most rapidly. Countries with severe deforestation, erosion, overcultivation and overgrazing tend to be hardest hit by natural disasters. People can alter their environment to make it more prone to certain disaster triggers, such as flood and drought. People can make land flood-prone by removing the trees and other vegetation which absorb the water. They can also make land more drought-prone by removing the vegetation and soil systems which absorb and store water in ways that are beneficial to humans. People can also make themselves more exposed and vulnerable to disasters. In many urban areas in developing countries, the poor live in temporary settlements such as shantytowns, slums or squatter settlements in self-built shelters unable to withstand strong wind, rain or tremors.

Disaster prevention measures taken by the state (such as sea walls or terracing) tend to raise the value of the property they protect beyond the financial reach of the poor who can afford only dangerous or unhealthy land. The poorest in the slums of Rio de Janeiro live on steep slopes which often wash from under them. The poor of Guatemala City and its suburbs are tossed down the slopes on which they live with every earthquake. Millions of Bangladesh's poorest people live on a river delta prone to cyclones and floods.

Drought, famine

To the general public "drought" means poor rainfall. But the definition of drought is not as simple as that. For example, in Haiti where deforestation has led to extensive soil erosion, rain water runs quickly down the bare slopes. The shortage of vegetation and topsoil means that the land cannot retain the water, and the crops do not benefit from it. What few plants there are begin to show the symptoms of drought-affliction. Such "droughts" during seasons of plentiful rainfall are sometimes referred to as pseudo-droughts.

Kenneth Hare (1984) recently made a distinction between two types of drought: meteorological drought and agricultural drought. The first occurs when rainfall is well below expectation in any large area for an extended period. In many cases such drought affects the economy of a region as it impairs food production, stream flow, water supply and other resource yields (for example, animal wealth, cash crops, etc.). Agricultural drought, however, occurs, when rainfall amounts and distribution, soil water reserves and evaporation losses combine in such a way as to cause crop or livestock yields to diminish markedly. Major recurrent droughts that have affected vast areas in Africa and elsewhere are essentially meteorological droughts.

Drought has struck the Sahel repeatedly and the series of droughts from 1968 to 1973 was catastrophic, shrinking Lake Chad to one-third its normal size. In the preceding winter, the great Niger and Senegal rivers had failed to flood leaving much of the best cropland in five countries — Niger, Mali, Upper Volta, Senegal and Mauritania — cracked and barren. The water table dropped, drying up wells throughout the Sahel's five million square kilometres and placing nomadic pastoralists and others in deadly peril. After they had consumed the last shreds of dried-up vegetation, famished herds were sold, slaughtered or driven southward in a fruitless search for pasture. Behind them a stripped landscape lay baking in the sun, flecked with patches of newly-created desert that began to link up and spread, so that the great Sahara desert seemed to be "marching southward". In the absence of reliable statistics, which are particularly difficult to obtain among nomadic peoples, it is difficult to say how many people died as a direct result of the drought, but estimates have reached 250,000.

Hundreds of thousands of people left their original habitat for neighbouring countries which were also having difficulty supporting their own people. Many

UNHCR. M. Amar

"Behind them a stripped landscape lay baking in the sun, flecked with patches of newly-created desert that began to link up and spread, so that the great Sahara desert seemed to be marching southward."

Sahelians moved south and west to the coastal West African nations where they took menial jobs and swelled shantytowns and slums. Reporting on conditions in Mauritania, the journal "Africa" said: "There is something unusual in this part of Africa: whole villages are being abandoned." Thousands of Mauritanian nomads, driven from their own country by drought, arrived in Mali swamping it with their cattle, searching for water and pastures. Some of these refugees from the desert had fled with their camels from as far north as the Algerian border, trekking for three months across Mauritania. Others travelled beyond Mali, towards Upper Volta and Niger. Ivory Coast was the principal destination for the environmental refugees from the Sahel, playing host to 1.4 million after the 1968 to 1973 drought, when every fifth person in the country was a foreigner.

The drought in Africa, which began in 1968, has not yet ended. In recent years drought has spread from the Sahel to southern Africa and some parts of eastern Africa. In early 1984, more than 150 million people in 24 western, eastern and southern African nations were "on the brink of starvation" because of drought.

In the West African countries of Upper Volta, Mali, Mauritania and Niger the prolonged dry spell has caused unprecedented livestock destruction. At least 50 per cent of the livestock in the Ansong and Menaka districts of Mali has died. In Mauritania, about 60 per cent of the livestock has been lost.

Ethiopia and Somalia are the most seriously affected countries in eastern Africa. By the end of 1984, more than 6 million people in 14 regions in Ethiopia were affected by drought. The situation was also serious in Sudan, where over one million drought-affected people in Darfour and northern Kordofan were in urgent need of aid. In southern Africa, persistent drought caused an equally critical situation with about 8 million people affected by drought and at least 1.5 million in need of food aid.

The catastrophic droughts in Africa forced millions of people out of their traditional habitat to become environmental refugees. Some migrated to areas within their national borders but many crossed

international borders to neighbouring countries. Governments, trying to cope with the starving populations, established hundreds of transit and refugee camps which had to rely heavily on assistance from the international community. But in their exodus, many refugees — women, children and the elderly — did not survive the journey. Starvation, dehydration and infectious diseases combined to accelerate the death of hundreds of thousands.

The influx of environmental refugees into an area causes a number of socio-economic and environmental problems. In the host areas the infrastructure and services are often below standard and hardly meet the basic needs of the indigenous people who use them. The influx of refugees into such areas exerts increasing pressure on the infrastructure and services and regularly creates conflict with those who already use them. For example, the enormous influx of refugees into southern Sudan strained medical services in the area to such an extent that urgent help from outside had to be requested. In some cases, such as in Afar, in Ethiopia, conflict has led to violence. Afar tribesmen gradually lost their traditional grazing lands as large cash-cropping schemes (mainly cotton and sugar) were established in their Awash river-basin lands. In 1984, drought drove them from their shrunken pastures in the dry lowlands into the central highlands of Wollo Region which was also suffering from drought. Tens of thousands of people, and some 700,000 head of cattle and camels, eventually reached the end of their line of retreat in the vast Borkena Valley which was already occupied by farmers and the few livestock their plots could support. The Afar's cattle quickly denuded the valley of grass and then began to die in the continuing drought. Tension, that in some cases led to violence, mounted between nomads and farmers with the latter considering the nomads "invaders" who had deprived them of grazing land and accelerated the deterioration of their environment.

UNHCR, S. Errington

This Ethiopian woman needed immediate medical treatment when she arrived at Sudan's Wad-El-Hileiwu camp. "In their exodus, many refugees — women, children and the elderly did not survive. Starvation, dehydration and infectious diseases combined to accelerate the death of hundreds of thousands."

Even in the absence of tension and conflict, an influx of refugees causes environmental disruption of varying magnitude. Refugees have to meet their basic needs, and to do so they sometimes over-exploit the natural resources of the host area. The removal of trees or shrubs for fuelwood is one example of such activities: slashing and burning to grow subsistence crops is another. Degradation of the host environment is further accelerated by the lack of appropriate sanitation and waste disposal methods which can lead to the formation of fertile grounds for vectors (disease transmitters) and, consequently, the possibility of the spread of various infectious diseases.

It is difficult to estimate how many of these environmental refugees will return to their original habitat (or to newly-established settlements). But, surely, no less than 10 per cent, particularly the young, will select either to stay permanently in their place of refuge, or to move on to some other

UNHCR, M. Barton

Wad Kowli camp. "Refugees have to meet their basic needs, and to do so they sometimes over exploit the natural resources of the host area."

destination. Many simply do not want to go through the ordeal of escape from disaster again.

Floods

Floods affect more people than any other disaster except drought and the number affected is increasing rapidly. In the 1960s, 5.2 million people were affected each year by floods while, in the 1970s, this figure rose almost threefold to 15.4 million. Between 1960 and 1980, floods killed about 80,000 people and affected 221 million worldwide (Wijkman and Timberlake, 1984).

During the first five months of 1979 above-normal rainfall was observed in western Jamaica. Thundershowers, which developed during the first week of June, saturated the soil, causing the rapid runoff of subsequent heavy rains. The following days were characterized by tropical depression associated with heavy rains. The resultant flash flooding was extreme. The flood waters swept away homes, roads, bridges and crops. About 160,000 people were affected and from 35,000 to 40,000 people were reported homeless (UNDRO, 1980). This is a typical example of what happens when floods strike, as they do each year in many developing countries. In 1984 there were major floods in Bangladesh, India, Nepal, Bolivia, Ecuador and other countries.

Water can be either a productive resource or a destructive hazard, depending largely

on the management of the vegetation and soils (UNESCO, 1974). One of the main factors behind the increase in flood disasters is the rapid rate of deforestation in the tropics. According to an FAO/UNEP study (UNEP, 1982, 1984), tropical forests are disappearing at the rate of 7.5 million hectares a year. Other studies have estimated tropical forest losses as up to 20 million hectares or more a year (UNEP, 1984). The serious degradation or loss of watershed forests in particular has a wide range of major ecological and economic effects through increased erosion and the silting of irrigation systems and reservoirs and through increased flooding.

The Himalayas send water southwards through the three great rivers of the Indian subcontinent: the Indus, the Ganges and the Brahmaputra. The mountains water a vast stretch of northern India and much of Pakistan, Burma and Bangladesh. Growing populations are stripping the forests from the habitable areas on the southern slopes of these mountains. The slopes can no longer hold the rain water and floods are increasing throughout the Himalayan watershed. Annual flood losses in India are today 14 times those of the 1950s. In 1978, the Indian government estimated that one in every 20 people in the country was vulnerable to flooding. Between June and September of that year, about 50,000 villages were flooded, over 9 million hectares were inundated with water and crops from 3.5 million hectares were lost. To quote an OXFAM report (in Wijkman and Timberlake, 1984) on disasters in West Bengal: "Floods are now an annual feature, and there are many flash floods. The problem in the main is due to the reduced and inadequate capacity of the river channels due to silting caused by the devastation of forests in the catchment areas which leads to heavy soil erosion and heavy runoff. The increased utilization of floodplains for agriculture and urbanization and the unplanned development of valuable areas liable to floods has increased the amount of damage over the years. There is every indication that it will continue to increase."

The Andes, like the Himalayas, are rapidly losing their topsoil as people living on their slopes over-exploit their fragile environment. In 1983, floods and landslides along the Ecuador coast killed scores and left US$400 million-worth of crop- and property-damage; Bolivia suffered record floods in its agriculturally-rich eastern lowlands; and in Peru, rains pelted the normally dry western

FAO, H. Null

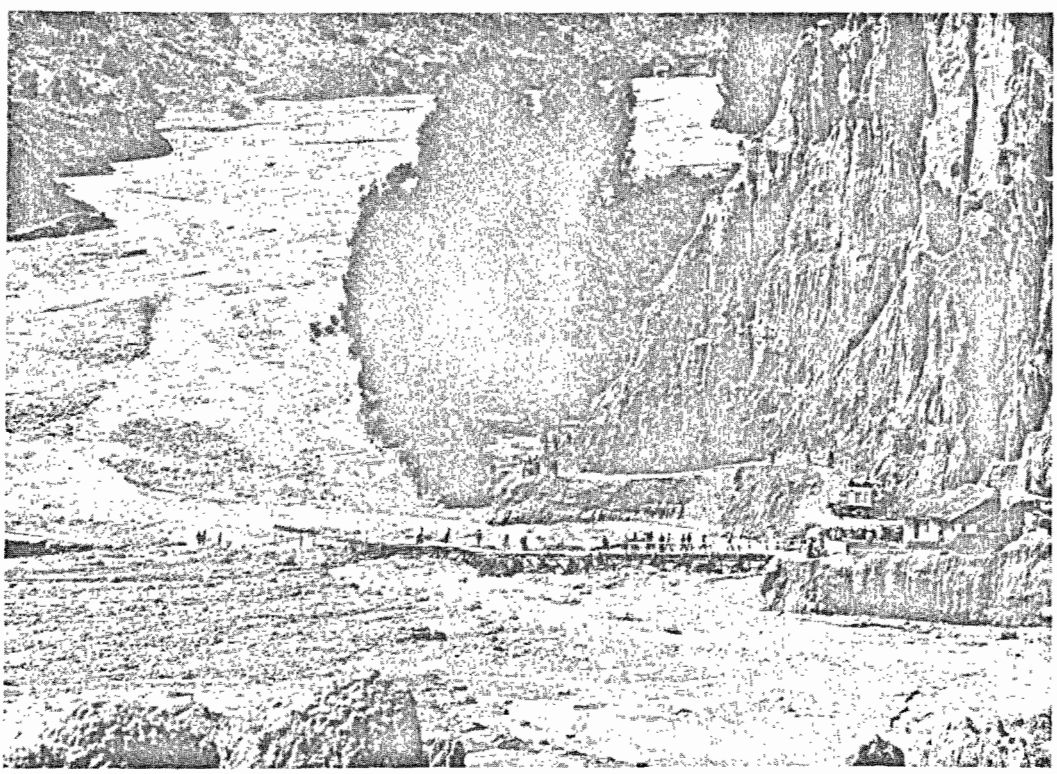
"The slopes can no longer hold the rainwater and floods are increasing throughout the Himalayan watershed."

slopes of the Andes, washing away whole villages. The Peruvian government declared four northern provinces to be in a state of emergency and epidemics of typhoid and dysentery broke out among the victims (Wijkman and Timberlake, 1984).

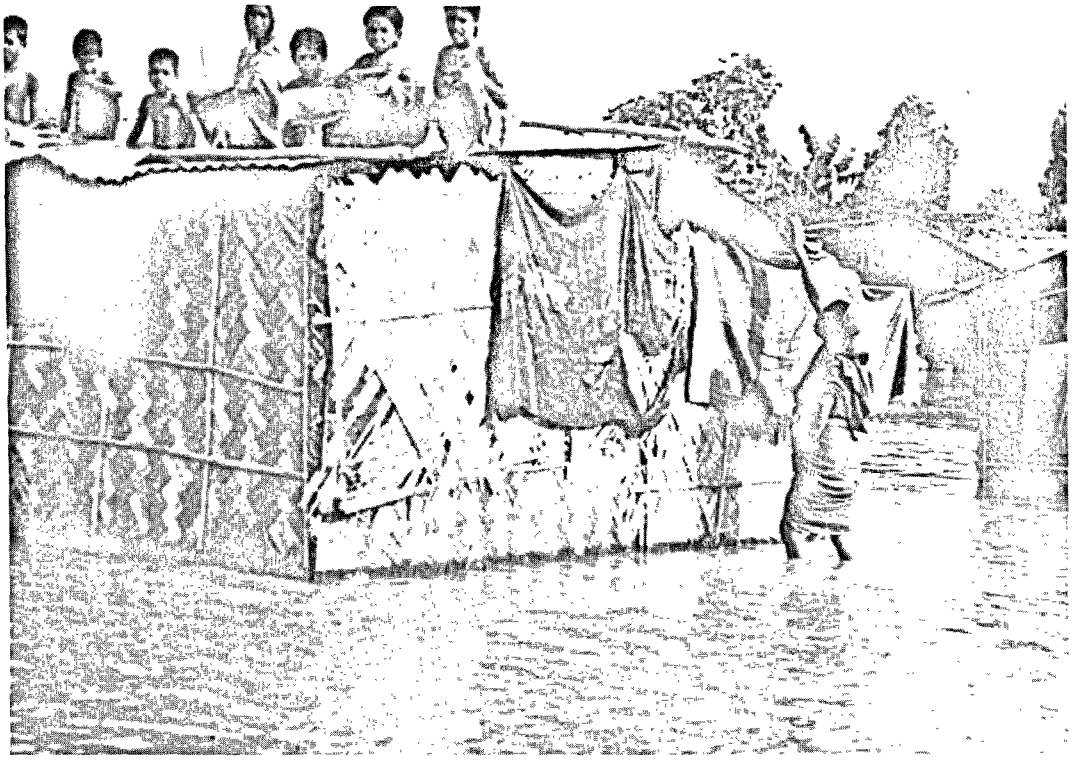
In developed countries, physical barriers and other flood-control mechanisms decrease the population's vulnerability to floods. However, in many developing countries such mechanisms are not available, and many poor people live in slums in areas prone to flooding. In Mexico City, some 1.5 million people live on the drained lake bed of Texcoco, land which either floods or becomes a bog when it rains. Many of Asia's poorest squatters live on floodplains. Much of the expansion of Delhi has been onto the floodplain of the Yamuna River. Many of the city's 600,000 squatters, plus 700,000 people living in unauthorized subdivisions and 150,000 to 200,000 in campsites, are vulnerable to flooding. Of Bangkok's population of about five million, at least 1.2 million live in slums and illegal settlements. Many of these settlements are on swampy ground prone to flooding, and the October 1983 floods made many such people homeless. Other Asian cities with flood-prone transitional settlements include Calcutta, Dhaka, Manila and others.

Despite the risk of floods, people have long been attracted to floodplains. Here rivers deposit the topsoil picked up elsewhere, so the land is fertile. The heavy settlement along the lower reaches of Egypt's Nile, India's Ganges, Bangladesh's

Bolivian floods destroyed this bridge and drowned 40 people in a nearby village. "In developed countries, physical barriers and other flood-control mechanisms decrease the population's vulnerability to floods."



WFP, P. Borel



UNICEF

Bangladesh villagers watch from the roof of their fragile home as Ganges Delta floods recede. "Residents... are well aware of the hazards of floods. But most do not migrate, even when they know of opportunities elsewhere."

Brahmaputra-Padma, the Yellow River and Yangtze of China, and the Tigris and Euphrates are all examples of floodplain civilizations. Flood-control mechanisms have been established in some of these countries to protect the people from the hazards of floods. Before the Aswan High Dam was built in the 1960s, extensive areas in Upper Egypt were flooded annually and thousands of people had to be evacuated for several months until the land had dried up. Since the building of the Aswan High Dam, however, there has been no need to migrate. Where no effective flood-control mechanisms exist, the routine migration or evacuation of people during floods is a common feature in many countries. In many areas, particularly in developing countries, migration and/or evacuation is not very effective in reducing the hazards of floods. Either the process is inadequately planned, too slow, or the people do not want to leave their homes and land, prefering to live with the risk than migrate. In such cases, the consequences of floods are catastrophic.

Most people who migrate because of floods return to re-build their homes and start again from scratch. Residents of the coastal lowlands of Bangladesh are well aware of the hazards of floods. But most of them do not migrate even when they know of opportunities elsewhere. The incentives for them to remain are strong and include traditions, family ties and the prospect of acquiring more land — as the demand for land in such disaster-prone areas would be low.

Tropical cyclones

Tropical cyclones, hurricanes and typhoons are regional names for the same phenomenon. Depressions in the tropics which develop into storms are called tropical cyclones in the south-west Indian Ocean, the Bay of Bengal and the Arabian Sea, parts of the South Pacific and along the northern coasts of Australia. These storms are called typhoons in the north-west Pacific and are known as hurricanes in the Caribbean, the south-east of the United States of America and Central America.

On average, 80 to 100 tropical cyclones form over the world's oceans each year. They do not all cause disasters but those that do kill about 20,000 people and diminish the economic resources of the countries affected by US$6,000 million to US$7,000 million. Evidently, there are wide variations from year to year and from place to place and the major catastrophes which occur from time to time can tragically distort average figures.

In late August and early September 1979, hurricanes David and Frederic ravaged the Caribbean region with force probably unprecedented this century. Hurricane David, with winds of up to 240 kilometres an hour and heavy rainfall, first reached the islands of Martinique, Guadeloupe and Dominica in late August, then continued towards the Dominican Republic which was hit during the afternoon of 31 August. Four days later hurricane Frederic, following a somewhat similar path and carrying far heavier rainfall than David, although with less intense winds (74 kilometres an hour), brought week-long downpours and caused extensive damage. Both hurricanes, David and Frederic, took a heavy toll on life and property in the Caribbean and in the southern United States. About 2,000 deaths were reported in the Caribbean, about 2 million people were affected and about 125,000 families were made homeless (UNDRO, 1980). Hurricane David destroyed the banana crop in Dominica, thereby depriving the island of 85 per cent of its annual income in a matter of hours.

USAID

Cyclone Meli's path of destruction in Fiji. "On average 80 to 100 tropical cyclones form over the world's oceans each year."

The major disaster of 1980 in the Caribbean region was caused again by a hurricane. Hurricane Allen passed through the Caribbean and the Gulf of Mexico from 4 to 8 August 1980 affecting 11 island states and killing about 250 people. Four weeks after the event some 230,000 people remained without permanent shelter and over 500,000 without means of subsistence. Total damage was estimated at US$530 million, about 90 per cent of which consisted of losses to agriculture (UNDRO, 1981).

Tropical cyclones also affect other countries in other regions. Table 3 gives a list of the countries that were affected by cyclones between 1960 and 1980 and shows that cyclones mostly affect island and coastal communities.

Table 3: Incidence of cyclones, 1960 to 1980 (after Wijkman and Timberlake, 1984)

	Storm events 1970 to 1981	Number of people killed
Low-income economy		
Bangladesh	37	386,200
Burma	7	1,350
China	7	170
Haiti	6	5,800
India	26	24,930
Madagascar	9	970
Vietnam	6	7,480
Fr. Caribbean	5	100
Middle-income economy		
Hong Kong	7	510
Mauritius	7	15
Mexico	14	1,560
Philippines	39	5,650
South Korea	10	700
High-income economy		
Italy	5	110

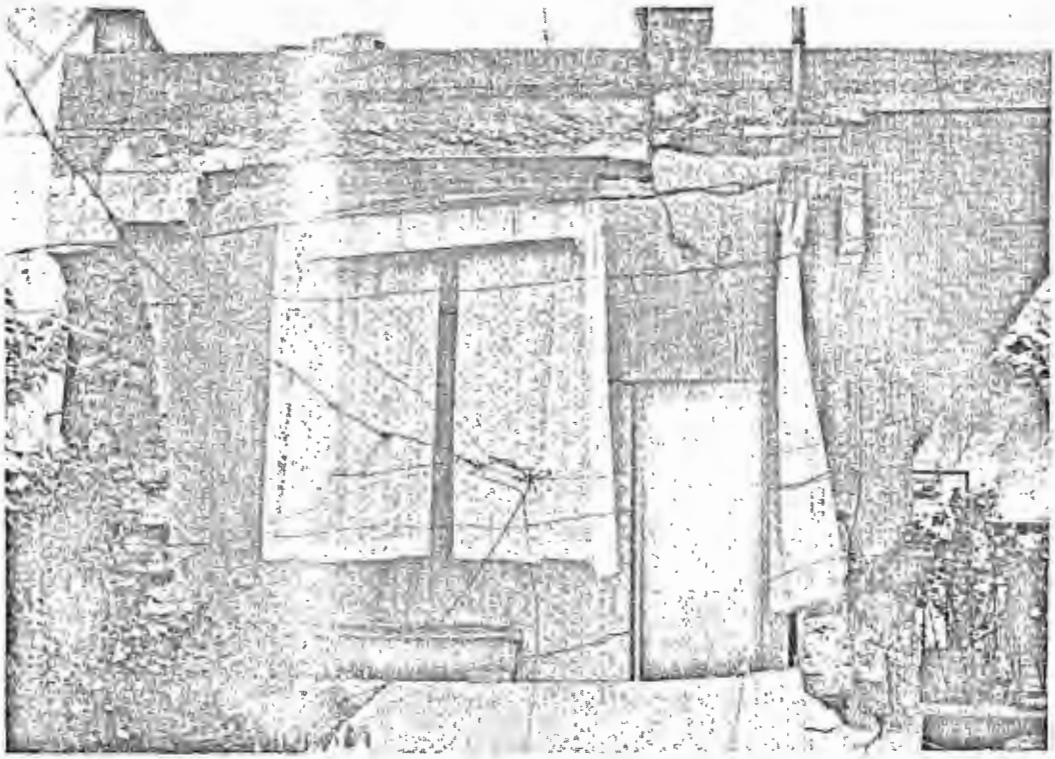
Altering the environment can make people and property more vulnerable to the effects of cyclones. The destruction of coral reefs, mangrove and other seafront forests, and the levelling of beach dunes clears paths which allow storm surges to reach people and their property more quickly and forcefully.

The Philippines suffered 39 violent storms between 1960 and 1980, with about 5,600 killed. While Bangladesh, which suffered 37 such disasters over the same period, lost as many as 386,200 people. Although the Bangladesh coastline is many times shorter than that of the Philippines it is estimated that some 20 million people in Bangladesh are exposed to the effects of cyclones. This is because Bangladesh has deforested most of its floodplains, and the rapid deposition or eroded soil from the Himalayas has made a smooth thoroughfare for floods moving down and storm surges moving up. The Philippines' varied coasts are more protected by reefs, mangroves and trees — and coastal population densities are also lower than in Bangladesh.

Earthquakes

Earthquakes are the deadliest natural disaster. In the 1970s they killed 38,970 people each year. The average for that decade was particularly high due to the 242,000 people killed in the earthquake that hit Tangshan in China in 1976.

Two-thirds of the world's large earthquakes have occurred in the "Ring of Fire" around



UNESCO, Alexis Vorontzoff

Above: "Earthquakes, like other natural disasters, affect mostly poor people."

Below: Searching the debris of Guatemala's 1976 earthquake. "The poor of Guatemala City and its suburbs are tossed down the slopes on which they live with every earthquake."

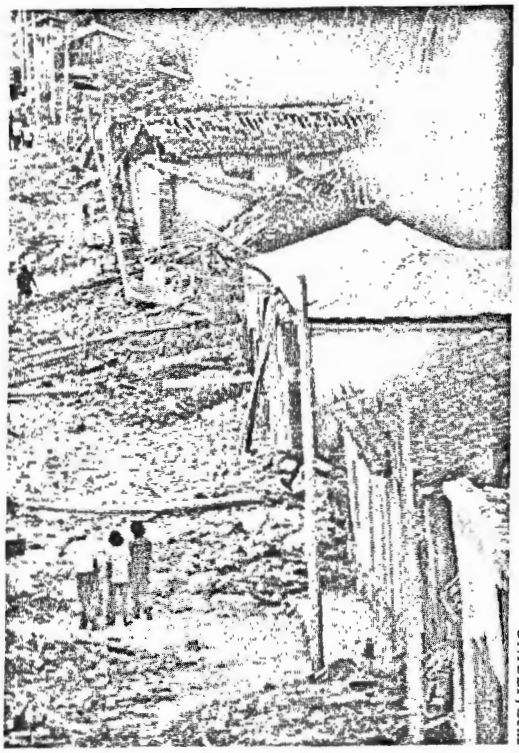
the Pacific. This ring stretches along the west coasts of South and North America into Alaska, across the Aleutians and through Japan, the Philippines, Indonesia and New Zealand. The next most important earthquake zone stretches along the plate boundaries from Indonesia, through the Himalayas and along the axis of the Mediterranean. Some 75 per cent of the world's earthquake deaths from 1950 to 1970 occurred in this zone which is more densely populated than the Circum-Pacific Belt. In the western hemisphere, the most damaging earthquakes occur on the west coasts of Central and South America.

Earthquakes, like other natural disasters, affect mostly poor people. The Guatemala earthquake of 1976, which measured 7.5 on the Richter scale, killed 22,000, injured 75,000 and left over one million of the

UNDRO

nation's six million people without shelter. Some 9,000 square kilometres were affected and 14 towns were almost totally destroyed. In another 17 towns, less than one-third of the buildings were left standing. Most of the people who died or who were injured lived in rural areas or slums. Many lived in poor houses in ravines or gorges highly susceptible to landslides whenever earth movements occur. The 1972 Managua, Nicaragua, earthquake registered 6.2 on the Richter scale and killed 5,000 people. The 1971 earthquake, however, in the much more developed community of San Fernando, California, registered 6.6 on the Richter scale but killed only 65. Economic losses were also greater in Nicaragua where some US$800 million-worth of property was lost compared with US$535 million in San Fernando. Other major areas in the developing countries in which large numbers of the poor are forced to live on disaster-prone ground and in fragile structures include Lima, Santiago, Quito, Caracas, Manila and Jakarta.

Guatemalan rubble; "less than one third of the buildings were left standing".

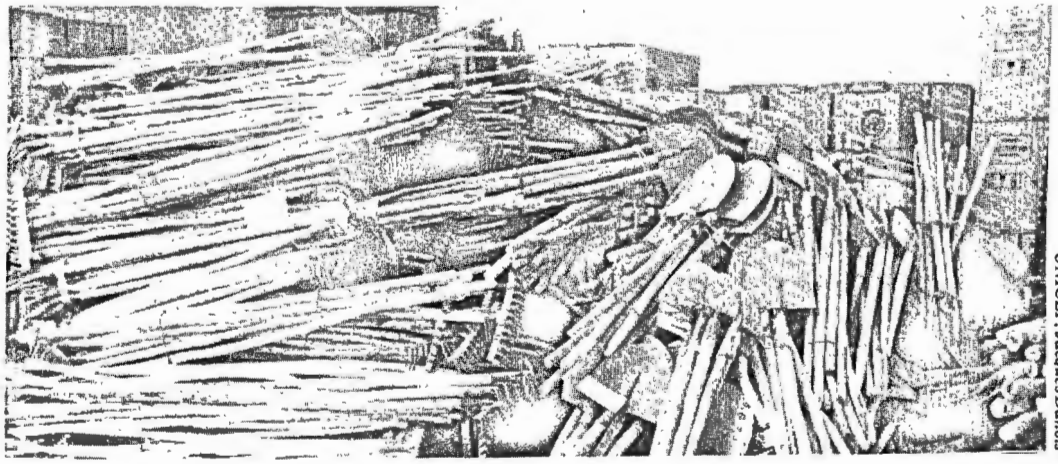


UNICEF, Seitz

Relief for refugees

In the aftermath of a natural disaster, displaced people need help in the form of food, medicine and shelter. If the consequences of the disaster can be managed locally, relief is normally provided by the government and local organizations. If the disaster assumes catastrophic dimensions that cannot be managed by the local government, international relief is needed. Events of the past two decades are, however, casting increasing doubt on the cost-effectiveness of international disaster relief, some of which is planned and managed on the basis of incorrect assumptions and mixed political and economic motives.

A major problem with relief is that the "relief period" following a natural disaster — as opposed to the reconstruction and rehabilitation periods, which may last some years — is very short: some experts put it at only 48 hours (Wijkman and Timberlake, 1984). In some weathers, if victims do not find shelter, warmth, water and at least the hope of food within a day or two they die. Few international relief agencies can deliver so fast. Besides, such necessities are almost always more quickly available near the disaster area. The World Food Programme (WFP) pointed out in 1982 that, wherever possible, it would purchase its emergency and relief assistance food regionally. It is now primed to bring food aid to disaster areas in sufficient quantities and in time to prevent starvation by diverting food from development projects in the country concerned or even from ships at sea. While recognizing that a substantial part of its relief resources is needed to feed starving people too weak to work after disaster has



UNICEF, Jacques Danois

Above: Agricultural tools to aid displaced people. "Some donors have sent potato crisps, sweet fruit drinks and spaghetti sauce as food aid to disaster areas."

struck, WFP advocates the phasing out of free relief distribution as soon as local governments can organize constructive rehabilitation.

A second major problem with international relief is its appropriateness. The following examples illustrate the completely inappropriate aid that has been sent to some disaster-stricken areas (Wijkman and Timberlake, 1984). The European Community sent powdered milk into an earthquake area where few cows had perished but where there was no water. After an earthquake in 1983, Turkey asked donors not to send any medicines or second-hand clothes only to find a Northern donor flying in a few days later with a planeload of precisely these items. Some donors have sent potato crisps, sweet fruit drinks and spaghetti sauce as food aid to disaster areas in Chad, Guatemala and the Dominican Republic. The Red Cross delivered 3,000 tents to the town of San Martin after the 1976 Guatemalan earthquake, but only a few of the tents were used as the victims of the disaster wanted to stay near their possessions and livestock.

A third major problem with international relief is that politics can affect the response

Below: Doling out aid. "Politics can affect the response of donors."

FAO, Peyton Johnson

of donors. In 1983, the Red Cross launched separate appeals for Polish food needs and for drought victims in north-eastern Brazil. Poland received four times the amount appealed for. By the end of the year, however, the Brazilian appeal had brought in only 2.4 per cent of expressed needs, though this figure had risen to about 50 per cent by March 1984. By the end of 1983 no more than 56 cents per Brazilian to be assisted had been raised (Wijkman and Timberlake, 1984) while an appeal, also launched in November 1983 by the Red Cross for Turkish earthquake victims, had almost immediately brought in US$233 per person.

Politics — along with a growing sense of pride and a growing realization of the limitations of foreign relief efforts — also play a role in limiting what disaster-stricken nations will accept today. China, India, Mexico and the Philippines have all recently declined disaster aid in certain cases, apparently through pride and because they could see no real gain in accepting it.

The only way out of this dilemma is to deal with the problem at its source — to reduce, or even possibly prevent, the incidence of natural hazard. Prevention is urgent, as the frequency and severity of disasters are increasing to the point of being unmanageable. In large parts of Asia, Africa and Latin America, the ecological base for human existence is being damaged so badly that it can no longer support its growing populations. Most disaster problems in developing countries are unsolved development problems. Disaster prevention and mitigation is thus primarily an aspect of development.

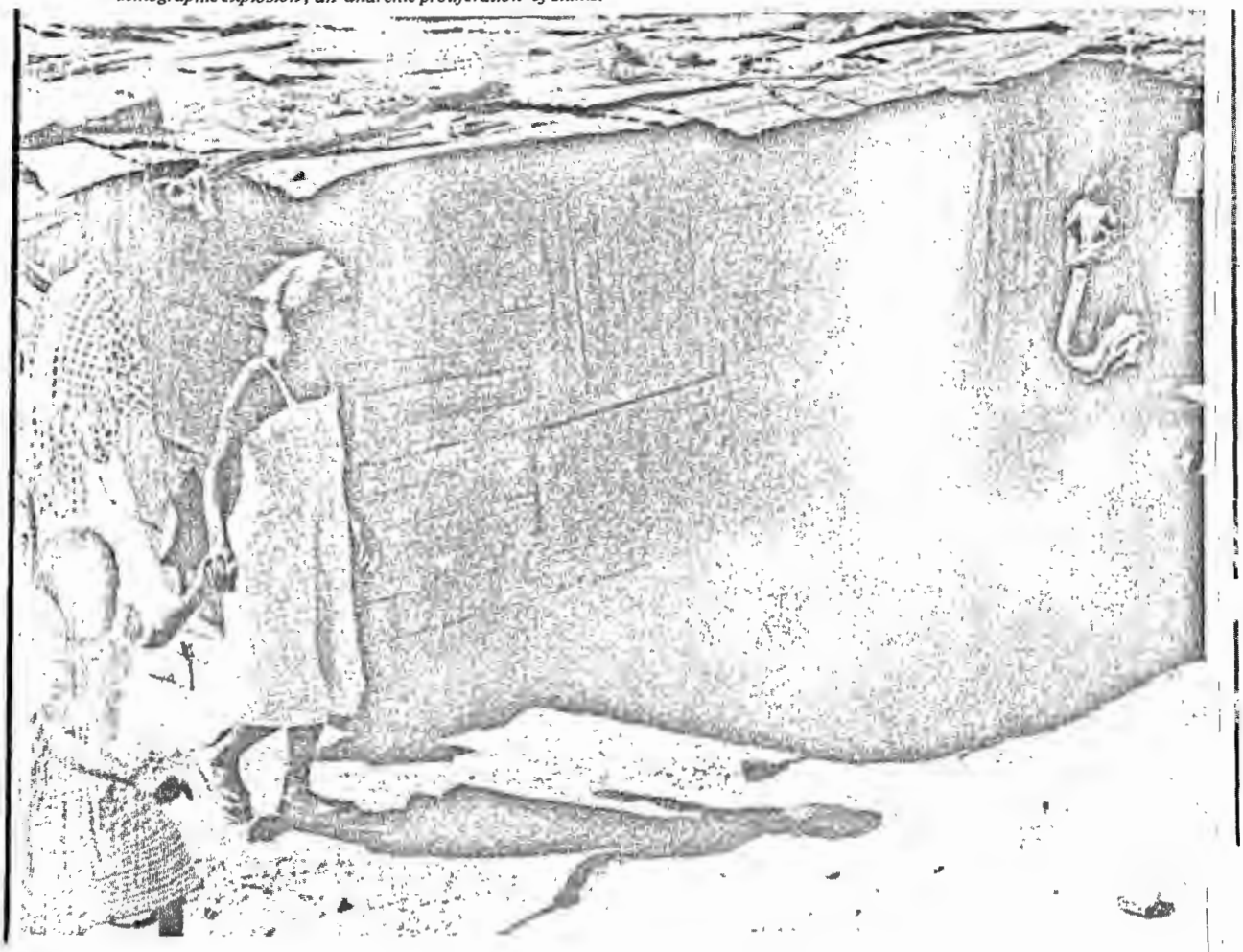
Natural disasters are failures in the interaction between vulnerable people and a vulnerable environment. Disaster mitigation, therefore, should aim at changes to improve both human and environmental conditions and the interactions between them. One cannot be isolated from the other. Improving the housing and infrastructure in transitional settlements such as slums and squatter-communities for example, would not only lead to improvements in the quality of life of the poor inhabitants of such areas, but would also reduce their vulnerability to natural disasters. Conservation of forests, reforestation and soil conservation would have a dual purpose — to provide the people with a sustainable resource base for food production and to reduce the incidence of floods and the consequences of cyclones. The question of averting natural hazards and halting the flood of environmental refugees is, therefore, a question of environmental management.

3 Degradi[illegible]e land

In 1983, Maggie Black, editor of "UNICEF News", described the quality of life in La Saline, one of Port-au-Prince's most crowded slums. She wrote: "Aidenaire Carm, who makes what must euphemistically be called her living buying bananas in the market and reselling them, peeled, was forced together with her family years ago to quit the countryside for the town. Why did they leave? The answer was definitive: My husband's homeland was uninhabitable, said Aidenaire."

Generations of intense population pressure, and of plantation practices which thoughtlessly stripped the ground of trees, have converted much of Haiti to a wasteland. The eroded countryside, with its reddish-coloured soil, looks as though the earth has been scratched away until it bleeds. The contour of every hill and valley is revealed in all its nudity: the land has no latent power left unexploited. The departure from countryside to town of people like Aidenaire Carm and her family represents a severe uprooting. It means the abandonment of land and life-style, of deep traditional, social and family ties. Nevertheless, thousands of Haitians feel they have no alternative. In the past ten

Port-au-Prince's slums, to which people fled from their uninhabitable homelands. "There has been what officials call a 'demographic explosion', an 'anarchic proliferation' of slums."



years, the population of Haiti's capital has nearly doubled to more than a million people. More than half live crowded in the slums, where population density reaches nearly 250 people a hectare. There has been what officials call a "demographic explosion", an "anarchic proliferation" of slums (or *bidonvilles*), a "massive exodus" into the city's pathetic periphery which has fuelled a population growth rate of nearly 7 per cent a year. Those who could no longer stand the deteriorating conditions in the slums embarked on a massive exodus to neighbouring Caribbean countries and to the United States of America. Thousands from Haiti, and other Caribbean islands which suffered the same degradation syndrome, found their way legally or illegally into the United States in search of a better quality of life. Those who could not make it have no alternative but to stay and live in poverty and misery.

What happened to Aidenaire Carm and her family in Haiti has happened to millions in other developing countries. Throughout the third world, land degradation has been the main factor in the migration of subsistence farmers into the slums and shantytowns of major cities, producing desperate populations vulnerable to disease and natural disasters and prone to participate in crime and civil strife. Such exodus from rural to urban areas has exacerbated the already dire urban problems in many developing countries. And, at the same time, it has delayed efforts to rehabilitate and develop rural areas — through the lack of manpower and the increased negligence of the land.

In large mountain regions in India, including Uttar Pradesh, Assam and Kashmir, the fertile valley floors have long been over-crowded and cultivation is constantly pushed onto steeper slopes by population growth and the lack of non-agricultural employment opportunities. Millions of hectares no longer have any topsoil, just a rocky sub-stratum lacking organic matter and fertility. Forests are receding under the combined pressure of shifting cultivators, uncontrolled herds of goats, sheep and cattle, and wood-gathering for home consumption or sale. Many farm families cannot subsist on the output of their small, often infertile landholdings. As a result, a high proportion of the able-bodied men migrate to the plains to find seasonal work, returning occasionally to help with the planting and harvesting. Families see little choice but to squeeze from the land what benefits they can, regardless of any possible long-term consequences for its fertility. Even so, the battle for subsistence through agriculture is often lost. Ultimately, the "seasonal" refugees settle elsewhere as soon as they find any permanent or long-term occupation.

In Ethiopia, the highlands, particularly the regions of Wollo, Tigre and Gondar, have been so overfarmed, overgrazed and deforested that efforts to scrape a bare living from this land threaten to destroy it permanently. The erosion resulting from over-use causes the Ethiopian highlands to lose one billion tonnes of topsoil each year. The situation is so desperate that the government has begun a major resettlement scheme to transfer farmers from the highlands to underpopulated lowlands. Government officials have referred to the people to be moved as "environmental refugees" (Wijkman and Timberlake, 1984).

Tropical forests and woodlands are menaced with excessive cutting and sluggish programmes of replacement. The FAO/UNEP Tropical Forest Resources Assessment (1982) gives the following estimates of area and rates of change:

Region	*Forest area (millions ha)*	*Rate of deforestation (millions ha/y)*
Tropical America	896	5.6
Tropical Africa	703	3.7
Tropical Asia	336	2.0
Total	1,935	11.3

The depletion of tropical woodlands results from excessive population pressures and poor management of the forest-society relationship (i.e. the rate of deforestation is 10 times that of planting). The two principal causes of deforestation are shifting cultivation and clearing for agriculture and pasture.

Much of the blame for tropical forest destruction is laid on the shoulders of shifting cultivators — those who slash and burn a clearing in the forest, grow crops for a few years until soil fertility has dissipated, and then move on to clear a new patch. However, while itinerant farmers are indeed major agents of deforestation, it is important to differentiate among the various types of shifting cultivators and the soundness of their methods. Traditional systems of shifting cultivation entail lengthy fallow periods during which soil fertility is restored and trees grow again on the cultivated plots. Today many traditional peoples in the Amazon Basin, Central Africa and South-East Asia are still practising shifting cultivation in harmony with nature. However, when the population of the shifting cultivators increases and when the free forest area around them shrinks, fallow cycles are shortened to the point where trees have no chance to grow back. Many of the shifting cultivators causing the greatest forest destruction today are not traditional practitioners of this art. They are rootless, landless people struggling to make what living they can amid unfamiliar ecological conditions. In Indonesia, for example, many of those who have migrated from crowded Java to the outer islands have found continuous cultivation of the land unworkable, either because the soils are inappropriate or because promised technical assistance has not materialized. Many migrants have become new shifting cultivators who damage the timber and wildlife resources of the areas over which they spread.

The destruction of forests undermines the basic operations of the ecosystem and may thus cause irreversible changes. The most serious of these appear to be due to the large-scale exposure of natural soil systems, leading to increased erosion and, in turn, indirectly affecting water resource development (Bowonder, 1983). Flooding, droughts and siltation are more severe in many parts of the world because of deforestation. Half a billion people in Bangladesh, India and Pakistan, for example, are affected by water runoff from the upper Himalayan watershed.

Soils are subject to the hazards of degradation — physical, chemical or biological changes that undermine the structure and functioning of the soil system, and may eventually lead to a decline in soil quality. The various forms of soil degradation, often related to land-use practices that overtax the system, include erosion, salinization and waterlogging, and chemical degradation. Soil erosion is a natural process that is often greatly increased due to land-use practices such as shifting cultivation and overgrazing that reduce the protective cover of plant growth. Brown (1984) estimated that the world is now losing from its croplands about 23 billion tonnes of soil in excess of new soil formation each year. He pointed out that because of the shortsighted way in which a third to a half of the world's croplands are being managed, the soil on these lands has been converted from a renewable to a non-renewable resource.

Excessive irrigation and inefficient drainage may convert productive farmlands into saline and alkaline wasteland. The history of agriculture in Mesopotamia records massive losses of farmland resulting from salinization. The problem is particularly acute in semi-arid and arid regions. Worldwide it is estimated that the area now being abandoned is approximately equal to the area currently being reclaimed and irrigated (Holdgate and White, 1977). Between 30 and 80 per cent of all lands under irrigation are subject to salinization, alkalinization and waterlogging (UNEP, 1982). Salinization is currently affecting

UN, John Isaac

"Desertification is caused almost entirely by human misuse of the environment, [which] takes the form of felling trees to provide fuel, overgrazing domestic animals and harmful agricultural practices."

large areas of such countries as Syria, Iraq, Haiti, Mexico and Afghanistan, and salinization and waterlogging are believed to cause serious problems in 200,000 to 300,000 hectares of the world's best land each year.

Soil degradation ultimately leads to desertification. To some extent the term "desertification" is misleading as the popular image of sand-dune encroachment is only a minor part of the problem. Desertification is the creeping destruction of the capacity of ecosystems to regenerate themselves, caused by land-use methods that are not adapted to the natural conditions. Soil, vegetation, water balance and even microclimates are seriously affected by poor land-use practices. Ultimately desert conditions become widespread, and this ecological degradation triggers off a series of socio-economic consequences.

Desertification must be seen as a human problem rather than one concerned solely with the deterioration of ecosystems. Desertification is caused almost entirely by human misuse of the environment, particularly fragile marginal areas with erratic and low annual rainfall. This misuse takes the form of felling trees to provide fuel, overgrazing by domestic animals and harmful agricultural practices such as planting crops on river banks and thereby enhancing soil erosion.

While people are the main agents of desertification, they are also its victim. The most important aspect of desertification lies in its impact on people — on the individual, the family, the community and the nation. The environmental degradation and the biological and physical stress described as desertification in the different dryland livelihood systems have their direct counterparts in physical, emotional, economic and social consequences for man.

As with the environmental manifestations, the impact of desertification on human beings shows a corresponding vulnerability, chronic or progressive, upon which are superimposed those critical periodic stresses that result in human disaster. The effects of desertification on man appear most dramatically in the mass exodus that accompanies a drought crisis. A survey of such events might suggest that the impact of desertification on people proceeds from crisis to crisis. But this would ignore the chronic effects of land degradation as reflected in persistent out-migration in good years as well as bad.

UNICEF, Bert Demmers

Ethiopian refugees in Korem, Wollo Province. "The effects of desertification appear most dramatically in the mass exodus that accompanies a drought or crisis."

A recent assessment by UNEP (1984) revealed that about 4,000 million hectares of the world's rangelands, rain-fed croplands and irrigated lands — an area approximately the size of North and South America combined — is affected by desertification. Currently each year some 21 million hectares are reduced to a state of near or complete uselessness. Projections to the year 2000 indicate that a loss on this scale will continue if nations fail to step up remedial action to combat this insidious scourge.

Table 4 presents, under the main types of land-use (rangelands, rain-fed croplands, and irrigated lands) the areas affected by at least moderate desertification within the major regions — and also expresses these values as percentages of the total productive land in each category of land-use. The regions most extensively affected by desertification tend naturally to be those with the largest areas of drylands — notably the Sudano-Sahelian region, followed by Africa south of the Sudano-Sahelian region then South Asia.

Table 5 indicates the populations affected by at least moderate desertification. Only the rural component is given in the table, although town-dwellers are also affected. It has been estimated that, worldwide, about 850 million people are affected to varying degrees by desertification. The rural population affected by severe desertification totals some 280 millions, or 470 millions if the urban component is included.

Migration ... and ... migration

Migration of people due to land degradation is not a recent phenomenon. Mobility within local rural areas and out-migration to urban areas are adjustments to environmental and socio-economic conditions that have existed for centuries. The migration of nomads is perhaps the best illustration of such a phenomenon. Migrants from desertifying districts — where land can no longer yield their basic needs — normally pass unnoticed in the larger flow of population from rural to urban centres. Initially, such migration represents a short-term adjustment to a temporarily limited period of adverse conditions. Migrants in this situation exploit urban resources only during crisis and envision returning to their villages once environmental conditions improve. Only

"Each year some 21 million hectares are reduced to a state of near or complete uselessness."

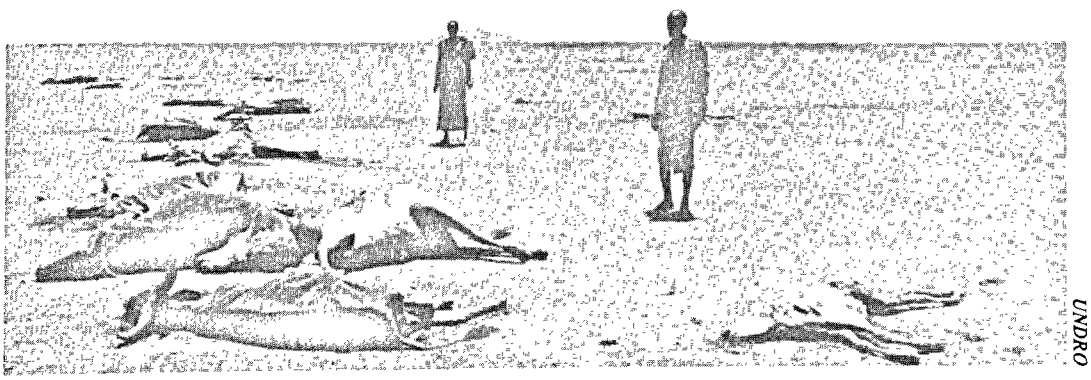


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Table 4: Regional extent of lands at least moderately desertified (in millions of hectares)

Region	Rangelands	(%)	Rain-fed croplands	(%)	Irrigated lands	(%)	Total drylands	(%)
Sudano-Sahelian	342	90	72	80	0.8	30	415	88
Africa south of the Sudano-Sahelian Region	200	80	42	80	0.6	30	243	80
Mediterranean Africa	68	85	15	75	0.5	40	84	83
Western Asia	98	85	15	85	3.0	40	116	82
South Asia	127	85	105	70	20.0	35	252	70
USSR in Asia	150	60	12	30	2.0	25	164	55
China and Mongolia	210	70	3	60	3.0	30	216	69
Australia	100	22	12	30	0.3	19	112	23
Mediterranean Europe	15	30	13	32	1.6	25	30	39
South America and Mexico	180	72	24	77	4.0	33	208	71
North America	125	42	33	39	4.0	20	102	40

Table 5: Rural populations affected by at least moderate (M) and by at least severe (S) desertification by regions (in millions)

Region	Rangelands		Rain-fed croplands		Irrigated lands		Total rural populations	
	M	S	M	S	M	S	M	S
Sudano-Sahelian	13.5	7	36	20	1.5	0.5	51	27.5
Africa south of Sudano-Sahelian Region	8	4.5	32	20	1	0.5	41	25
Mediterranean Africa	4	2	11	6	1	0.5	16	8.5
Western Asia	4	2	16	9.5	12	4.5	32	16
South Asia	9	4.5	34.5	18	23	6.5	66.5	29
USSR in Asia	1	0.5	1.5	0.5	4.5	1	7	2
China and Mongolia	3	1	4	2	10.5	3.5	17.5	6.5
Australia	0.03	—	0.1	0.3	0.1	—	0.23	0.03
Mediterranean Europe	2	1	13	4.5	1.5	0.5	16.5	6
South America and Mexico	4	2	22.5	11.5	2.5	1	29	13.5
North America	1.5	0.5	2	0.5	1	0.2	4.5	1.2

when their land has drastically deteriorated, or when drought continues for several consecutive years (often accelerating the desertification of the land), do migrants plan to move permanently and to seek other ways of earning their living. Many of them end up in slums and shantytowns, whether or not this is their best option.

When large numbers of migrants stay away frequently and for long periods, the productivity of the rural resource base decreases as the labour available is no longer sufficient to maintain yields. Migrants in this situation become both the cause and victims of desertification. One example, among many, is provided by the Otomi Indians of Central Mexico who, to seek wage employment outside their communities, are forced to neglect their terraced fields. The unmaintained terraces are eroded and lose their moisture-retaining capacity necessary to produce dependable yields under erratic rainfall conditions. In good years, the average family holding yields a six-month supply of maize. In bad years it yields almost nothing. Farmers are often even unable to harvest enough fodder to keep their livestock through the winter dry season. This, in turn, places a heavier burden on the already overgrazed communal pasture land. Consequently, precious animals weaken and die during the winter months, further threatening the family's survival. The old pattern of life appears inadequate to maintain Otomi households, and thus accelerates the out-migration of much-needed labour power.

Replicas of the above-mentioned example, in some cases modified, have been frequent in many developing countries. In some cases the migrants do not just abandon the land, they destroy its productive capacity. After the Aswan High Dam was built, salinization and waterlogging increased in some areas, particularly where drainage systems were not adequate. Moreover, the annual silt and clay load that comes each year with the Nile floods is now trapped behind the dam. Formerly, this silt and clay not only replenished the land with nutrients but some of it was also used to manufacture red bricks for the building industry. When small plots began to deteriorate, and their yield decreased, farmers started to migrate temporarily to find wage employment in urban areas. Soon, this migration assumed new dimensions. High wages in some occupations and the many opportunities offered by the Arab OPEC countries prompted the migration of hundreds of thousands of farmers who mostly took jobs other than farming. This led to the increasing neglect of the land in the villages and caused many farmers to have second thoughts about keeping their land. Some sold their plots to other farmers. But many resorted to a most destructive way of extracting the most from their land by simply mining layers and layers of soil with which to manufacture red bricks to sell at high prices to the building industry. Many land areas were destroyed: during the 1970s over a million hectares were lost in this way before being abandoned. Recently, the Egyptian government stepped in to prevent this destruction of the land and to enforce measures for the conservation of agricultural land.

The end of the line

When environmental refugees first migrate to urban areas they expect a "rosy" quality of life. But soon they find themselves in slums and squatter settlements*. In such areas they are usually deprived of access to the basic facilities of drinking water and waste disposal. They are frequently forced to use open water for washing, cleaning and the disposal of waste in unhygienic ways; to

* According to UNCHS (1982), there is no simple classification of low-income residential areas in third world cities. Squatter settlements, slums and shantytowns are different terms that describe low-income, high-population-density areas described by poor housing and an almost total lack of infrastructure such as water supplies and sanitation in urban areas.

UNICEF, Bernard Wolff

A Bombay slum where newcomers "are frequently forced to use open water for washing, cleaning and the disposal of waste in unhygienic ways; to break open municipal water mains; to use public places such as open grounds to relieve themselves; and to live in makeshift shelters surrounded by accumulating domestic waste."

break open municipal water mains; to use public places such as open grounds to relieve themselves; and to live in makeshift shelters surrounded by accumulating domestic waste. Often, unhygienic living conditions in slums can spread diseases, such as typhoid, cholera, malaria and hepatitis, through entire settlements.

With the old slums overflowing, increasing numbers of migrants become squatters on vacant lands or buy illegally subdivided plots and build their own dwellings — anything from tar-paper shanties to sturdy, inhabitable structures. The most disadvantaged people end up on dangerously steep hillsides or in flood zones, where natural hazards join over-crowding and the lack of sanitation to endanger health.

Low incomes and weak purchasing power are manifestations of the poverty that characterizes most families living in slums and squatter settlements. The cause of this poverty lies in the lack of sufficient opportunities for steady and gainful employment. The major problem for most families is underemployment and the low, fluctuating incomes which this entails. Underemployment rates for slums and squatter settlements can reach more than 60 per cent (UNCHS, 1982). Despite the great variety of occupations cutting across all sectors of the urban economy, most slum and squatter-settlement residents work in the informal sector and in the lowest paying categories of work in the formal sector. Comparatively few are engaged in occupations requiring higher levels of skills and training.

The economically precarious conditions of most slum and squatter-settlement residents triggers an increasing number of

"The most disadvantaged people end up on dangerously steep hill sides or in flood zones, where natural hazards join overcrowding and the lack of sanitation to endanger health."

social hazards: an increase in the number of conflicts among the residents of these settlements; an increase in the number of riots and the extent of crime and drug addiction (which in turn tends to increase the crime rate); and, ultimately, increasing mistrust and alienation between the regular urban-dwellers and the slum-dwellers. Finally, some of the migrants from the villages, instead of finding a better quality of life, may end up in a state of social stress and disarray.

Relocation

Large development projects often entail the displacement of people inhabiting the area where the project is to be set up. The building of dams, which result in man-made lakes which inundate large areas upstream, often necessitates a mass relocation of people. The number of people that have had to be resettled due to the construction of dams in various parts of the world is given in Table 6.

The Volta Dam in Ghana inundated an area of about 85,000 square kilometres resulting in a lake with a shoreline of over 6,400 kilometres. Some 78,000 people and more than 170,000 domestic animals had to be evacuated from more than 700 towns and villages of different sizes. Eventually, 52 new settlements were developed to house 69,149 people from 12,789 families. This constituted a major social problem as a large number of the people came from small villages (600 of the 700 original villages had less than 100 people, and only one had a population of over 4,000) with different ethnic backgrounds, languages, traditions, religions, social values and cultures, yet had to be resettled into only 52 locations. The complex emotional relationships between the different tribes and their lands were not properly understood. There were many who found it hard to make a clean break with their ancestral roots by leaving their shrines and the graves of their ancestors. The

Table 6: Resettlement of people due to various dams (after El-Hinnawi and Biswas, 1981)

Dams and dates reservoirs filled	Number relocated (approx.)	Countries involved
Aswan, 1968	120,000	Egypt and Sudan
Bkakra, 1963	36,000	India
Brokopondo, 1971	5,000	Surinam
Damodar, 1953 to 1959 (4 projects)	93,000	India
Gandhi Sagar	52,000	India
Kainji, 1969	42,000-50,000	Nigeria
Kariba, 1963	50,000-57,000	Zambia and Zimbabwe
Keban	30,000	Turkey
Kossou, 1971	75,000	Ivory Coast
Lam Pao, 1963 to 1971 (11 projects)	30,000 130,000	Thailand Thailand
Nam Ngum, 1971	3,000	Laos
Nam Pong, 1965	25,000-30,000	Thailand
Nanela, 1967	90,000	Pakistan
Netzahualcóyotl, 1964	3,000	Mexico
Pa Mong (projected)	310,000-480,000	Thailand/Laos
Tarbela, 1974	86,000	Pakistan
TVA (20 dams) 1930s to1980s	60,000	United States
Upper Pampanga, 1973	14,000	Philippines
Volta, 1965	80,000-84,000	Ghana

development of a socially cohesive and integrated community, with a viable institutional infrastructure, became hard to achieve. The settlers' economic stability depended on agricultural products from family farming plots. But unfortunately land-clearing schemes did not progress on schedule and, in some cases, cleared areas were not ready for farming when the settlers arrived. The World Food Programme had to step in to avoid a major catastrophe.

Similarly, the Kariba Dam on the Zambezi displaced approximately 57,000 Tonga tribesmen who had to pay a major price for this progress. Their resettlement programme left much to be desired: not only did it subject them to great cultural shock by thrusting them into communities far different from their own but it also took two years to clear sufficient land to meet their subsistence needs. The Zambian government had to step in to avert famine and, ironically, this well-intentioned step became one of the most destructive parts of the process as food distribution centres became transmission sites for the dreaded sleeping sickness disease.

In Egypt and Sudan, the Nubians, from ancient times, had clung to their narrow strip of fertile land along the banks of the Nile. They were separated from the rest of the world by the arid expanse of the Sahara desert and were content with their land and what it yielded. They had managed to adapt themselves to all the differing aspects of their environment and, down the ages, they had derived a high moral tradition from it. They boasted that they had deep roots and that their ancestors had contributed to building the first civilization known to man. It was the Nubians, however, who suffered most directly from the construction of the Aswan High Dam. Their homeland was inundated by the rising waters of Lake Nasser and they had to abandon their houses, fields and property. In Egypt, about 50,000 were moved to a resettlement area near Kom Ombo, about 50 kilometres north of Aswan. In the Sudan, where part of Lake Nasser lies, an additional 50,000 Nubians were also moved to a new resettlement area about 1,000 kilometres south-east of Lake Nasser — Khashm El Girba on the Atbara river. The relocated villages in Egypt were patterned after those the Nubians had left behind. However, the move has been culturally and socially disruptive, although it did not have a negative effect on the Nubians' health. Despite improvements in health and housing facilities in the new villages, many Nubians, nonetheless, want to return to their homeland and establish villages on the shores of Lake Nasser. At Khashm El Girba, in the Sudan, there are also many signs of dissatisfaction among relocated Nubians. The layout and structure of the new houses were different from their original dwellings, and it took a long time for them to adapt. There were also health problems, particularly the increase in the incidence of malaria. The resettlement area had to be sprayed with insecticides for several years until the incidence of the disease decreased.

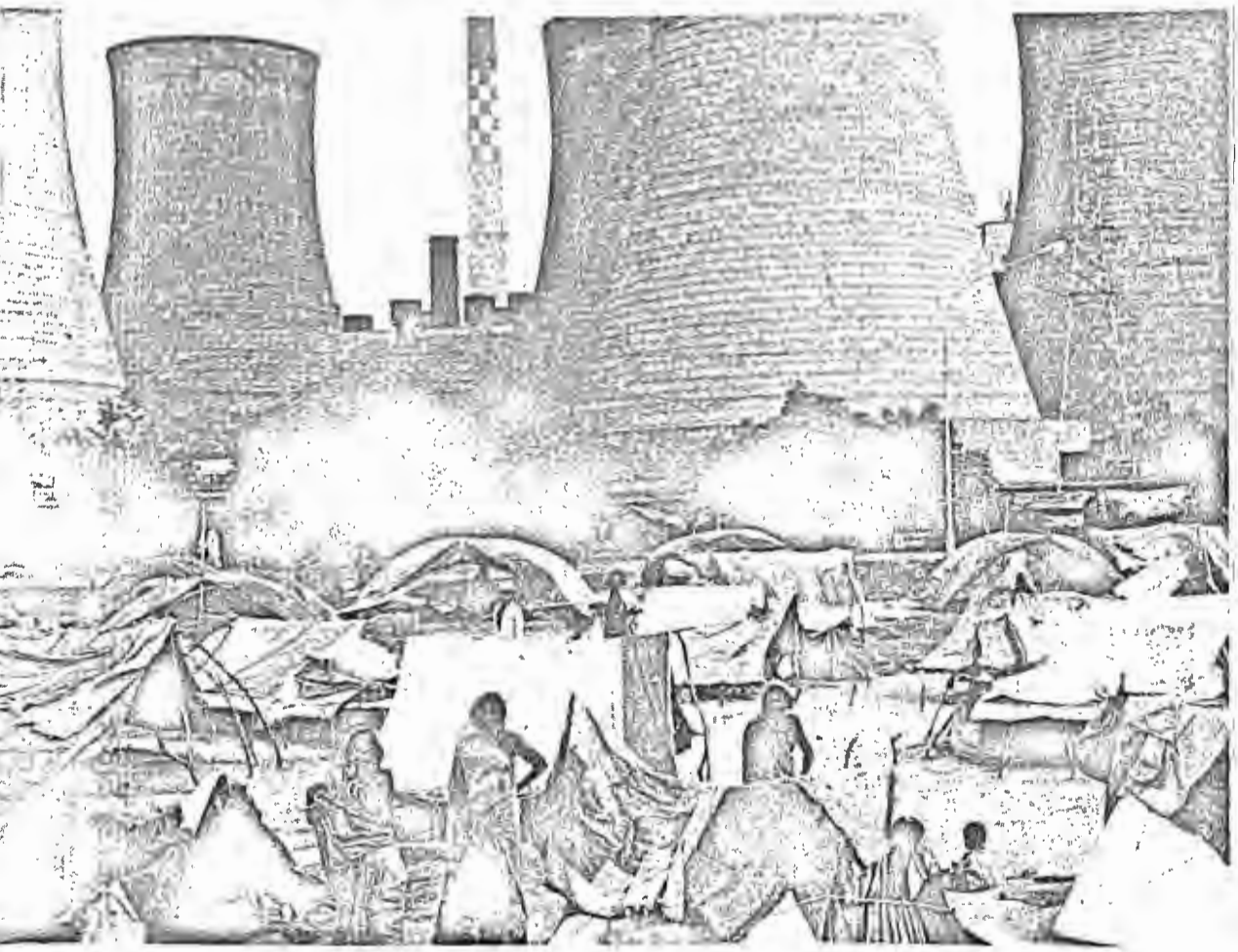
The resettlement of populations due to water development projects has not been a satisfactory experience in many developing countries. Inadequate planning, insufficient budgets, the incomplete execution of plans and little appreciation of the problems of technology transfer have all contributed to the failure of plans. The fact that many of the people to be resettled were rural and illiterate, and thus had little political power, was no asset. The direct beneficiaries of the projects were often the educated elites, who were in power, while the direct social costs fell to the rural poor.

5 Environmental accidents

The history of industry is full of examples of accidents that have harmed public health and the environment. Some of these accidents reached catastrophic dimensions, killing and injuring people and causing extensive damage to property and the evacuation of thousands of citizens for varying lengths of time. Recent industrial catastrophes compel us to redirect attention to the matter of improving our handling of environmental, health and safety risks.

On 10 July 1976, an explosion at a chemical factory in the north Italian town, Seveso, released a cloud of vapour which contaminated the surrounding area. The vapour consisted primarily of trichlorophenol but also contained 2.3.7,8-tetrachlorodibenzo para-dioxine (TCDD or dioxin). The total amount of dioxin was estimated at a mere two kilograms. Dioxin is a by-product or contaminant produced during the manufacture of 2,4,5-trichlorophenoxyacetic acid, (2,4,5-T), a herbicide usually used in the form of butyl ester. It was used as a component of Agent Orange, a defoliant used extensively during the Vietnam War.

"The Bhopal accident will not be the last... as long as such plants are not located far from dense population centres, such industrial accidents, particularly in the third world, are likely to increase."



Dioxin is extremely toxic, and thousands of people were evacuated after the Seveso explosion.

The most obvious effect on those exposed to the vapour, particularly children, was the eruption of chloracne, a skin disease with disfiguring sores. By June 1977, 135 certified cases had been reported and, among the women of the area, a number of legal abortions had been performed.

At 3.53 a.m. on 28 March 1979, all seemed to be operating routinely at the Three Mile Island nuclear power station, Harrisburg, Pennsylvania. One minute later, however, the station was plunged into chaos when Unit 2 experienced a loss of normal feedwater supply that led first to a turbine trip and then to a reactor trip. Thousands of gallons of contaminated water poured from the system onto the floor of the containment building. By 6.10 a.m. steam-clash made radioactive by its contamination in the generator — roared down the lines to a cooling tower, releasing, as it condensed, large quantities of radioactivity into the quiet dawn air. The reactor, meanwhile, had still not been brought under control by those who were struggling to reduce its temperature to a shut-down condition.

Civil defence teams in Harrisburg began mapping out a contingency plan, including possible evacuation, for the almost one million people living within 20 miles of Three Mile Island. During the first 24 hours, about 10,000 people had evacuated the area voluntarily, moving north to Hershey or other points of relative safety. This exodus, combined with the growing uncertainty created by the lack of official information and the conflicting reports on the degree of danger, stimulated rumours passed on by telephone or word of mouth. Slowly, with no apparent panic, the urge to evacuate began to gain ground. The nuclear threat was unlike, for example, the fear of flooding by a rising river. In a flood situation, it was only necessary to stay tuned to the radio and leave when the officials indicated: the fear caused by the invisible threat of radioactive emissions was far more terrifying. One day later, when the Governor of Harrisburg advised and urged pregnant women and pre-school-age children within five miles of the plant to evacuate their homes, his announcement had instant effect. During the next six hours, more than 100,000 people fled the vicinity, leaving block after block in Middletown vacant. Realising the need to calm those citizens who remained in their homes, President Carter made a visit to Three Mile Island which had some stabilizing effect on the communities in central Pennsylvania. Several days later, when the reactor had been finally brought under control, those who had migrated started returning home.

The Three Mile Island accident was not the first serious nuclear accident — nor will it be the last. It is both stunning and sobering to realise that most of the emergency systems which may be called upon to save peoples' lives have never been subjected to full-scale field tests. Even more devastating accidents may yet be in store.

On 19 November 1984, a massive explosion at a liquefied petroleum gas storage facility in the crowded San Juanico neighbourhood of Mexico City killed 452 people, injured 4,248 and displaced 31,000. The blast illustrated the precarious nature of a city where many of the 17 million inhabitants live cheek by jowl with a variety of potentially dangerous installations.

The leak of methyl isocyanate on 3 December 1984 at the Union Carbide pesticide plant on the outskirts of the industrial city, Bhopal, about 600 kilometres from New Delhi, India, is considered the worst industrial accident on record. It killed more than 2,500 people.

At 11 p.m. workers at the factory noticed that pressure was building up in a storage tank containing 45 tonnes of methyl isocyanate. At 56 minutes past midnight,

the substance started escaping through a faulty valve, forming a vast, dense fog of death that drifted noiselessly and lethally towards Bhopal. Before the tank was sealed almost one hour later about 30 tonnes of the chemical had escaped in vapour form into the Bhopal slums where 200,000 people lived. Hundreds of people died within minutes and, by the week's end, more than 2,500 were dead, while some 3,000 remained critically ill and another 20,000 were seriously affected by the gas. The accident triggered a massive exodus from Bhopal during which at least 200,000 people left the town for other destinations.

The Bhopal disaster is the latest in a series of major industrial mishaps worldwide. Some had immediate fatal results but most caused people to migrate for varying periods of time — thus disrupting their life-styles and exposing them to stress and other hazards. But the Bhopal accident will not be the last. As long as strict safeguards and standards are not implemented and as long as such plants are not located far from dense population centres, such industrial accidents are likely to increase, particularly in the third world. In developing countries people often live in crowded slums and other settlements around industrial plants. Most have no access to transport which is both expensive and inadequate, so choose to live next door to the factories where they work. Most of the victims of the accidents at San Juanico and Bhopal were living in squatter settlements near the plants.

Such accidents demand a critical examination of industry's philosophy of and approach to managing environmental, health and safety risks. Most companies address environmental issues on one of three levels. The first and most basic is the problem-solving approach which waits for a problem to occur before thinking of a solution. Most industries with this approach do nothing until a problem erupts which leaves them vulnerable to the "hidden hazards" associated with their operations. The second approach is a compliance-management approach which recognizes that health and safety issues can be actively managed like other business affairs. Management determines which requirements apply and what actions are needed to bring the organization to an appropriate level of compliance with existing national regulations. Some industries strive to meet all applicable regulatory requirements; others may weigh the potential penalties of not complying. But where regulations are simply not adequate to protect the public even careful compliance will not enable managers to protect their plants from accidents. The third approach includes those relatively few companies that, out of enlightened self-interest, apply broad-scale risk management perspectives to their environmental, health and safety affairs.

This approach can be costly and may involve measures that are not required legally. But, as the compliance approach may be insufficient to protect a concern's assets or values in the case of major accidents, environmental matters should be managed whether or not regulations exist. This approach to risk management tends to be less apparent in a company's foreign branches that are both geographically and culturally removed from headquarters, as in the case of foreign branches of multinationals located in developing countries.

6 Post-war refugees

The most obvious and horrifying direct effects of war fall on people. But wars also affect, directly and indirectly, the environment. The effects may be short-term and the environment may be restored almost to its original condition and those who migrated because of war may return. But the effects may endure in which case the refugees will stay away longer and many may never return.

The Second Indochina War, from 1961 to 1975, was noted for the widespread and severe environmental damage inflicted in its theatre of operation, particularly in former South Vietnam. The United States strategy in South Vietnam involved the massive bombing of rural areas, the excessive chemical and mechanical destruction of the forests, the large-scale chemical and mechanical destruction of crops, wide-ranging chemical anti-personnel harassment and isolation, and the massive forced displacement of people. In short, the strategy represented the intentional disruption of both the natural and human ecologies of the region.

In South Vietnam, chemical herbicides completely destroyed 1,500 square

Vietnamese refugees crowd into Hong Kong. "In South Vietnam, chemical herbicides completely destroyed 1,500 square kilometres of mangrove forest and caused some damage to another 15,000 or so square kilometres."

kilometres of mangrove forest and caused some damage to another 15,000 or so square kilometres. The natural recovery of these areas is proceeding at a disturbingly slow rate and millions of people have been affected by this deliberate destruction of the environment.

More than a decade later an international group of ecological and physiological scientists was convened in southern Vietnam to evaluate the evidence of the long-term effects of the herbicidal assault on Indochina. The group's findings are summarized in the following (Westing, 1984): "Recent examination of the inland forests of South Vietnam has established that the wartime herbicidal damage of more than a decade ago is still much in evidence ... The damage to nature involved the death of millions of trees and often their ultimate replacement by grasses, in turn maintained to this day by subsequent periodic fires; deep, lasting inroads into the mangrove habitat; widespread site debilitation via soil erosion and loss of nutrients in solution; decimation of terrestrial wildlife primarily via destruction of their habitat; losses in freshwater fish, largely because of reduced availability of food species; and a possible contribution to declines in the offshore fishery."

The impacts of such environmental disruption have been far reaching. About 17 million people were displaced — most of them from rural areas. The majority flocked to the cities: one estimate suggests that the populations of ten of the major areas outside Saigon trebled between 1963 and 1971 (UNEP, 1982). In the short term, such refugees not only experienced personal suffering and economic loss, but exerted severe pressure on the areas to which they migrated. After the war many could not return home because their farmland had been irreparably destroyed. The resources with which to combat soil erosion or reforest denuded areas have not been made available.

Other post-war hazards that hinder the rehabilitation of affected areas and, consequently, the return of refugees, are embodied in the remnants of war. Unexploded mines, bombs and shells can hamper the rehabilitation of vast areas, and endanger people who disturb them. In a UNEP survey (1980), 44 governments reported on the environmental effects of the remnants of war. One government said that it had cleared 14,469,600 land mines left behind after the Second World War, and that clearance was continuing at the rate of 300,000 to 400,000 a year. Many thousands of shells, bombs and other munitions have had to be cleared in a number of countries. The country most seriously affected reported that remnants of war had killed 3,834 people, mostly children, and injured 8,384 others including 6,783 children. Further information was provided at a special symposium held in 1981 in Libya on the Material Remnants of the Second World War on Libyan Soil (see UNEP, 1982). The symposium revealed that, after the Second World War 58.5 million mines were removed from some 2.5 million square kilometres in the USSR alone. In France, 13 million mines, 23 million shells and 600,000 bombs were cleared between 1945 and 1980, mostly from coastal zones. Such remnants of war have also been a problem in South Vietnam. The Second Indochina War is calculated to have left some 150,000 to 300,000 unexploded munitions in the combatant territories. The removal of unexploded weapons is not only costly but is often hampered by a lack of records as to where mines were laid. Moreover, many developing countries lack both the skills and resources for such operations and argue that, where outside powers were the belligerents, they should bear the costs of environmental restoration.

Areas known to contain remnants of war, particularly those in developing countries, are often far removed from any hope of rehabilitation or re-development and their original inhabitants are forced to seek

refuge elsewhere. Even in desert areas, nomads avoid areas known to contain remnants of war, even if they offer water and good grazing. The remnants of war (from the Second World War) that are scattered in Egypt's north-western desert and the Libyan desert have driven nomads from areas they frequented for generations. The same is now true in areas of the Middle East and Africa.

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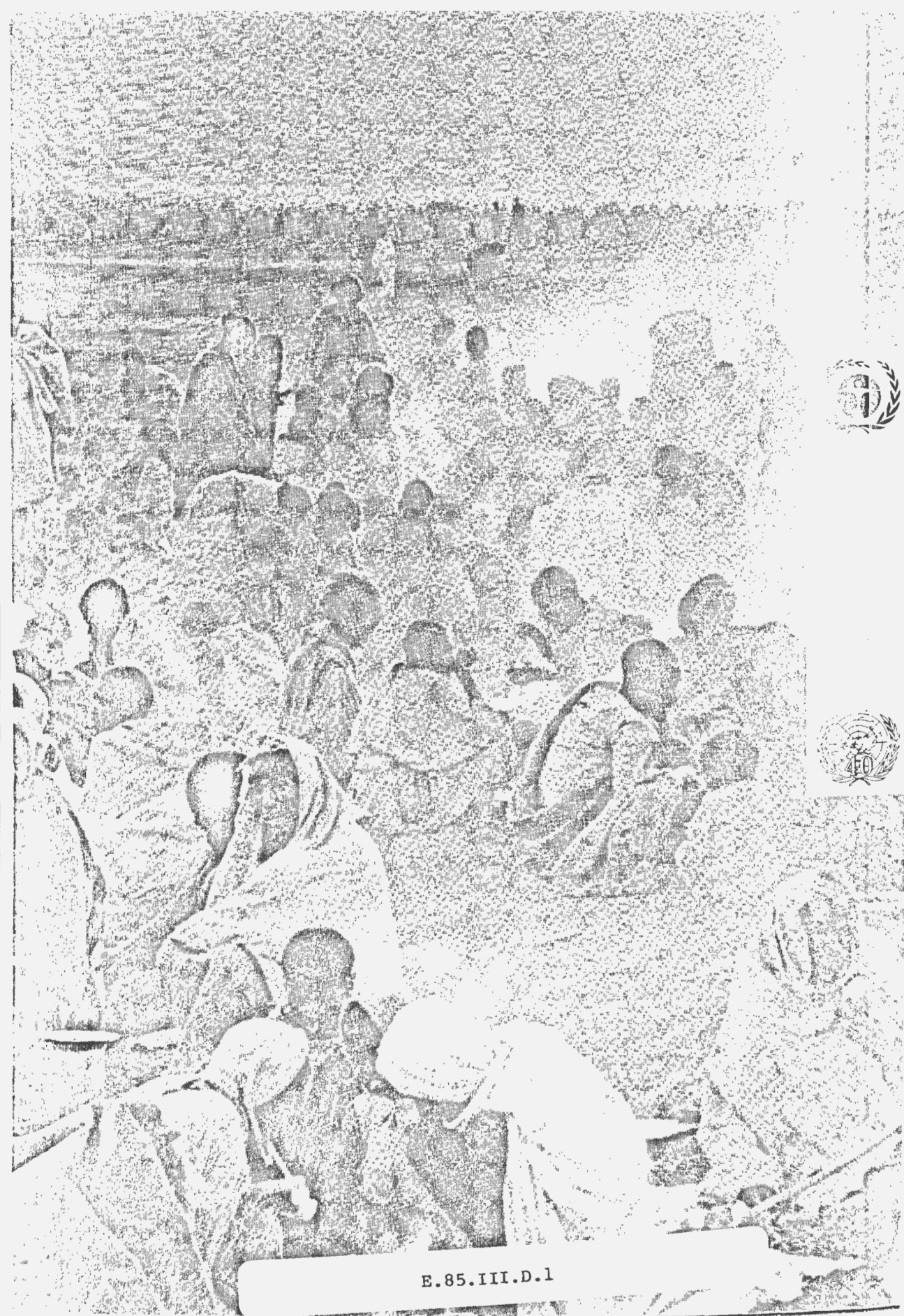

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