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Final Report

Afghanistan Environmental Profile: Phase I

Submitted to the
Office of the A.I.D. Representative
for Afghanistan Affairs

Under
Contract No. 306-0205-C-00-9385-00
Delivery Order No. 20

June 1992

Submitted by
Nathan Associates Inc. and
Louis Berger International, Inc.
A Joint Venture

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EXHIBIT

GLOSSARY

Acantholinum	a prickly herb
ADS	Afghan Demographic Survey
afghani	unit of Afghan currency (official rate Af 50.60 = US$1.00 for every year since 1981-1982; "bazaar rate" Af 692 = US$1.00, average for 1990-1992)
Af	afghani
A.I.D.	Agency for International Development
Artemisia	a genus of strong-smelling herbs and shrubs
ASSP	Agricultural Sector Support Project, O/A.I.D./Rep
AVHRR	Advanced Very High Resolution Radiometer
BHC	pesticide commonly known as lindane
bustards	a family of game birds (*Otididae*)
CFR	U.S. Code of Federal Regulations
DAP	diammonium phosphate, a fertilizer that contains both phosphate and nitrogen
Earthsat	Earth Satellite Corporation, subcontractor to DAI on ASSP
FAO	Food and Agriculture Organization (UN)
GDP	gross domestic product
Gini coefficient	a statistical measure of income distribution within a given population
GIS	Geographical Information System
ibex	wild mountain goat
ILO	International Labor Organization
jerib	Afghan unit of land area equal to 44 m x 44 m, or 1,936 m^2, usually rounded to 2,000 m^2
karez	hand-dug subterranean channels that direct water from permanent water tables under mountains or hills to the surfaces adjacent to villages or their fields; also called *kariz* or *qanat*
kgce/cap	kilograms of coal equivalent per capita
km^2	square kilometer
kW	kilowatt
kWh	kilowatt hour
Landsat	a remote-sensing system
macaque	short-tailed Old World monkey
MSH	Management Sciences for Health
MSS	Landsat multi-spectral system
MT	metric ton

MUAC	measurement of mid-upper arm circumference, a means of assessing nutritional status
mujahidiin	Afghan resistance fighters engaged in the *jihad* (holy war) against the Kabul government
MW	megawatt (one million watts)
NDP	net domestic product
neurotoxic	poisonous to the nerves or nerve tissue
NGO	nongovernmental organization
NWFP	North-West Frontier Province of Pakistan
O/AID/Rep	Office of the A.I.D. Representative for Afghanistan Affairs
palaearctic	relating to the biogeographic region that includes Europe, Asia north of the Himalayas, northern Arabia, and Africa north of the Sahara
pica	magpie
PSC	personal services contractor
rupees (Rs)	Pakistani currency (official rate Rs. 24.01 = US$1.00 as of July 1, 1991)
suslicks	large short-tailed ground squirrels
tce	tons of coal equivalent
TM	Landsat thematic mapping
transhumant	pertaining to seasonal movement of livestock under the care of herders or to nomadic populations accompanying such livestock
UN	United Nations
UNDP	UN Development Programme
UNICEF	UN Children's Fund
UNOCA	Office for the Coordination of the United Nations Humanitarian and Economic Assistance to Afghanistan
WFP	World Food Program
xerotic	characterized by abnormal dryness
xerophytic	pertaining to plants structurally adapted to life and growth with a limited supply of water, especially by means that limit transportation or that provide for the storage of water

PREFACE

This report was prepared in response to Delivery Order No. 20 of A.I.D. Contract No. 306-0205-C-00-9385-00, Afghanistan Studies Project. The work was carried out by the joint venture of Nathan Associates Inc. and Louis Berger International, Inc.

Mr. Andrew Blelloch served as team leader. Principal contributors to the work were Dr. Phylo Evangelou, Mr. Abdul Aziz Ferogh, Mr. Massaye Girma, and Mr. David Thirkill. Mr. A. Tawab Assifi reviewed the report and provided specialized counsel. The work was carried out under the supervision of Mr. Robert R. Nathan and Mr. Harvey A. Lerner.

We wish to express our thanks to the staff of the Office for the Coordination of the United Nations Humanitarian and Economic Assistance to Afghanistan (UNOCA) for providing us with a copy of *Opportunities for Improved Environmental Management in Afghanistan*, prepared by the World Conservation Union under contract to UNOCA. We have drawn heavily on this document in our discussions of ecology and protected areas.

All research activities were carried out in the United States. No visits to Pakistan or field surveys in Afghanistan were conducted.

EXECUTIVE SUMMARY

Afghanistan's environment will undergo severe stress as its external and internal refugees are resettled. Deterioration of some of the country's important natural resources—a serious problem before the Soviet invasion—has been exacerbated by more than a decade of warfare and disruption and the absence of even traditional limits on their exploitation. Rural depopulation itself can be a source of environmental problems as shortages of human labor and animal traction lead to ecologically unsound farming practices. However, refugee repatriation in the near future could strain the land with a significantly increased population, creating a major ecological challenge. The ability of Afghan leaders and development officials to understand, plan for, and manage Afghanistan's environment as refugees are resettled could significantly affect the country's long-term prospects for stability and self-sufficiency.

In this introductory study, problems of resettling Afghanistan's refugees are considered from the broad perspective of A.I.D's environmental mandate, which reflects a comprehensive range of vision derived from U.S. experience and embodied in U.S. environmental legislation. The environmental movement in the United States originated from general concerns about protecting nature from man. This movement received its early direct political expression from concerns about the treatment of public lands—either irrigating them or placing them in protected national forests or parks. Modern environmental concerns in the United States have expanded to include air and water quality; preservation of the national ecological, biological, and historical heritages; handling of hazardous wastes; and prudent management of renewable and nonrenewable resources.

Over time, environmental regulation has become increasingly inclusive in its coverage. Accordingly, it has often provided a forum in which interests of economic growth and environmental quality appear to have been pitted against each other and have needed to be reconciled. However, economic growth and sound environmental policies are in fact quite compatible when decision makers adopt a long-term view and take into account the full range of forces influencing the environment. The comprehensiveness and breadth of view represented by environmental assessments usually exceed those in most other forms of development studies. Requirements for a larger vision help to

identify constraints and policy issues that may not be readily apparent from narrower perspectives.

In Afghanistan, as in many developing countries, the national government has had relatively little effective regulatory control over land used by its citizens. In the meantime, population growth and exposure to commercial technology have eroded practices rooted in tradition and in customary social controls. The modest protection of the environment provided by government or by traditional sociocultural arrangements has been eroded by more than a decade of war and civil unrest. Environmental problems that can be anticipated following a political settlement within Afghanistan include those that existed before the Soviet invasion in 1979 (e.g., erosion, desertification, and periodic shortages of water for agriculture), those that have received attention in the intervening period (e.g., deforestation, destruction of crops by pests, presence of live land mines), and those that may be specifically associated with refugee return.

Prospects for refugee return raise a variety of questions with far-reaching environmental implications. Does Afghanistan have sufficient properly irrigated land to support the increased population of residents and expatriates? Where will returning refugees obtain home-building materials and fuel? Is it realistic to expect large numbers of refugees to return to Afghanistan's countryside? If they do return, will Afghanistan's rural regions experience swift and possibly irreversible degradation without substantial investment in improved rural infrastructure and in human skills in maintaining a productive environment over the long term? If Afghanistan's cities are likely to be the main locus of refugee return, either initially or following unsuccessful attempts at rural relocation, should not urban environments be a major focus of attention? Indeed, is "resettlement" a period that precedes "reconstruction" and "resumption of development" or is it an activity that requires some contemporaneous reconstruction and development projects to be undertaken in order to succeed? Answers to such questions lie far beyond the brief compass of the present introductory study, but they flow inevitably from an attempt to examine the resettlement environment from a comprehensive viewpoint.

This report presents information available on the country's environment both before the invasion and today, identifies the major concerns, outlines possible measures to address these concerns, examines the Mission's Geographical Information System (GIS) program, and makes recommendations on how Phase II could be developed and how environmental concerns could be integrated into A.I.D. programs for the resettlement of refugees.

Afghanistan is a poor, landlocked, and largely mountainous country with an estimated 1978 population of 14.6 million, of which 2.1 million were urban and 1.6 million were nomadic. Although the climate within Afghanistan varies from monsoonal to desert, most of the country can be classified as semiarid. Agriculture produced approximately 56 percent of the gross domestic product

(GDP) and provided employment for 80 percent of the population. Approximately two-thirds (by weight) of the major crops are produced on irrigated land, a fact that indicates the importance of water to the economy. Less than 10 percent of hydroelectric potential has been tapped. It is conceivable that much more water could be made available for irrigation than in the past. To our knowledge, no global estimates have been made of the extent of additional potentially irrigable land, or of the capital and operating costs associated with making such land productive. Agricultural production is regularly afflicted by infestations of locusts and sunn-pests. These have been met with applications of BHC, a pesticide banned in both the United States and the former USSR.

The country has a low level of literacy. In 1978, only 30 percent of rural children attended school (10 to 15 percent of girls). In 1978 there were 220 basic health centers in rural regions, providing basic health services to approximately 19 percent of the population. Malaria had been largely eradicated.

At one time, approximately 1.9 million ha or 3 percent of Afghanistan's land area was covered in forest, including timber, scrub, and pistachio forest. Topographically, Afghanistan consists primarily of grasslands (61 percent), followed by desert and mountains (24 percent) and arable land (12 percent). Centralized environmental systems such as water and sewer systems were highly limited.

Before the Soviet invasion, Afghanistan was reported to be suffering from overgrazing and deforestation. Timber harvesting was occurring at a nonrenewable rate. This depletion of natural resources is typical of many developing countries. Some timber was cut for export, but the major use of forest resources was firewood. The pressures on natural resources are therefore largely proportional to population growth. The growth rate in 1978-1979 was estimated at 2.18 percent.

Afghanistan is relatively well-endowed in hydrocarbon fuel resources. Major sources of coal and natural gas have been identified, and it is believed on the basis of geological formations present in the country that considerable oil reserves may be found if adequate exploration is undertaken.

Information on the impacts of the hostilities on natural resources is limited and primarily anecdotal. Extensive timber-cutting for export and clearance of cover for military purposes is reported. The most significant known impact is the escape of many people from rural war zones, creating a large refugee population. Between 1978 and 1990, the resident population of Afghanistan decreased by 15 percent from 12.4 million; the prewar rural population decreased by 25 percent to an estimated 9.3 million (75 percent of the total population); and the urban population increased by almost 50 percent to an estimated 3.1 million. The in-country population, added to the population of refugees in Iran and Pakistan, totals approximately 17 million, an increase

of approximately 17 percent from 1978-1979. The proportion of dependents, including widows, orphans, and the incapacitated, has increased significantly. The war has led to extensive damage and deterioration of infrastructure, including roads, irrigation systems, schools, and health centers and has undoubtedly left Afghanistan with even fewer professionals in fields that are needed to protect the environment and natural resources, such as forestry and agronomy.

The major issue facing Afghanistan and its environment is the impact of the return of refugees. A simplistic concept is that they will all return to their original family homes, most of them in the countryside. This is unlikely as many may have lost touch with their agricultural roots and may be unwilling to face the harsh realities of Afghan rural existence. When the refugees return, the carrying capacity of the land will depend on the inputs provided, such as the provision of temporary food supplies until agricultural systems are operable; rehabilitation of agricultural systems, particularly irrigation systems, seeds, and fertilizers; construction materials; and technical assistance. If this support is not provided, people are likely to practice environmentally degrading methods of agriculture in order to avoid starvation. Their presence en masse could impede agricultural efficiency and ultimately result in an irreversible depletion of natural resources. When they can no longer survive on what is left in the countryside, they may be expected to join the urban poor, creating additional environmental problems in the cities to which they migrate.

This report suggests a worst-case scenario in which refugees are encouraged or compelled to return to the rural regions of Afghanistan in a year of good harvests only to be starved out in normal or bad years. Rather than assume that rural Afghanistan can support returning refugees, it would be preferable to make informed estimates of the sustainable rural population under present conditions and with adequate support. Investment in rural infrastructure and human skills needed to expand that capacity should be scheduled. It should be accepted that much of the refugee population will not return to the countryside. Realistic programs should be established either to maintain the population that the countryside cannot accommodate in Afghanistan's cities or to leave them in place outside the country, where they can be served more cost-effectively than in isolated rural locations. The number of refugees encouraged to return to rural regions should be limited to the carrying capacity of the natural environment, in accordance with a schedule based on the development of adequate rural infrastructure. Responsible application of such a policy requires realistic estimates of that carrying capacity, perhaps initially on the basis of gross estimates and ultimately on the basis of specific, region-by-region assessments. The objective is not to micromanage resettlement but rather to avoid a situation in which policymakers unwittingly contribute to a human and ecological tragedy by assuming a set of relationships between man and nature that simply cannot be maintained in Afghanistan's countryside under present circumstances.

The remaining timber forests are of particular concern. Extensive forest-cutting during the period of hostilities has been reported but information on the extent of remaining forests is not available. Methods of cutting and preparing timber are reported to be inefficient and to waste a significant amount of usable wood. Once the hostilities end, rebuilding is likely to create a large demand for timber, thereby threatening the remaining accessible forest land. The loss of this forest cover, primarily from steep mountain slopes, will increase the problems of watershed management, including soil erosion, flash flooding, and siltation of reservoirs.

The GIS being developed and maintained by DAI/Earthsat was reviewed as part of this study. The DAI/Earthsat program is specifically geared to the needs of the Agricultural Sector Support Project (ASSP), rather than to environmental and natural resources planning. Therefore, it has only indirect applicability. However, use of the GIS and interpretation of satellite imagery in combination with environmental work to be undertaken in the future could greatly assist in determining the carrying capacity of the land.

There is a tremendous lack of data to guide repatriation of refugees in a manner that minimizes environmental damage and loss of resources. Remote sensing, in the absence of ground-truthing, has distinct limitations, but it remains the most promising source of readily available objective information.

The geographic information system, installed and utilized by DAI/Earthsat, provides a useful framework that can be updated continually as new data are received or new interpretations are made. In the case of remote-sensing information entered in the system, the basic information (satellite imagery) remains unchanged, but its interpretation can be altered substantially.

Interpretation of satellite imagery is much further advanced in some areas than in others. Forest cover can be interpreted with a reasonable degree of accuracy, even given limitations on ground-truthing. A comparison of satellite imagery in 1978 and 1992 could remove or substantially reduce doubts concerning the pace and extent of deforestation experienced by Afghanistan. Technology for assessing rangelands is significantly less advanced. Earthsat has proposed the use of relatively inexpensive Advanced Very High Resolution Radiometer (AVHRR) satellite imagery to obtain multiple images over the entire 1978-1992 period. Trends identified through the interpretation of these images would be compared with rainfall data. The technique is experimental but merits the Mission's serious consideration.

Use of satellite imagery will remain important long after it becomes possible to gather information by other means, including aerial and ground surveys, because of its advantages in terms of coverage, technical quality, and cost for particular purposes. Because imagery over a considerable span of years is now available, its interpretation permits the recovery of a historical perspective, which is important to analysis of environmental trends.

Subject matter experts who have knowledge of Afghanistan need to be involved in the interpretation of satellite images: a forester in the case of forest resources; a range management specialist in the case of grasslands. Computer technicians, geographers, and development generalists can help, but they often encounter difficulty when they attempt to interpret data without detailed technical knowledge of the subject matter and the country.

During a period of reduced budgetary resources, it is particularly important that funds expended on gathering and interpreting information on Afghanistan be invested wisely. Long-term and short-term strategies should be developed for dealing with information needs pertaining to environmental issues, particularly those that are directly related to refugee return and the carrying capacity of the land.

If pertinent, objectively verified data are important to impending decisions but are not available, the Mission should seek estimates from persons with knowledge of Afghanistan and its environment and people. A range of views should be sought and compared to the extent possible under these circumstances. A comprehensive program of gathering and analyzing information should be developed for the long term—one that integrates data from all sources and informs both environmental and development planning.

The multiple specters of political instability, extreme poverty, and ecological disaster loom large over Afghanistan. Prospects for an extended period of political turmoil pose substantial challenges to environmental programs as they do for refugee resettlement and national reconstruction activities. Vigorous action is required on the environmental and other fronts.

Recommended guidelines for environmental action are as follows.

1. The Government of Afghanistan, with support from donors, should address problems of environmental policy, regulation, and institutional responsibility immediately.

2. Local populations should be involved in designing and implementing environmental programs.

3. Projects that combine positive economic and environmental effects should be given high priority during resettlement and reconstruction.

4. Unfavorable environmental impacts of resettlement and reconstruction activities, in addition to suitable mitigation measures, should be identified clearly.

5. The Government of Afghanistan should avoid subsidies, legal preferences, and institutional perquisites that impede attainment of environmental objectives.

6. Land and water ownership rights should be clarified. Local private or communal ownership of resources should usually be preferred over state ownership, but innovative combinations of local and national control for protection of environmental assets also should be considered under suitable circumstances.

7. The Government of Afghanistan should use economic criteria and market mechanisms for achieving environmental objectives whenever feasible.

8. The government should promptly address major threats to public health, particularly those posed by inadequate water supplies, poor sanitation, and improper disposal of hazardous waste in Afghanistan's cities.

9. The government should establish a framework for heading off future urban environmental problems, particularly those that may be expected to affect Kabul.

10. The Government of Afghanistan should specify the environmental responsibilities of its Ministries and subsidiary organizations and establish a central capability to set environmental priorities and monitor progress toward attaining environmental objectives.

This report recommends:

- Preparation of a Phase II Profile, including an assessment of the conditions of the forests and grasslands and a more detailed approach to addressing the resettlement issues.

- Establishment of a program for integrating environmental concerns into other A.I.D.-financed programs for Afghanistan.

- Development of a comprehensive management plan for protecting Afghanistan's environment.

- Development of a comprehensive training program for Afghan cadres in environmentally sound natural resources management.

- Preparation of a detailed water resources study that explores in detail both constraints and potentials of water resources development.

Chapter 1 presents background information and the objectives of the report. Chapter 2 presents a summary of environmental conditions and environment-related project experience before the Soviet invasion. This summary draws on pertinent portions of studies carried out on the basis of information gathered before 1979. The chapter follows a standard format for

environmental analysis in developing countries, with sections on physical geography, ecology, population, socioeconomic factors, public health, infrastructure, and energy sources and uses. Chapter 3 identifies the main impacts on Afghanistan's environment that have been reported or are presumed to have occurred during the period of war and civil unrest since 1979. Particular attention is given to the effects of population relocation, deforestation, locust and sunn-pest infestation, and health conditions. Chapter 4 provides a forward-looking assessment of how Afghanistan's environmental problems are likely to interact with resettlement and other assistance efforts undertaken in the period following a political settlement. Chapter 5 presents potential mitigation measures.

Chapter 6 reviews the status of GIS and related assessment systems being developed and maintained by DAI/Earthsat and the O/AID/Rep's Data Collection and Analysis Unit. It discusses the extent to which data currently available in these systems can contribute to environmental studies and the ways in which information gathered during environmental studies can be used to build up these GIS databases.

Chapter 7 presents recommendations for Mission involvement in the assessment and mitigation of Afghanistan's environmental problems. It outlines the information and analysis needed to prepare an appropriate environmental profile in the light of the findings of this report and on the assumption that suitable information could be freely gathered by conventional means in Afghanistan in the future. The chapter identifies portions of the outline that the Mission may wish to give particular attention to and recommends short- and long-term environmental activities that could be undertaken as part of the Mission's program.

Chapter 1

INTRODUCTION

The objectives of this report are to

- Estimate environmental conditions in Afghanistan before the Soviet invasion and assess changes believed to have taken place since then on the basis of current studies, information, and informed opinion outside Afghanistan;
- Identify environmental problems most likely to affect and be affected by resettlement, rehabilitation, and development programs undertaken by A.I.D. and other international development agencies once a political settlement is reached;
- Prepare an outline of a suitable environmental profile for Afghanistan;
- Recommend actions that can now be taken by O/AID/Rep to develop portions of such an environmental profile and to prepare itself for the urgent environmental issues and requirements that it may face in the near future;
- Recommend ways in which geographic information systems supported by O/AID/Rep may be best utilized to provide information for environmental studies and ways in which environmental studies in turn can supply new information to these Mission-supported GIS systems.

Each Afghan refugee, whether in Afghanistan's cities or in neighboring countries, bears a capacity to destroy or downgrade any environment in which he or she may come to reside. Each refugee also carries a positive potential. Given good planning, sufficient investment, well-chosen technology, and essential changes in social behavior, refugees collectively can contribute to the capacity of the land to sustain a growing population in balance with its natural environment.

Avoiding negative impacts and utilizing positive human potentials during the resettlement of Afghanistan has a significant price tag. The extent of the negative environmental impacts of war and of resettlement and the costs of reversing them vary by location. Whatever the variations from place to place may be, refugees must settle somewhere. Environmental impacts there inevitably will be: their attendant effects and costs cannot be escaped.

This study focuses on Afghanistan only. It anticipates major problems not only because of the destruction to the land and its infrastructure wrought by 12 years of conflict, but also because Afghanistan's population, inside and outside the country, has experienced a very high rate of growth. Serious environmental problems loomed in the late 1970s, before Afghanistan was seized with its current trauma. Today these environmental problems appear much more threatening.

In the late 1950s and early 1960s, many Afghan officials were confident that the country had plenty of land to support a growing population. The droughts and starvation of the late 1960s shook that confidence. In the early 1970s, the country's leaders responded by introducing a number of the features of the Green Revolution to Afghanistan. The results were so favorable that some planners envisioned a future in which Afghanistan could devote a substantial portion of its irrigated acreage to export crops.

However, there were some early cautionary statements by Norman Borlaug[1] and others that there were distinct limits to the productivity of Afghanistan's arable land and, implicitly, to the population that it could support. Moreover, it soon became clear that the introduction of new agricultural production technologies could produce negative social and economic side effects as well. As larger landowners introduced tractors, fertilizers, pesticides, and improved seeds on their farms, some small farmers, sharecroppers, and farm laborers left the land. This movement was perhaps primarily attributable to actions taken in anticipation of land reform, but new technology probably facilitated it.

An exodus to Afghanistan's cities, particularly to Kabul, commenced. That exodus in turn produced requirements for productive employment and for investment in urban infrastructure that Afghanistan was hard put to provide. Where farmers were not familiar with the dangers of overuse of irrigation water, fertilizers, and pesticides, significant environmental problems also emerged.

In the mid-1970s, before the Communist coup against President Daoud, the Government of Afghanistan formulated a strategy to deal with both the

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[1]Norman Borlaug is an American agricultural scientist renowned for his work on agricultural productivity and well familiar with the problems of developing countries. He was awarded the Nobel Peace Prize in 1970.

potentials and the difficulties of applying new technologies to agriculture. That strategy focused on the use of modern technology and agricultural inputs to obtain higher yields from the land, measures for promoting rural equity and for inducing rural residents to remain in the countryside (such as land reform, protection of water rights, and mechanisms for rural development), and identification of arable lands for irrigation.

Agricultural production and productivity have suffered during the war. Irrigation systems have deteriorated and little has been done on water resource planning. The war will leave the country with many unresolved issues of property rights and of achieving equity in the countryside.

In the meantime, the birth rate in the refugee camps has been very high. The question remains whether Afghanistan's depopulated countryside or already swollen cities can receive and sustain a large, largely unskilled, and predominantly young population. The answer is not certain. But even if that answer proves clearly affirmative, the solution does not promise to be inexpensive.

A.I.D.'s environmental regulations (22 CFR 216) identify *resettlement* as an activity "normally having a significant impact on the environment." The Afghanistan Mission's own early experience with the Helmand Valley Project underlined environmental dimensions of resettlement programs undertaken in that region of the country. As O/AID/Rep draws closer to its return to Kabul and as refugee return gains momentum, environmental issues are likely to assume great importance and urgency in the Mission's counsels. To prepare itself for these circumstances, O/AID/Rep sought a synopsis of environmental conditions and experience before the Soviet invasion of Afghanistan, a summary of readily available information on what has happened during the intervening period of war and civil unrest, and recommendations of steps that can be taken by O/AID/Rep to prepare itself to address environmental information requirements and problems in the future.

Chapter 2

THE ENVIRONMENT IN 1978

Physical Geography

The administrative districts of Afghanistan are illustrated in Figure 1, the natural landscape in Figure 2, and the relief in Figure 3.

Located in southwest Asia, Afghanistan is bounded to the north by the former Soviet Union, to the east and south by Pakistan, and to the west by Iran. In the northeast, the Wakhan corridor constitutes a small stretch of border with China.

Afghanistan is a mountainous country. The Hindu Kush ranges extend for approximately 965 km from the Pamir in the northeast to the border of Iran in the west. The Hindu Kush range and lesser ranges and the deserts of the south and west limit the arable land to 12 percent of Afghanistan's 652,225 km^2, with only approximately 6 percent actually cultivated in a normal year.

Altitudes vary from 300 m to more than 7,000 m, but much of the country's population and agriculture are located in the foothills and narrow valleys of the Hindu Kush range, at altitudes between 1,000 and 3,000 m. The climate is generally characterized by low humidity, plenty of sunshine, low rainfall, high temperature during the day, and low temperature during the night. The average annual rainfall varies from 100 mm to 400 mm, including snow.

Geographical Zones

Before the war, there was no official definition of geographical zones in Afghanistan. However, the government's concerned agencies had divided the country into seven administrative regions to facilitate administration of land and taxes, as well as planning and implementation of transport, public health, agricultural, and development programs.

Some foreign scholars have tried to establish a basis for geographic zoning in Afghanistan. Dupree (1980) has divided the country into 11 geographic zones. The Hindu Kush mountain system comprises the first six zones. The remaining five zones are composed of deserts and plains that surround mountains in the north, southwest, and west.

These geographic zones do not coincide with the recognized administrative boundaries in the country, and preparing an environmental profile for each zone is therefore impossible at this stage. For the purposes of this report, we have divided Afghanistan into six regions that, to some extent, represent the primary features of the geographic zones prepared by Dupree. Figure 4 illustrates these zones, and their primary features are briefly discussed in the following paragraphs.

Northern Region

The northern region includes four provinces, namely Faryab, Balkh, Samangan, and Jowzjan. The region comprises the Turkestan plains and a major part of the northern mountains and foothills. Thus, the topography is mountainous in the center but flattens in the north and east towards the Amu Darya River.

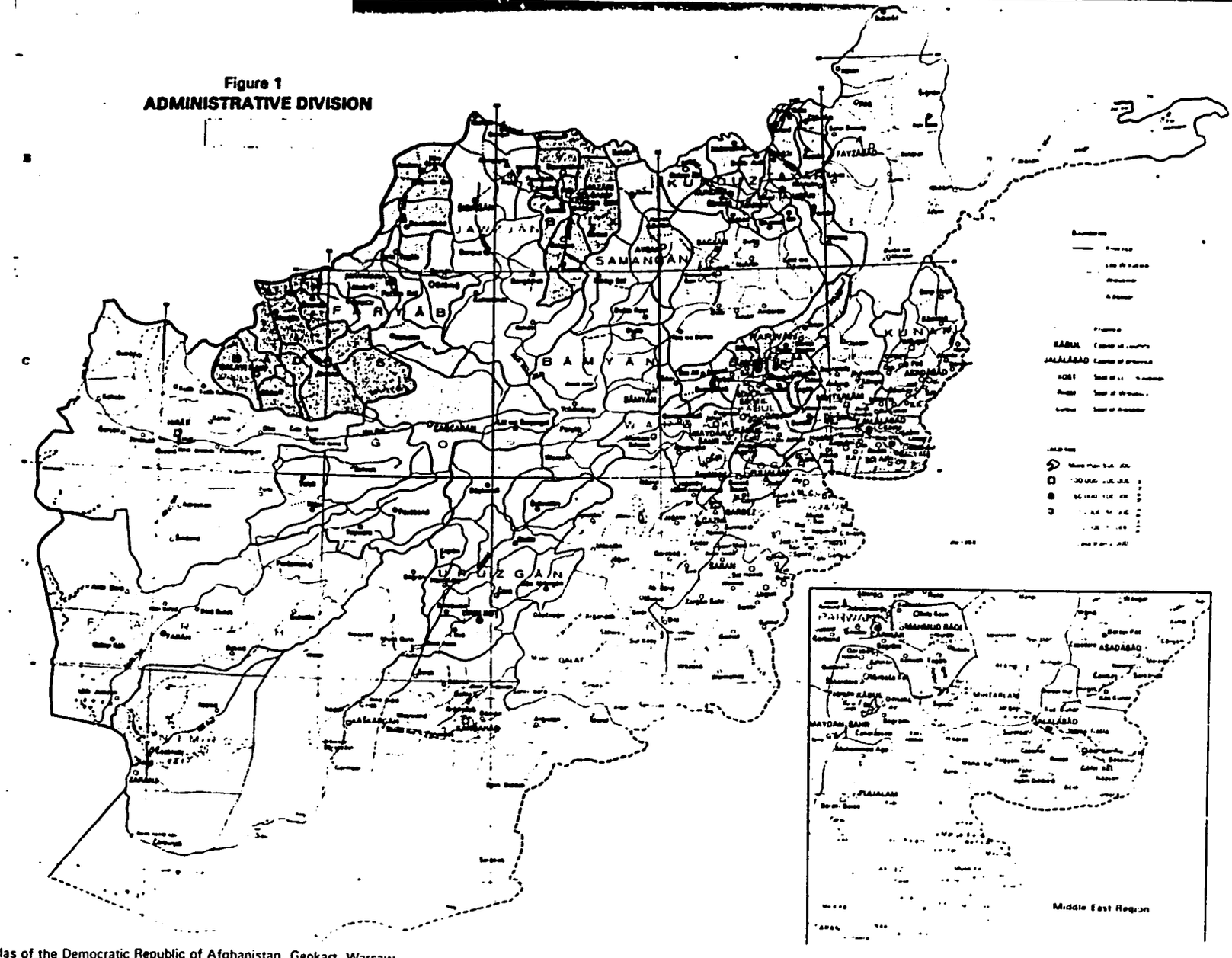
Before the war, the region included approximately 15.4 percent of the national population, 24 percent of total land cultivated, and 24 percent of total irrigated land. Rainfed agriculture also accounted for 24 percent of total dry farming at the national level. Livestock production was also significant. The northern region contained approximately 17 percent of the national flock of ordinary sheep and 86 percent of the country's karakul flock.

The industrial sector included cotton ginning, textiles, oil extraction, and natural gas. The country's only fertilizer factory is also located in this region. A 600-km paved road links Kabul and Mazar-i-Sharif and continues west to Shaberghan, the capital of Jowzjan Province. An 80-km paved road links Mazar-i-Sharif and the Hairatan port on the Amu Darya.

Northeastern Region

The northeastern region comprises the Wakhan corridor, Badakhshan, and a small part of the northern foothills and mountains covering Takhar, Kunduz, and Baghlan provinces. Kunduz and Baghlan have relatively wider fertile plains; the Badakhshan region has a mountainous topography. Approximately 83 percent of the Wakhan Pamir region lies above 3,000 m. Likewise, elevations higher than 1,800 m constitute more than 63 percent of the Badakhshan geographical zone. The Wakhan corridor was formed by the Anglo-Russian Border Commission to serve as a buffer zone between British India and czarist Russia.

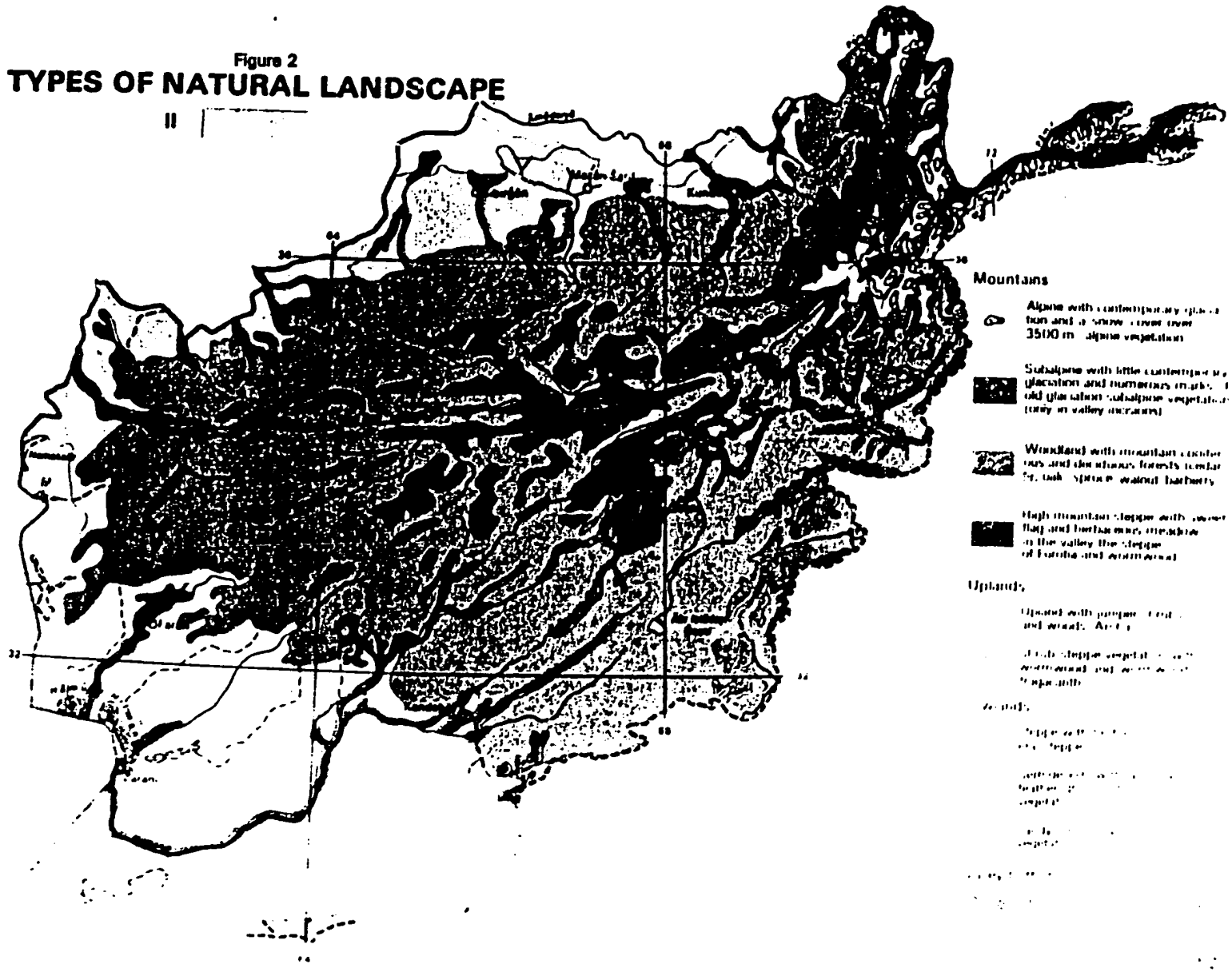
Figure 1
ADMINISTRATIVE DIVISION



Source: National Atlas of the Democratic Republic of Afghanistan, Geokart, Warsaw.

Figure 2

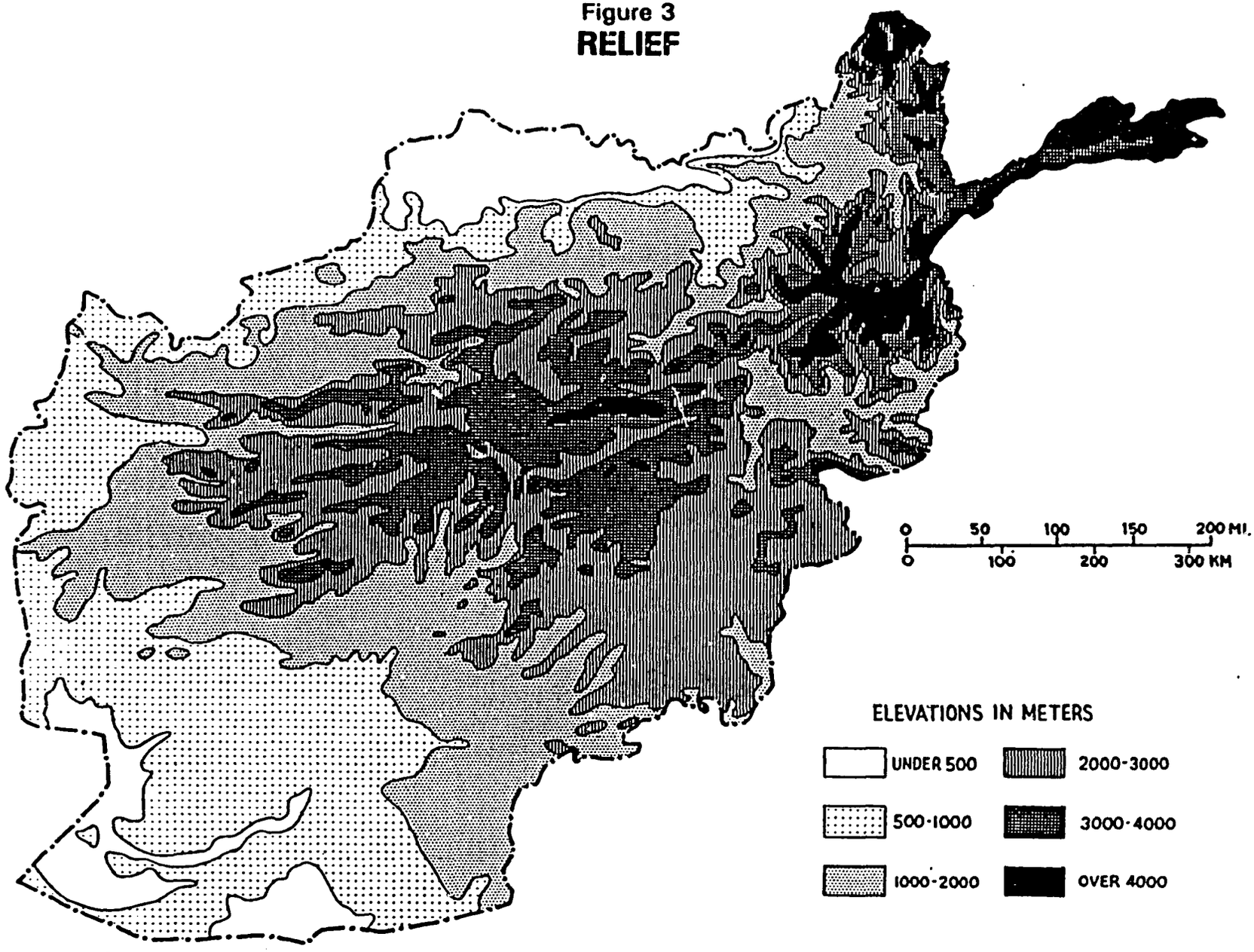
TYPES OF NATURAL LANDSCAPE



Source: National Atlas of the Democratic Republic of Afghanistan, Geokart, Warsaw.

Figure 3

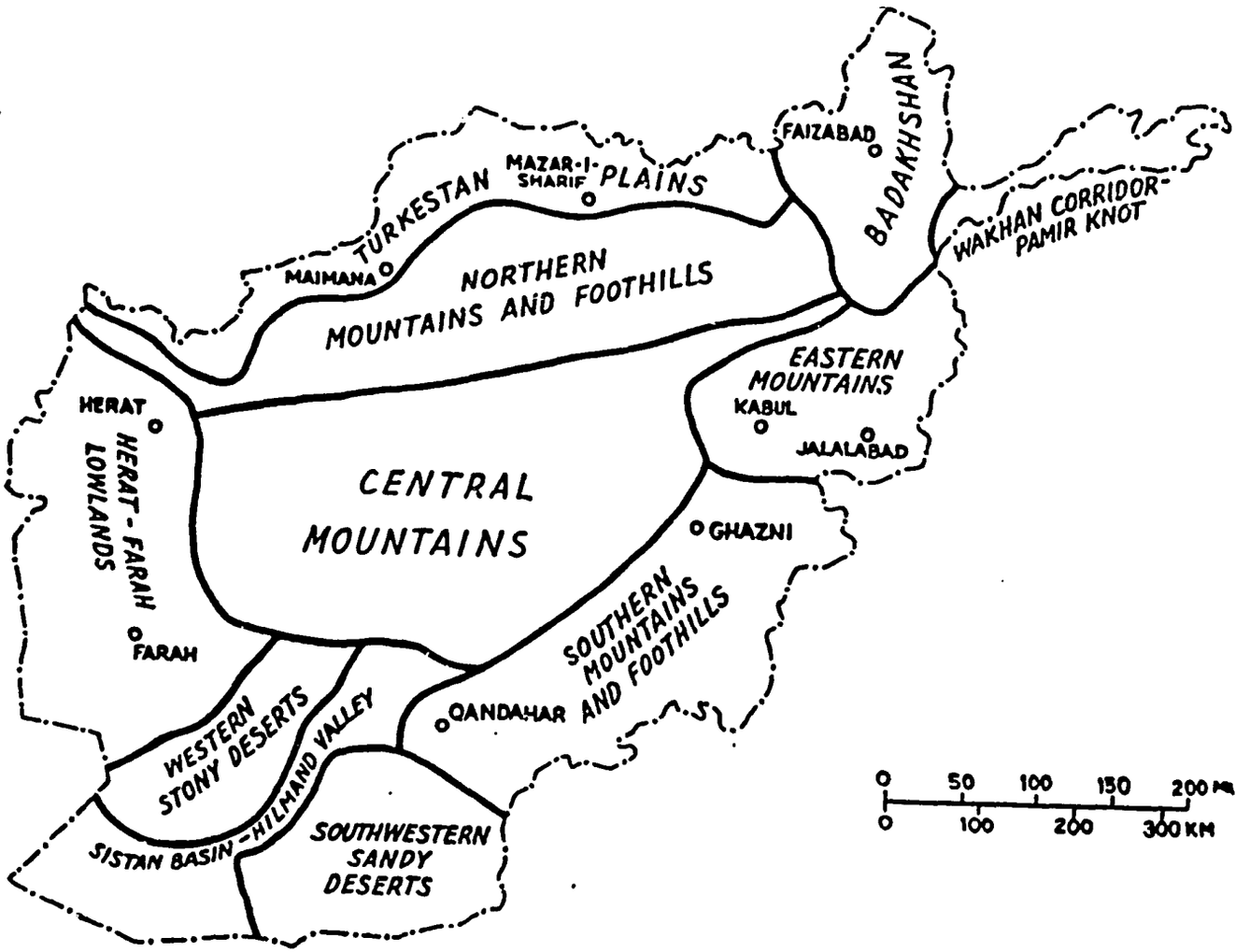
RELIEF



Source: Louis Dupree, Afghanistan, Princeton University Press, 1980.

Figure 4

GEOGRAPHIC REGIONS AFTER DUPREE



Source: Louis Dupree, Af[illegible], Princeton University Press, [illegible].

Before the war, the northeastern region was one of the most important agricultural regions in the country; it included approximately 15.8 percent of Afghanistan's settled population, 23.5 percent of total land cultivated, 17 percent of the country's irrigated region, and 30 percent of total rainfed land. Grazing land—approximately 12 percent of the national total—was also significant. Industries consisted of cotton ginning, seed oil, soap manufacturing, cement production, and sugar-beet processing. One paved road, approximately 200 km long, links Kunduz and the Kabul Mazar-i-Sharif highway at Doshi, through Baghlan. The river port of Shirkhan is located in Kunduz, on the Amu Darya River.

Western Region

The western region comprises Herat, Farah, Ghor, and Badghis provinces. The Herat-Farah complex consists of mountain ranges and low hills separated by relatively flat valleys. The Ghor province represents the western section of the central mountains.

In 1978, the region accounted for approximately 12.1 percent of the national population, 21 percent of total cultivated land, 16.6 percent of irrigated land, and 26.7 percent of total dry farming. Ordinary sheep accounted for 22 percent and karakul sheep for 8 percent of the national flock. Forests, primarily natural pistachio, constituted 12 percent of the national total. Grazing land accounted for 29 percent of the country's total pasture.

In 1978 the region had a modern industrial base that included cotton ginning, textiles, a cement factory, the Hari Rud dam, oil extraction, coal extraction, and barite mines. A concrete road links Farah and Herat and continues north to Torghundi. The Herat-Islam Qala road links the region to Iran at Islam Qala.

Southern Region

The southern region comprises Paktika, Zabul, Kandahar, Helmand, Nimros, and Oruzgan provinces. By 1978, it included approximately 15.8 percent of the national population, 17.7 percent of total land cultivated, 22.5 percent of irrigated land, 12 percent of dry farming, 32 percent of grazing land, and only 4.7 percent of the national forests. Irrigation infrastructure was well developed in both the Kandahar and Helmand provinces. Industries included fruit canning, woolen and cotton textile production, and hydroelectric power generation in Kandahar and ginning and oil extraction in Helmand. A paved road links Qalat and Kandahar and continues west to Girishk in Helmand.

East-Central Region

The east-central region comprises Kabul, Bamiyan, Parwan, Logar, Wardak, Ghazni, and Kapisa provinces. By 1978, it included approximately 26.8 percent of the national population, 9.4 percent of the total cultivated area, 13.7 percent of total irrigated land, 4.7 percent of total rainfed land, 12.6 percent of total grazing land, and 11 percent of the nation's sheep population. Industries included food processing, textile production, metal work, cement production, and hydroelectric power generation, primarily in Kabul. Asphalt roads link all the provincial towns, except Bamiyan, and the capital city, Kabul. In the past, the Panjsher valley, situated to the north of this region, served as a major route and was used by the nomads who gathered in Badakhshan during summer and returned to eastern Afghanistan in winter.

Southeastern Region

The southeastern region includes Paktia, Nangarhar, Laghman, and Kunar provinces, with approximately 14 percent of the national population and only 4.4 percent of total land cultivated. In 1978, the region had 6.1 percent of the national irrigated area and only 2.5 percent of the total rainfed land. This is the most heavily populated rural region with small farms and intensive irrigation agriculture.

Topography is mountainous; flat land is scarce and usually occurs in narrow valleys. Kunar and Paktia are the most heavily forested zones of the country. Before the war, 52 percent of total forests were natural forests capable of supporting commercial operations.

Local industries include wood processing, mining of semiprecious stones, and hydroelectric power generation. In 1978, the provincial towns were accessible by paved roads. However, the upper reaches of the Kunar and Laghman provinces were accessible only by foot trails.

Climate

Afghanistan's climate is continental, characterized by sharp variation of seasonal and diurnal temperature, even within short distances. Climatic regions are illustrated in Figure 5. Summers are dry and hot; winters are cold and wet with heavy snowfalls in the mountains. The average temperature is approximately 35°C during the hottest month and 10°C during the coldest month.

Summer temperatures generally range from 35°C to 45°C. Much of the country experiences long periods during which winter temperatures fall well below zero. The mean annual temperature is less than 18°C, except at Kandahar and Jalalabad. Meteorological data for major agricultural centers are presented in Table 1.

Table 1. Average Annual Precipitation and Temperature

Station	Average Annual Precipitation (mm)	Average Annual Temperature (°C)
Kabul	346	11.8
Kunduz	371	17.7
Baghlan	271	16.2
Mazar-i-Sharif	197	18.2
Herat	207	16.2
Kandahar	180	19.3
Ghazni	296	11.4
Jalalabad	172	21.3
Ghor	-	16.8
South Salang	1,169	-
North Salang	1,168	-

Note: Dashes indicate that no information is available.

Sources: *Agriculture Sector Review Mission Report*, Rome: UNDP/FAO, 1985. *The Journey to Economic Development*, Washington, D.C.: World Bank, 1978, Table 7.2.

The distribution of summer and winter temperatures is illustrated in Figures 6 and 7. In the south, summer temperatures may reach 45°C in the daytime, but may fall to 15°C at night. In the northern desert, winter temperatures may vary from -24°C at night to 10°C during the day. Summer temperatures as high as 49°C are recorded in the north; mid-winter temperatures as low as -9°C are common at the 1,980-m altitude in the Hindu Kush.

Afghanistan is a relatively dry country. Precipitation is generally low and irregular and the risk of severe drought ever-present. The growing season in most regions is short, reducing the opportunity for double cropping. The severe winter temperatures necessitate housing and protection of livestock from cold.

The distribution of precipitation is illustrated in Figure 8. The average annual precipitation in much of the country varies from 100 mm to 400 mm. Most precipitation occurs between October and April, mostly in the form of snow. Precipitation varies with altitude; the highest precipitation has been reported at Salang; the lowest level has occurred in the lowlands southeast of Lashkar Gah and Farah, north of Mazar-i-Sharif and Sheberghan, and west of Kunduz and Baghlan.

Distribution of annual precipitation in Afghanistan is uneven. Total precipitation from June to October represents only about 3 percent of the yearly amount of rainfall and snow. The average relative humidity ranges from 8 percent during the hottest summer month to 83 percent in certain

regions, particularly in the west. A small region in the east of the country has two rainy seasons.

Water Resources

Water availability is depicted in Figure 9. Only a relatively small portion of the country has perennial availability of water, and fresh water is lacking or scarce in much of it.

Afghanistan has been divided into the four following primary drainage regions (see Figure 10): (1) the Amu Darya, (2) the Hari Rud, (3) the Seistan (Helmand-Arghandab), and (4) the Indus (Kabul). These main drainage regions include some 30 major river systems. Figure 10 shows an adjustment to the boundary between the Helmand-Arghandab system and the Indus system as defined by Dupree, on the basis of analytical work carried out under a previous Nathan-Berger study.[2]

According to some rough estimates, only 20 to 30 percent of the 65 billion m^3 average annual flow has been used to date. The remaining 70 to 80 percent of water has been wasted because of a lack of adequate storage facilities and scarcity of suitable land. Thus, control of water, and not its quantity, has consistently been a major problem for Afghanistan.

Almost all of the existing irrigation systems are traditional and incapable of providing an assured supply of water for year-round cultivation. These structures are damaged during spring floods and must be repaired by farmers a number of times a year.

Because of the lack of proper water management, insufficient use of water remained a severe constraint on agricultural production. Traditional water rights also impeded efficient water distribution. In some traditional systems, water efficiency was as low as 30 percent.

The main river systems comprise Amu Darya and its tributaries in the north, Helmand and its tributaries in the southwest, the Hari Rud River in the west, and the Kabul River system and its tributaries in the east. The rivers, fed largely by melting snow, have a generally low annual flow. Hydrological data, representing the average annual flow of the major rivers, are presented in Table 2.

The major water source in Afghanistan lies in the high watershed of the Hindu Kush mountains. Seasonal flow fluctuates greatly. Most rivers have maximum flows in spring and early summer and minimum flows in late

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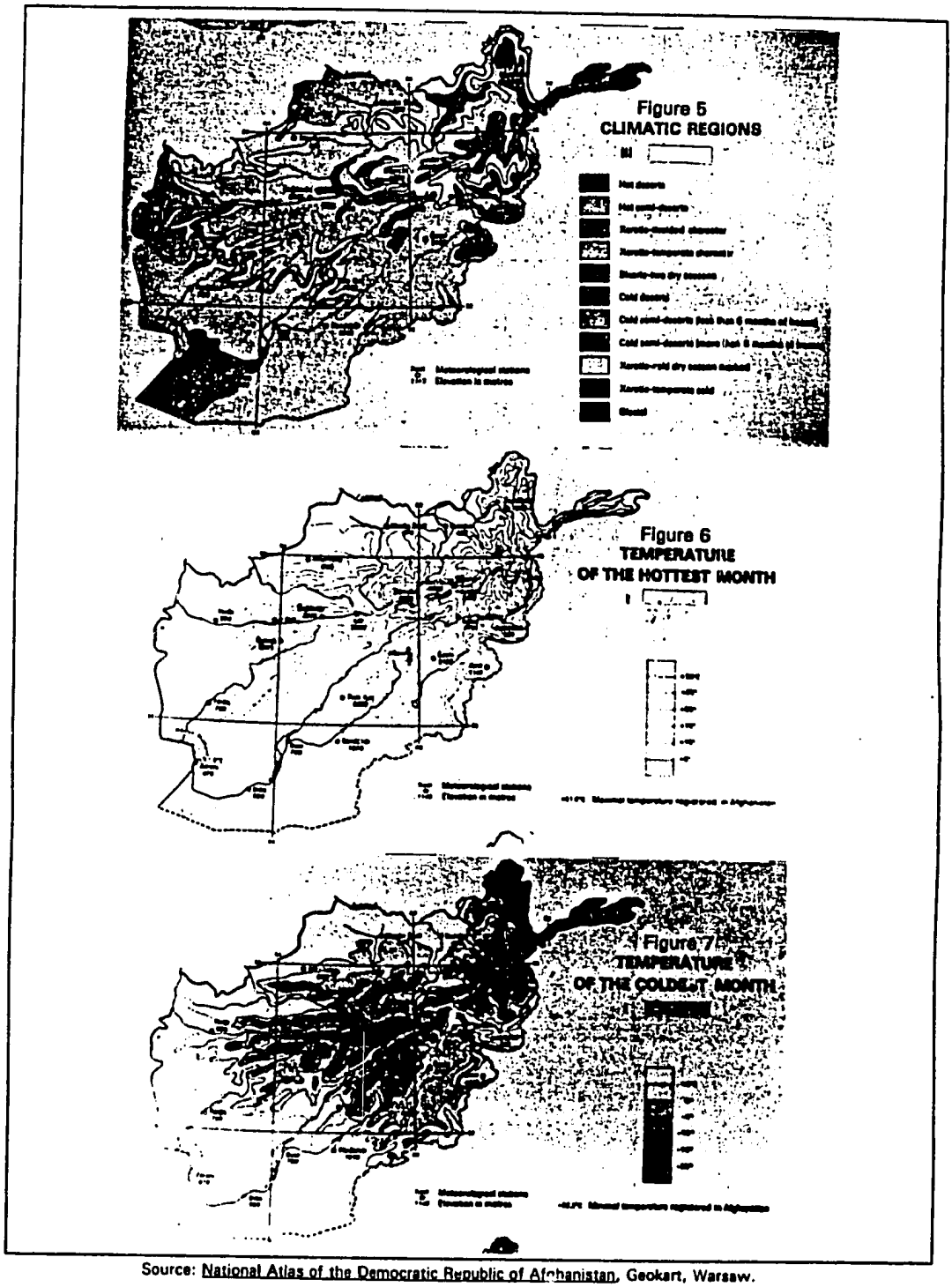
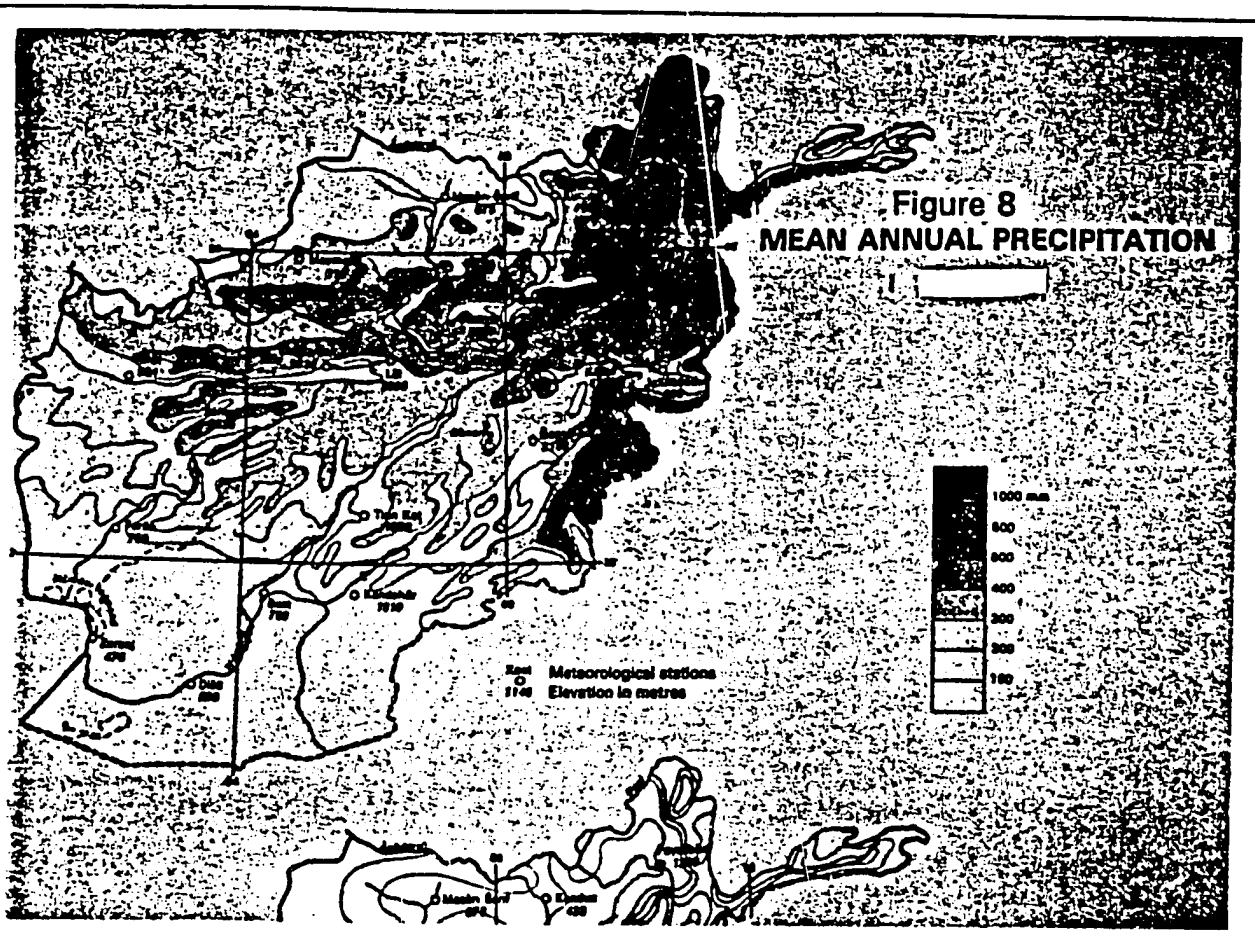
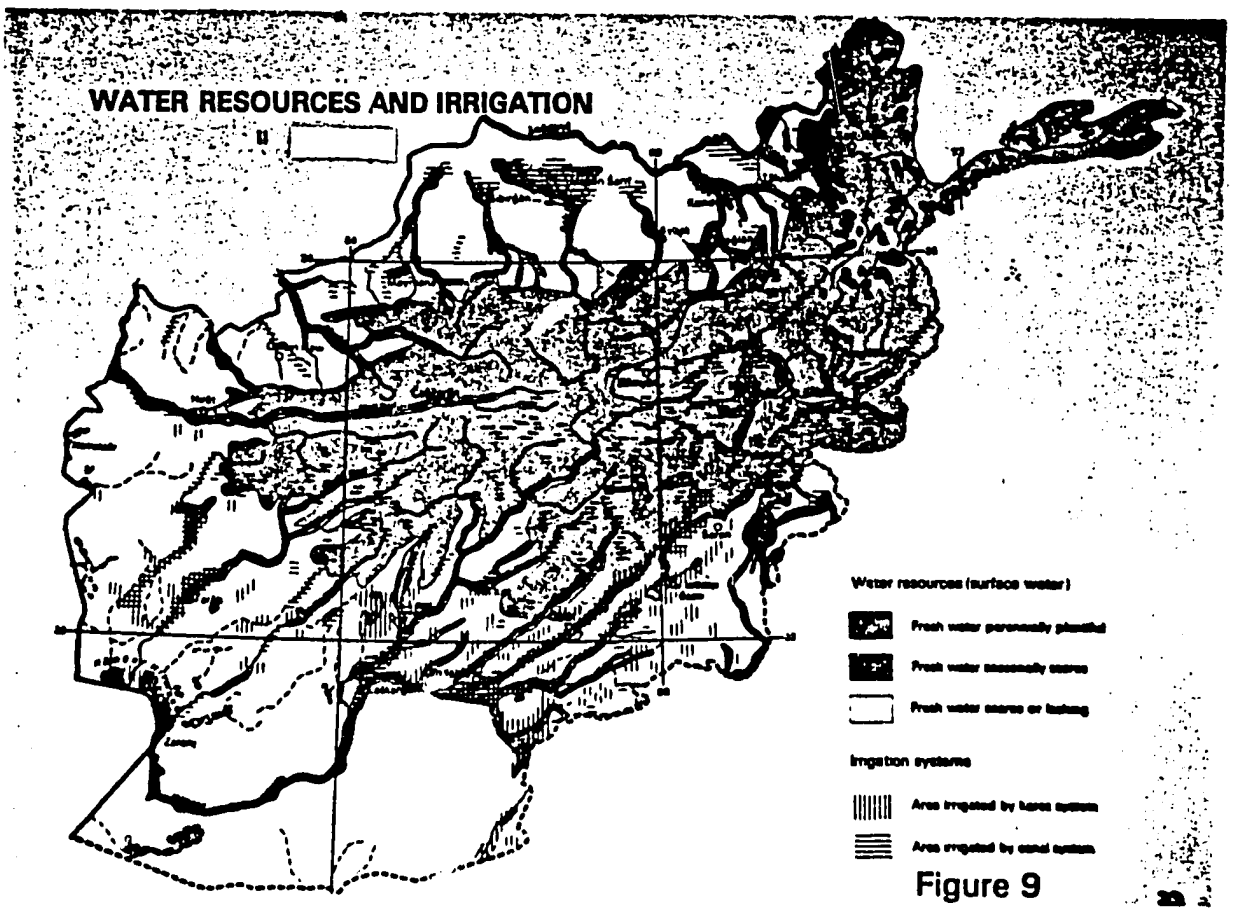
[2]Nathan-Berger Joint Venture, *Afghanistan Water Constraints Overview Analysis* (Final Report, Delivery Order No. 16, Afghanistan Studies Project, A.I.D. Contract No. 306-0205-C-00-9385-00, May 1992), p. 29.



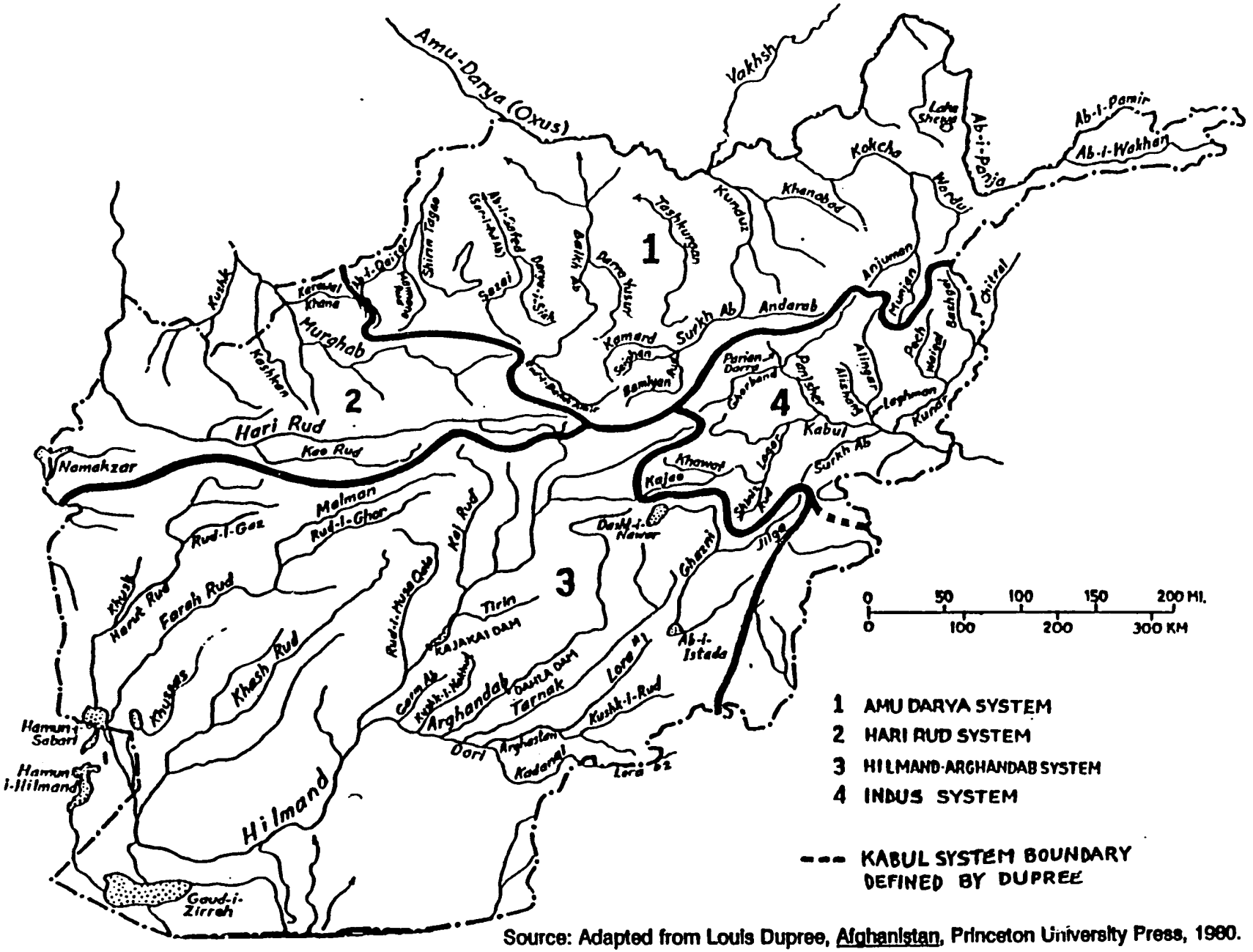
Source: National Atlas of the Democratic Republic of Afghanistan, Geokart, Warsaw.





Source: National Atlas of the Democratic Republic of Afghanistan, Geokart, Warsaw.

Figure 10. Principal River Drainage Systems



Source: Adapted from Louis Dupree, Afghanistan, Princeton University Press, 1980.

summer. The Kabul River and its tributaries, such as the Panjsher River, Logar River, and Kunar River, drain only 14 percent of the total area, but carry more than 30 percent of the total flow because of higher precipitation in the drainage region. After flowing through Kabul city, the Kabul River flows through Sorobi and Jalalabad and finally joins the Indus some 38 km northeast of Peshawar in Pakistan.

The Helmand and its tributaries drain approximately 40 percent of Afghanistan's land area, mainly the southern face of the Afghan highlands. The river rises in Koh-i-Baba range near Kabul and flows in a generally southwesterly direction until it reaches the Helmand region. The river then traverses the Dasht-i-Margo desert before ending in the marshes of Hamuni Helmand, around the Iranian city of Zabul. It is dammed in Kajakai in Afghanistan and diverted at Kohak in the Iranian territory. Its major tributary, the Arghandab River, rises in eastern Hazarajat, is dammed at Dahla, and reaches the Helmand at Qala Bist.

Table 2. Mean Annual Flow of Major Rivers (million m^3)

River System	Mean Annual Flow
Kabul[a]	23,100
Helmand[b]	6,000
Arghandab	1,870
Panj	4,230
Kokcha	5,480
Kunduz	2,210
Farah	1,200
Hari Rud	1,820
Balkh	1,840
Subtotal	47,750
Other flows	17,250
Total estimated flow	65,000

Note: No data on usable water resources are available. The figures on water flow cited in the table are based on inadequate hydrological records and rough estimates. For the total flow, see United Nations, *Water Use Statistics in the Long-Term Planning of Water Resources Development*, 1989, pp. 4 and 51.

[a]Measured near the Pakistan border.
[b]Measured at Kajakai.

Sources: *Agricultural and Rural Development Sector Report*, Vol. II, IBRD, 1975, Annex 3, p. 1. *Seven Year Economic Development Plan*, Government of Afghanistan, Ministry of Planning, 1976, pp. 144-170. *Konar River Basin Development Master Plan Report*, Electrowatt Engineering Services, 1977, p. 30.

The Amu Darya system dominates the north. Forming the principal boundary with the former Soviet Union, the river runs for approximately 1,100 km before it empties into the Aral Sea. More than 14 percent of the surface area of Afghanistan, mainly the northern face of the country's highlands, is drained by this system.

Before becoming Amu Darya, the river is known by the Afghans as Ab-i-Panja. It is called Amu Darya only when it is joined by the Kokcha River. At least 30 percent of the total flow of the Amu Darya is contributed by the portion of the basin inside Afghanistan. The Kokcha and Kunduz are the most important tributaries of Amu Darya.

In the west, the Hari Rud River of Herat and Murghab River of the Badghis province each turn north into the former Soviet Union and finally lose their characteristics as rivers in the Karakum desert. Before reaching the former Soviet Union, the Hari Rud becomes part of the Afghan-Iranian border north of Islam Qala.

Very little information on Afghanistan's underground water resources exists. In the past, the government implemented a number of hydrological projects in various parts of the country, but the information obtained has so far been inadequate to determine the size and location of Afghanistan's groundwater potential.

Based on the limited studies so far carried out, however, the groundwater potential in certain regions is believed to be significant. In the Kabul region, the resources with potential for urban use comprise four aquifers with a total estimated yield of 233,000 m^3 per day. As of 1978, only 13 percent of this potential had been utilized.

Ecology

Vegetation

According to the World Conservation Monitoring Centre (1988), evidence suggests that the natural vegetation of large parts of Afghanistan was originally woodlands and forest. The present rangelands have resulted from the cutting of wood by humans and grazing of domestic animals over millennia, indicating that trends in resource depletion started long ago (MacPherson and Anderson 1991).

The natural vegetation of Afghanistan is illustrated in Figure 11. A major part of Afghanistan is covered with rangelands used for pasture. Before the war, the total forest area of the country was estimated at 1.9 million ha. Table 3 presents Afghanistan's land resources in 1978-1979.

Table 3. Land Resources

Land Classification	1978-1979 Area (000 ha)	Percent
Arable Land	7,910	12.0
Forest		
Timber forest	1,200	1.8
Pistachio forest	200	0.4
Shrubby vegetation	500	0.8
Subtotal	1,900	3.0
Pasture		
Winter pasture	15,000	23.0
Summer pasture	25,000	38.0
Subtotal	40,000	61.0
Mountains and Desert	15,453	24.0
Total land area	65,263	100.0

Sources: *Statistical Yearbook, 1990-1991*, Ministry of Statistics, Government of Afghanistan, Sept. 1991, p. 103. *Afghanistan Land Ownership*, Nathan Associates, Aug. 1991. *Agricultural Sector Review Mission Report*, Rome: UNDP/FAO, 1985.

Forests

The timber forests are at altitudes of between 1,500 and 3,600 m, mainly in the southeastern region of the country. Timber forests capable of supporting commercial logging operations on a sustained basis were concentrated in Kunar and Paktia provinces, comprising approximately 400,000 ha each. These forests have supported stands of cedar, spruce, pine, and fir, which met most of the country's timber requirements.

The pistachio forests have been utilized for fruits and are situated in Badghis, Samanagan, and Faryab provinces. The shrubby vegetation is primarily xerophytic bushes and can be found in many regions of the country. At lower altitudes, shrubs and trees are hazel, ash, juniper, and evergreens; below the 900-m elevation, vegetation is primarily herbs and some shrubs. In 1978, the existing stock of timber in the coniferous forest regions was estimated at nearly 15 million m^3 and the volume of fuelwood at approximately 14 million m^3.

Afghanistan's limited forest resources have long been in danger of rapid extinction through wood overcutting by humans and domestic animals in a country with harsh climatic and adverse soil conditions. This process has led to timber and fuelwood scarcity and accelerating land degradation, accompanied by deteriorating climatic and ecological conditions.

In most regions, because of the absence of control over forest, the annual exploitation rate of forests was substantially above their annual growth rate. There was no forest law in force that covered the essential aspects of forest management. The annual felling rate was approximately 1 million m^3, while the annual production capacity was estimated to be about 100,000 m^3. The annual felling rate was about 1 million m^3, while the annual production capacity was estimated to be about 130,000 m^3.[3]

Because of the high rates of waste resulting from cutting wood, only 50 to 60 percent of the volume exploited annually was used. In Kunar and Paktia regions, wastage rates were estimated to be as high as 60 percent. Trees have been felled by crude axes and sometimes by burned holes through their trunks.

In Kunar province, the logs have been transported to the nearest river by hand skidding. After reaching the rivers, the logs were floated to Pakistan for sale, causing additional damage and deterioration. In Paktia province, logs have been transported to Kabul or Pakistani markets by camels and trucks. Usually, high-value butt logs have been left in the forest because they are too big to be moved by hand. The logs have been exposed to adverse weather conditions for years, considerably reducing their usable wood content. Forests have been administered on the basis of traditional laws by various tribal groups or communities with rights to exclude others.

As Hotte (1979) described in planning the management of the Diwagal Forest, the portion of the forest considered commercial was generally stagnant and overmature. In certain regions extensive damage had been caused by villagers attempting to clear land for agriculture. Illegal cuts of the best quality cedar trees had occurred, largely for structural timber and fence posts, and few young stands of conifers existed. There was little regeneration because of overgrazing.

Accelerated soil erosion was found to be quite advanced, with residual patches of cedar timber cut down by the local inhabitants in order to increase their agricultural regions and food production. The lack of vegetation to intercept rainfall during intense storms had resulted in gully erosion. Hotte concluded that in the steeper regions where dryland cultivation was taking place, eventual loss of the remaining topsoil would occur unless soil were stabilized with permanent vegetation. The trend of shifting cultivation spreading to commercial regions was considered to further aggravate erosion problems.

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[3]Ministry of Planning, First Seven Year Economic & Social Development Plan, March 1976-March 1983, Kabul, 1976, Vol. 1, p. 96; *Afghanistan—Journey to Economic Development, World Bank*, Washington, D.C., March 1987, Vol. 1, p. 65.

A study of fuelwood requirements conducted in Azad Kashmir, Pakistan, also demonstrates the demographic and economic underpinnings of the fuelwood crisis emerging in Afghanistan (Cernea 1981). The study concluded that in order to maintain the needed supply of fuelwood, far-reaching changes would be required—not only to relieve local, social pressures on existing forests but also to increase the productivity of forests.

Average yearly consumption of firewood per family was estimated at 2 to 4 tons a year. An assessment of the scale of reforestation needed in Azad Kashmir in order to provide an adequate fuelwood supply estimated yearly use of fuelwood at approximately 800,000 tons. With the best practices known, foresters can grow fuelwood trees yielding approximately 5 to 6 tons/ha each year. To produce 800,000 tons per year, therefore, the equivalent of 133,000 to 160,000 ha of fully planted and well-managed fuelwood plantations would be needed. Equally massive reforestation efforts are likely to be required in Afghanistan.

Grasslands

Pastures cover approximately 40 million ha or nearly 60 percent of Afghanistan's land area. There are basically two types of pastures: (1) winter pastures, which are usually below 1,000 m and are primarily in the north, west, and south and (2) summer and spring pastures, which are above 1,000 m, primarily in the central and northeastern regions of Afghanistan. Before the war, of the total grazing land, approximately 15 million ha of lowlands were used for winter grazing and 25 million ha on the mountains were available for spring and summer grazing.

The total feeding capacity of pastures has not yet been determined. In 1978-1979, an estimated 25 million animals grazed on this limited area. While deforestation is a dramatic environmental change that can be seen firsthand, deterioration of grasslands may be less readily apparent. In the extreme, loss of rangeland vegetation leads to desertification, defined as a process of sustained land (soil and vegetation) degradation in arid, semiarid, and dry subhumid regions, caused at least partly by humans. It reduces productive potential to an extent that can be neither readily reversed by removing the cause nor easily reclaimed without substantial investment.

But degradation can take place gradually, without the extreme stages of desertification being reached. This is happening in Afghanistan. Botanists studying the natural vegetation have found vast areas covered with indicators of overgrazing, including unpalatable plant species such as *Artemisia*, *Indigofera*, and *Hierochlos* (in Alpine meadows). Thorny species of *Acantholinum* and *Cousinia* have replaced valuable forages as a result of overgrazing and the uprooting of plants for fuel (Bradford 1990).

The annual migration in the spring and fall of numerous tribal groups always using the same route is characteristic of rural life both north and south of the Hindu Kush. Nomads moved long distances to exploit the spring and summer grazing land in Hindu Kush ranges and returned each winter to the eastern and southeastern lowlands of Afghanistan and the border region. These groups have always been in competition for the available grazing area.

Overgrazing is particularly apparent in the winter grazing regions and is worsened by the widespread custom of uprooting the remaining browse plants to fire the bread ovens. The transhumants, or seminomadic groups, were more restricted in their movement between winter and summer grazing regions than were nomads.

Before the war, the pastures were overgrazed, and in certain regions soil erosion created severe problems. However, because of the uncertainty of land tenure and the common ownership of the natural grassland, no serious attempts were made by the government to improve their productivity.

Wetlands

There are three types of wetlands in Afghanistan—river courses, lakes and marshes, and artificial lakes. Because most of Afghanistan is dry, the few wetlands that exist are of considerable importance.

Most river courses are liable to great seasonal variation in water level and are subject to intensive human use. Most unmanaged rivers are not particularly rich wildlife habitats, with the exception of the Amu Darya, which meanders through an extensive area of natural marsh and scrub (*Salix spp.*). In the past, the river valley ecosystems have supported forests and a variety of wildlife. However, the lack of soil along most contemporary river courses is a consequence of the erosion that follows removal of the vegetation by cutting and overgrazing. Natural conditions would have supported a rich fauna, including some large mammals that are now rare or extinct.

Many of Afghanistan's rivers have no outlet to the sea and drain into a series of depressions from which water is lost by evaporation. This results in the formation of large shallow saline lakes and marshes, the most extensive being those of the Seistan in the southwest. These biologically productive ecosystems are mineral-rich and are considered to be of international importance for migrating and wintering waterfowl. Hamun-i-Puzak, Ab-i-estada and Dashte Nawar are the three wetlands of outstanding importance as habitat for water birds.

Artificial bodies of water such as Qargha Lake, Sarobi Lake, and Darunta Lake are not as rich biologically as the wetlands mentioned previously. They do not support fish populations or fish-eating species of birds (MacPherson and Fernando 1991).

Fauna

According to the World Conservation Union (MacPherson and Fernando 1991), Afghan fauna is characterized by many animals adapted to arid steppe or mountain conditions. The large herds of wild asses (*Equus hemionus*) and gazelles (*Gazella spp.*), which until recently populated the rangelands, have been almost exterminated by hunting. Similarly, their predators, the cheetah (*Acinonyx jubatus*) and to a lesser degree the hyena (*Hyena hyena*), have declined. The forests and mountains harbored large numbers of wild goat (*Capra aegagrus*), urial (*Ovis orientalis*), ibex (*Capra ibex*), markhor (*Capra falconeri*), Bactrian deer (*Cervus elaphus bactrianus*), feral yak (*Bos grunniens [E]*), otter (*Lutra lutra*), marten (*Martes foina*), and long-tailed marmot (*Marmota candata*). These have also been significantly reduced by hunting and habitat degradation.

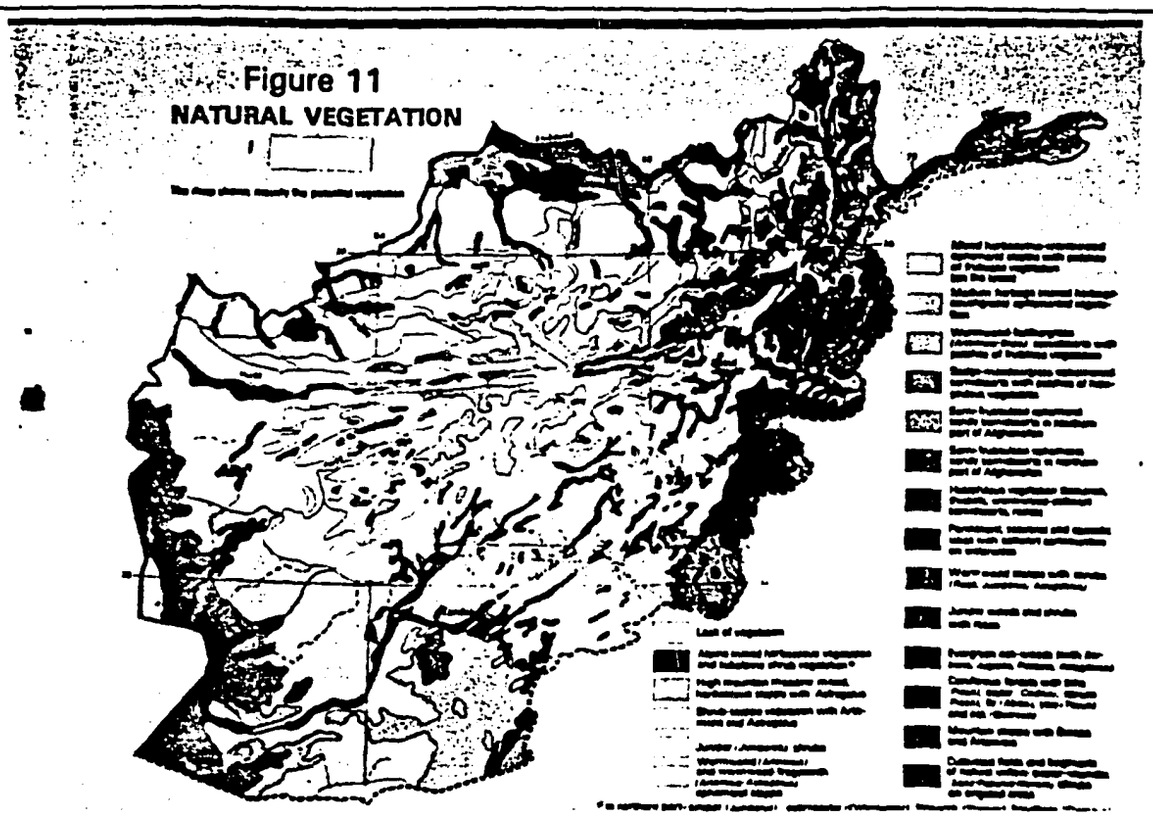
Predators, such as the Turanian tiger (*Panthera tigris virgata*), which is probably extinct in Afghanistan, snow leopard (*Panthera uncia*), leopard (*Panthera pardus*), wolf (*Canis lupis*), red fox (*Vulpes vulpes*), brown bear (*Ursus arctos*), ermine (*Mustela ermine*), and lynx (*Lynx lynx*), much sought after for their furs, are rarely seen. Only relatively protected or isolated areas such as the Pamirs with its Marco Polo sheep (*Ovis ammon polio*) have retained their faunas.

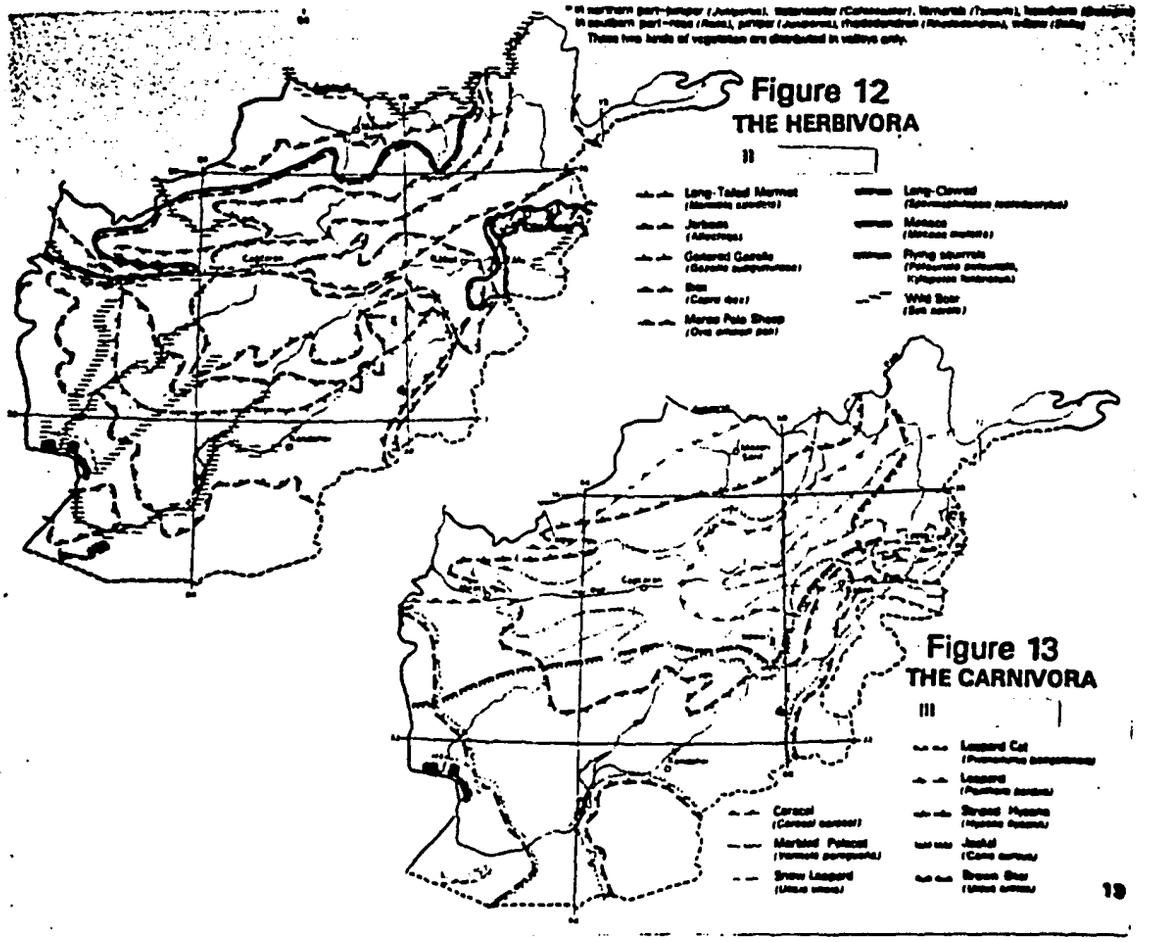
The natural ranges of some important herbivores and carnivores are depicted in Figures 12 and 13.

Numerous birds of prey exist, including hawks, falcons, and owls. Other birds include ducks, geese, larks, jays, rooks, crows, and pipits. Many varieties of smaller land and shore birds, including nightingales, are also found. There were 389 species of bird in Afghanistan, of which 231 were believed to breed in the country (MacPherson and Fernando 1991).

In the migration season huge numbers of birds migrate from Siberia through Afghanistan to the warmer Indian peninsula and Africa. During these seasons the wetlands throughout the country serve as essential resting places for the thousands of waders, ducks, and other waterfowl. The rare Siberian crane (*Grus leucogeranus*), the greater flamingo (*Pheonicopterus roseus*), and the falcon (*Falco cherrug*) are among these species. For these birds, the Afghan wetlands are an essential place for resting and feeding during their migrations and many overwinter there.

Among the reptiles of Afghanistan are lizards, large land turtles, and several kinds of poisonous snakes, including two species of cobra, neurotoxic krait, and many vipers, including Russell's viper. Most of these reptiles occur in the deserts and dry foothills. Frogs are also common.





Source: National Atlas of the Democratic Republic of Afghanistan, Geokart, Warsaw.

Fish and amphibians are scarce in such an arid country. Trout are found, however, in many mountain streams. The insect fauna is poor in diversity, but certain species of pests, such as the locust, can be numerous at times. Mosquitoes spread malaria, and other insects, including fleas, ticks, lice, and roaches, live parasitically in regions of human habitation.

Before the war, the livestock population was estimated at 22 million sheep and goats and 3.7 million cattle. Donkeys, horses, mules, and camels made up another 2 million.

Rare and Endangered Species

No information is available on the plant and animal species that were in immediate danger of extinction in 1979. The primary cause of plant and animal extinction in Afghanistan has been the gradual destruction of habitat. Drainage of marshes and lakes in both the south and north of the Hindu Kush and conversion of shrublands to grazing land and then to dry farming have gradually reduced available habitats.

Similarly, cutting and clearing of forests along with urbanization, construction of roads, and irrigation facilities have resulted in the fragmentation of habitat. Overhunting and increased use of chemicals and pest controls also have exerted some pressure on fauna.

A large number of game animals are hunted in many parts of Afghanistan. Among the game birds hunted are duck, partridge, quail, grouse, and pheasant. Small birds are also hunted in large numbers. Hunters of duck, geese, swans, and other migratory birds in east-central and southeastern valleys prowl the edges of lakes and marshes near villages and try to lure birds into shotgun range by using decoys. Hunters in the Helmand-Arghandab valleys also use decoys for hunting birds. Netting, mainly for fishing and bird hunting, was also popular in most regions.

Among the larger game hunted are various wild sheep and goats, including ibex and markhor, in the mountains; gazelle in the deserts; and snow leopards and bears. Hunters of larger game use both stalking and stand hunting techniques. Before the war, the best-known game animals for international sportsmen were the Marco Polo sheep and Siberian tiger, which occasionally penetrated the high Pamir mountains. There were no laws in Afghanistan to protect declining species. Thus, unregulated hunting in certain regions threatened the existence of some game birds and animals. The concept of establishing national parks, where wildlife would not be threatened, was considered in the 1970s.

Humans have strongly influenced the fauna, both directly by hunting and indirectly by altering its habitat, grazing livestock, burning practices, and

fuel collection. In addition, the prolonged war has taken its toll on more than the human population.

It is impossible to obtain an accurate estimate of current wildlife populations because access to important wildlife habitat areas is severely restricted by heavy fighting and mined areas. According to the World Conservation Union (MacPherson and Fernando 1991), all of the descriptive accounts of field and village project workers report few local sightings of wildlife species. Occasional wolf and fox sightings are mentioned, particularly in the mountains of the northeast.

Protected Areas

There is one national park, Bande Amir. Two waterfowl sanctuaries, Ab-i-Estada and Dashte Nawar, have been gazetted in response to petitions submitted to the Head of State (MacPherson and Fernando 1991). Afghanistan ratified the World Heritage Convention on March 20, 1979. Since the onset of war that same year, no further actions have been taken in the field of conservation and protected areas.

The Protected Areas Data Unit of the World Conservation Monitoring Centre at Cambridge published a draft report in 1988 containing the following candidate protected-area sites.

Ab-i-Estada Waterfowl Sanctuary. Located in the Hindu Kush highlands in the Ghazni province of southeast Afghanistan, Ab-i-Estada, together with Dashte-Nawar to the north, is a vital staging ground for migratory waterfowl and waders of the Siberian-Kazakhstan/Pakistan-India population (in particular, the rare Siberian crane *Grus leucogeranus*) as well as an essential breeding ground for the greater flamingo (*Phoenicopterus roseus*). The international importance of the two sites was recognized at the 1971 International Conference on Wetlands and Waterfowl, which adopted the Ramsar Convention. Ab-i-Estada is also an important archeological site exhibiting stratigraphic sequences. Several early dwelling mounds have been discovered with accompanying artifacts that suggest occupation from Palaeolithic to Buddhist times (Shank and Rodenberg 1977).

In addition to damage from the war, threats to the area come from extensive grazing by domestic stock and from irrigation projects that divert water, thereby decreasing water levels and increasing salinity. Egg collection, disturbance during breeding, and hunting throughout the year are other significant problems. In 1978, 70 Siberian cranes were estimated to be in the Indo-Soviet flock; only 17 are known to have survived to 1990. Siberian cranes have historically used Ab-i-Estada as a stopover rest site, but no scientists have visited the lake in the last decade to confirm whether this is still the case.

Ajar Valley Wildlife Reserve. This area in the Hindu Kush highlands northwest of Bamiyan was used as a hunting reserve by royalty after the turn of the century and protected as such since the early 1950s. Proposed as a national park by the FAO in 1978, the area contained the ibex (*Capra ibex*), Bactrian deer (*Cervus elephus bactrianus*), feral yak (*Bos grunniens* [E]), snow leopard (*Panthera uncia* [E]), leopard (*P. pardus* [V]), lynx (*Lynx lynx*), wolf (*Canis lupus* [V]), jackal (*C. aureus*), fox (*Vulpes vulpes*), otter (*Lutra lutra*), marten (*Martes foina*), and long-tailed marmot (*Marmota candata*). The avifauna is the most diverse recorded in the Hindu Kush, with 60 species identified. Ajar Valley is the largest tract of land in Afghanistan with a history of effective environmental protection (Shank and Rodenberg 1977).

Dashte-Nawar Waterfowl Sanctuary. In Ghazni province in southeast Afghanistan, Dashte-Nawar is an important breeding and feeding site for migratory waterfowl and waders, along with Ab-i-Estada. It is also an important archaeological site, exhibiting intact stratigraphic sequences. Several mounds representing early dwellings have been discovered with accompanying artifacts that suggest occupation from Palaeolithic to Buddhist times (Shank and Rodenberg 1977).

Pamir-Buzurg Wildlife Sanctuary. In the Western Wakhan corridor on the border with the former Soviet Union in Badakhshan province, the Afghan Pamirs are among the most spectacular landscapes of central Asia, providing habitat for the Marco Polo sheep (*Ovis ammon poli*) in addition to 17 other mammal species, including ibex (*Capra ibex*). Carnivores include the wolf (*Canis lupus*), red fox (*Vulpes vulpes*), brown bear (*Ursus arctos*), ermine (*Mustela ermina*), lynx (*Lynx lynx*), and snow leopard (*Panthera uncia* [E]).

The Afghan Pamir is one of history's greatest crossroads and migration routes for travelers. It contains valuable archaelogical sites, including petroglyphs that probably date to pre-Islamic times in the Wakhan Valley, in addition to the well-known sites in the Small Pamir.

Bande Amir National Park. In the Hazarajat mountains of the western Hindu Kush, Bamiyan province, the six lapis lazuli lakes of Bande Amir National Park are nestled between 300-m magenta rock walls in the Bande Amir Valley. The deep blue color is the result of the water's purity and high lime content. The area is reported to be one of the most beautiful landscapes in Afghanistan and has been a popular tourist attraction since the 1950s, with day tours operating from the Bamiyan. In 1978 it was reported that the area was becoming seriously degraded as a result of unlimited grazing, harvesting of reeds, and uprooting of shrubs.

Kole Hashmat Khan Waterfowl Sanctuary. On the southern outskirts of Kabul in Kabul province, Lake Hashmat had been used as a hunting ground since Moghul times. In the 1930s King Mohammed Zahir Shah declared it a waterfowl reserve. As of 1978 there were more than 30,000 migratory birds

using the lake and 157 species identified. The lake lies in the Hindu Kush flyway and was a major staging ground for western Siberian waterfowl. It is the only remaining water body and marsh area of the formerly expansive marshland of Kabul.

Before the war, the lake was threatened by pollution in the Logar River, grazing of domestic animals, cutting of reeds, indiscriminate shooting of birds, water diverted for irrigation, and laundering of clothes in the lake. Since 1979 the area has been restricted for security reasons, and management activities have not been sustained (MacPherson and Fernando 1991).

The high number of waterfowl available in the markets in Kabul would indicate that indiscriminate shooting of waterfowl from Lake Hashmat continues in 1991.

Population

Population Statistics

Demographic data for Afghanistan are very limited. No population census was undertaken before the war, and available population estimates were location-specific and subject to a wide margin of error. Most of the surveys conducted in the 1960s and early 1970s contained problems of inaccurate reporting because of social and cultural constraints. As a result, population estimates were crude and in the mid-1970s ranged from as low as 12 million to as high as 19 million.

An extensive and scientific demographic survey was undertaken by the government in 1972-1973 with assistance from A.I.D. However, the Afghan Demographic Survey (ADS) was not approved by the government and was believed to have underestimated the population by 5 to 10 percent. The method and theoretical basis for estimating national level parameters were also the subject of serious criticism. A number of agencies, including the World Bank, U.S. Bureau of Census, and International Labor Organization, later adjusted and refined some aspects of the ADS work to compensate for underestimation and inconsistencies.

The program for a population census in September 1978 was launched by the government in early 1976 with assistance from the United Nations, and until March 1977 population mapping and prelisting had been completed in 68 major civil divisions. In the meantime, the Ministry of the Interior completed the civil registration for the settled male population. Although the census was implemented by the communist government in 1979, its results should be viewed with caution as it was executed during a time of unrest in many parts of the country.

Population Composition, Distribution, and Growth Rate

Within the range of accuracy indicated, Afghanistan's population in 1978-1979 was estimated at 14.6 million. Population densities are illustrated in Figure 14. Approximately 1.5 million were thought to be nomads, and the remaining 13.1 million were settled. The population growth rate was moderate, approximately 2.2 percent per year. The settled population comprised 6.8 million men and 6.3 million women. This distribution probably changed very little during the 1970s. By 1978-1979, the urban population had risen to more than 20 percent, indicating a slow drift to the towns. Compared with neighboring countries, however, this rate of urbanization was modest indeed. Of the total urban population, more than 42 percent resided in Kabul itself. Table 4 summarizes data on population and growth rates.

Table 4. Population and Rate of Growth, 1972-1973 to 1978-1979

	1972-1973 (millions)	1978-1979 (millions)	Average Annual Growth Rate (percent)
Settled	11.46	13.06	2.21
Urban	1.77	2.13	3.10
Rural	9.69	10.93	2.00
Male	5.95	6.79	2.69
Female	5.51	6.27	2.62
Nomads	1.38	1.55	2.00

Source: Population figures for 1978-1979 were projected from World Bank estimates of population for 1972-1973 to 1976-1977, using growth rates from the World Bank report. For World Bank estimates, see *Afghanistan: The Journey to Economic Development*, Vol. II, World Bank, March 1978.

Approximately 84 percent of the settled population was rural and widely dispersed, with approximately half of the total population living in the eastern region, one-quarter in the north, and the remainder almost evenly distributed between the southern and western regions.

In 1978-1979, almost half of Afghanistan's population was younger than 15 years of age. Those aged 14 years or less totaled 45 percent of the total population. The age distribution of the Afghan population is shown in the following table.

Age Structure	*Total Population (million)*	*Percentage of Total*
0-14	6.648	45.5
15-64	7.480	51.2
64+	0.482	3.3

Afghanistan's population growth rate was expected to increase significantly in coming years for a number of reasons. The main reason was that the population was young; more than 16 percent of the population was younger than 5 and almost 50 percent younger than 15. Other reasons included high birth and fertility rates and low levels of knowledge and practice in family planning. Only approximately 13 percent of the total population was literate and only 3 to 4 percent of women could read.

The crude birth rate was estimated at 51 per thousand, and the fertility rate was 8 per women. The population would also grow at a fast rate if the mortality rate were reduced by expanded public health measures.

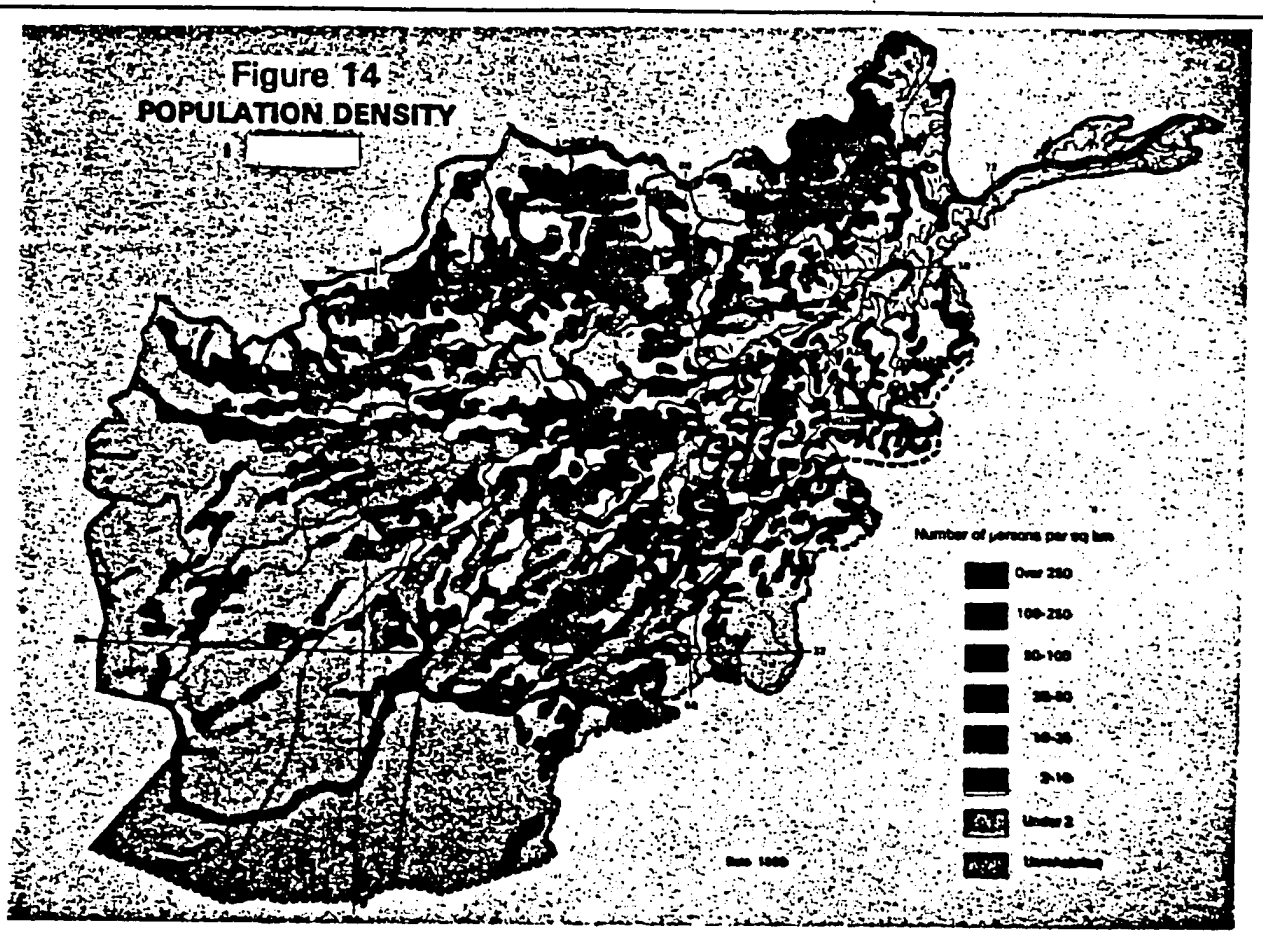
The mortality rate was high nationwide, regardless of age and sex. The crude death rate was estimated to be between 28 and 32 per thousand, with life expectancies of 34 years for men and 36 years for women. Adjusted ADS data indicated an infant mortality rate of 269 per thousand; approximately one-fourth of all children born died before reaching the age of one year.

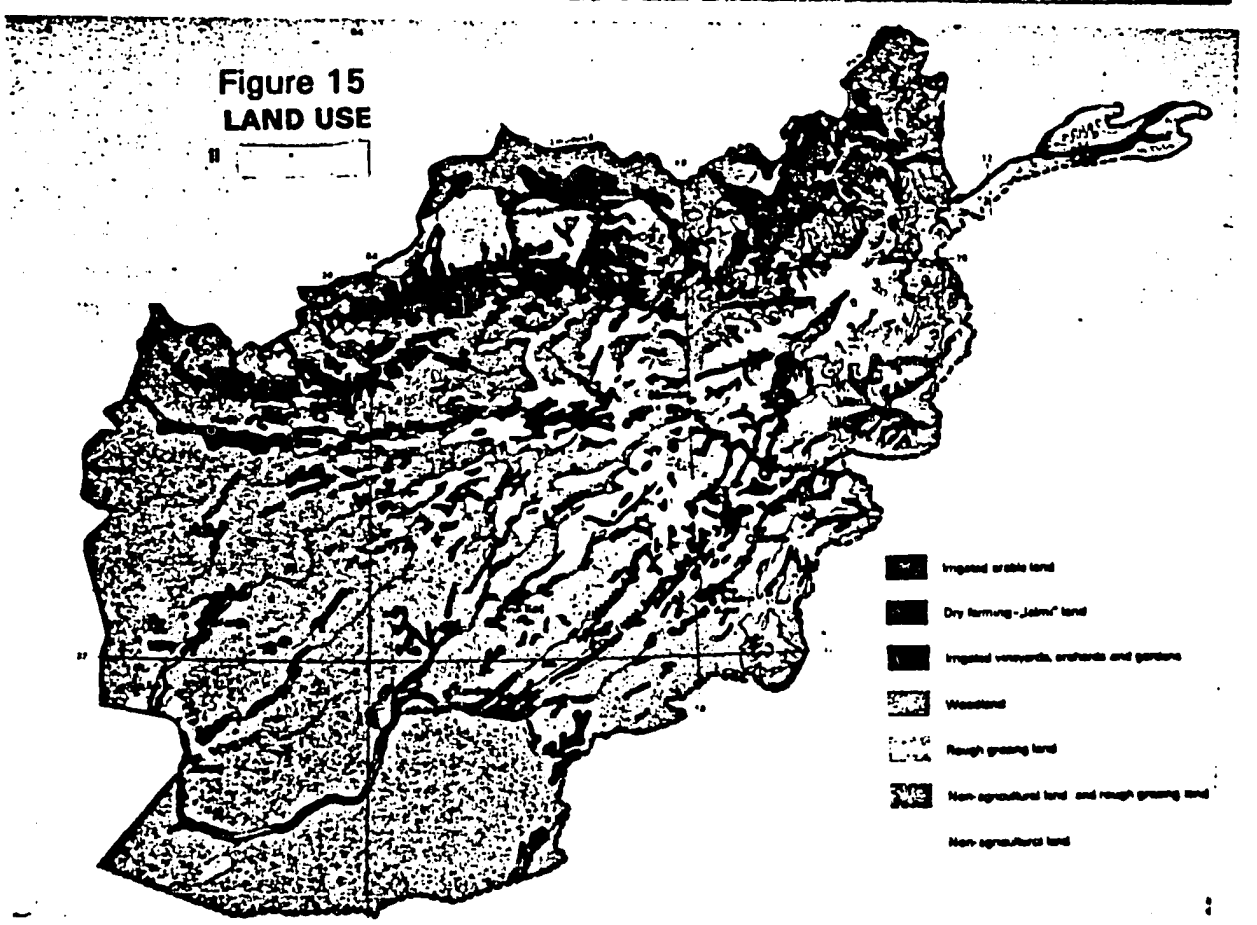
The population of working age (15 to 64 years of age) was estimated at 7.2 million during 1976-1977, including nomads; the settled working age population numbered only 6.4 million, of which 53 percent were men and 47 percent women. Total labor force was estimated at 4.7 million during the same period, including 0.4 million women. Approximately 71 percent of the labor force participated in agriculture and handicrafts. Of the remainder, 22 percent was employed in services of various kinds, including commerce, only 1 percent in manufacturing, and the remaining 3 percent in other sectors. Only 3 percent of the labor force was unemployed.

Ethnic and Religious Breakdown and Composition

Ethnic diversity is characteristic of Afghanistan. The main ethnic groups have consisted of Pushtuns, Tajiks, Hazaras, Turkomans, Baluchs, and Nuristanis. Quantitative systematic data available on the composition and size of these groups have been very limited. For the purposes of this report, the data in Table 5 on the ethnic composition of the country's population were derived using the most recent sources available. The distribution of the main ethnic groups is illustrated in Figure 16 and that of the spoken languages in Figure 17.

In Afghanistan, religion and ethnicity have been deeply interconnected. The mix of ethnic and religious traditions in the country has intensified intercommunal conflicts, particularly when the parties involved also differ in their religious traditions. Islam, the religion of most of the population, is divided into two major groups: the Sunni and the Shi'a.





Source: National Atlas of the Democratic Republic of Afghanistan, Geokart, Warsaw.

Table 5. Ethnic Composition of the Population of Afghanistan, 1978-1979

Ethnic Group[a]	Population (thousands)[b]	Percentage of Total[c]
Pushtun	7,000	48.0
Tajik	3,800	26.0
Uzbek	1,170	8.0
Hazara	1,020	7.0
Turkoman	150	1.0
Nuristani	140	1.0
Baluch	140	1.0
Others	1,180	8.0
Total	14,600	100.0

[a]According to the *World Almanac and Book of Facts (1992)*, p. 734, Pushtuns constitute 50 percent of Afghanistan's population, Tajiks 25 percent, and Uzbeks and Hazaras 9 percent each.
Sources: *Afghanistan: The Northern Provinces*, The Orkand Corporation, Maryland, April 1988, pp. 1-50. L. Dupree, *Afghanistan* (1980 ed.), Princeton University Press, 1980.

The Pushtuns have dominated the country in the southeastern and southwestern regions, extending up to the central region. Large communities of Pushtuns also lived in the northern region, mainly in Baghlan, Kunduz, Balkh, and Faryab provinces. They are a confederation of tribes and probably have the strongest tribal identity of all Afghan ethnic groups. Virtually all Pushtuns are Hanafi Sunnis and speak their own language, Pushtu.

Most of the general population of northern Afghanistan is Dari-speaking Tajiks—particularly in the provinces east of Mazar-e-Sharif, mainly Takhar and Badakhshan. They are both urban and rural dwellers but do not function as a tribe. Most Tajiks are Hanafi Sunnis, but a substantial portion of the Pamir and Wakhan Tajiks in the Badakhshan province are Isma'iliya Shi'a.

Uzbeks are concentrated in Faryab, Jowzjan, and Balkh provinces. They can also be found in sizable numbers in Samangan, Kunduz, Baghlan, and Takhar provinces. Uzbeks are at present sedentary agriculturalists and are invariably Sunnis of the Hanafi school. They speak their own language, Uzbeki.

The Hazaras have been based primarily in the central mountains of Afghanistan, known as Hazarajat, but sizable communities of Hazaras also live

in many parts of the country. They are not, as popularly believed, descendants of Genghis Khan's army. Most Hazaras are Shi'as of the Imami subsect. Others are Isma'iliya Shi'as, while a few are Sunnis of the Hanafi school.

Most Turkomans came to Afghanistan in the early 1920s, following the *basmachi* revolts against the communists in the Soviet Union. Since then, they have resided in Badghis, Faryab, Jowzjan, and Balkh provinces. Almost all Turkomans are Sunnis and speak their own language. Turkomans are still tribally organized and largely pastoralists. Other major ethnic groups include the Baluch and Nuristanis. Most Baluch are now semisedentary and live in Farah and Nimruz provinces; some live in northwest Afghanistan; others travel from Sistan to Herat in summer and return to Sistan in winter. Most Baluch are Sunnis. The Nuristanis have been limited to the Kunar province. They refer to themselves according to the valleys in which they live. The Nuristanis were converted to Islam by Amir Abdur Rahman in the 1880s. At present, most Nuristanis are Sunnis of the Hanafi sect.

Approximately 85 percent of the population are Sunnis and represent the principal branch of Islam. This percentage has not changed in recent years. The Hanafi school of jurisprudence is the most common of the four subsects.

In Afghanistan, the Shi'a tradition has comprised two major subsects: Imami, or the twelvers, and the Isma'iliya. Most of the Imami Shi'as in Afghanistan live near the Iranian border and urban regions such as Kabul, Kandahar, and Herat, where the majority of Qizilbash live. The Hazaras are the largest Shi'a group and have important links with Iran. However, large numbers of Hazaras, particularly in regions adjacent to the northern region, are Isma'iliya Shi'as. Most Isma'iliya Shi'as live in the valleys of the northeast, mainly in Badakhshan province. Other religious groups include Hindus and Sikhs, who are scattered in urban regions of Afghanistan, mainly in Kabul, Jalalabad, and Kandahar, as merchants and money lenders. They speak either Pushtu or Dari, and most are Afghan citizens and perform their ceremonies without undue interference.

Socioeconomics

Income and Income Distribution

Income levels in Afghanistan were extremely low even before the war. The per capita income estimates varied from US$150 to US$180. In view of this situation, only a small part of the country's population was able to meet its basic needs adequately. The problem was indeed very serious for the poorest segments of the society.

The World Bank, in 1976-1977, estimated the absolute level of poverty for the country as a whole at US$85. Similarly, the ILO estimated the absolute poverty level for the rural population at Af 2,600 (US$52) and for the urban population at Af 3,460 (US$70). Those who were below this level lived in absolute poverty. According to these estimates, between 30 and 40 percent of Afghanistan's population lived in absolute poverty.

Both studies revealed that the problem of poverty was more acute in rural regions. According to the survey of 12 villages in 7 provinces conducted in 1970, between 11 and 60 percent of the population of these villages lived in absolute poverty. In urban regions, the percentage of the population below the poverty threshold varied from 15 percent in Lashkar Gah to 30 percent in Jalalabad. Table 6 presents data on per capita income and absolute poverty level derived from the survey of 12 villages in 7 provinces.

Table 6. Annual Per Capita Income, Absolute Poverty Level, and Concentration Ratios

Province	Income per Capita (Af)	Percentage of Population in Absolute Poverty	Concentration Ratio
Kunduz	4,508	21	0.42
Baghlan	6,670	11	0.28
Kandahar	5,631	25	0.37
Nangarhar	2,041	60	0.31
Laghman	2,671	47	0.31
Parwan	2,653	48	0.37
Ghazni	2,514	59	0.31

Notes: Information is based on a survey of 12 villages in 7 provinces conducted by the Ministry of Planning in 1970 and assumes a 1969-1970 absolute poverty level of Af 2,907, calculated by the World Bank. Results were calculated from data on income distribution in sampled areas.

Sources: *Afghanistan: The Journey to Economic Development*, Vol. I, World Bank, 1978, p. 51. Ministry of Planning, survey of progress, 1970-1971.

The data on income distribution are limited and only some tentative and broad conclusions can be drawn. The first impression that emerges is that income distribution was somewhat skewed. The data on income distribution in Kabul City showed that the bottom 20 percent of the sampled population earned only 4.3 percent of the income, while the top 4.6 percent earned as much as 42 percent of the income. This was mainly due to the relatively high level of remunerations for the top managerial, administrative, and professional staff in both the government and private sectors, as well as the high level of business and entrepreneurial incomes.

These limited surveys indicated that income in the rural regions appears to be more evenly distributed than in urban regions. Based on the survey of 12 villages in 7 provinces conducted in 1970, the bottom 50 percent

of households earned between 15 and 25 percent of the income, whereas the top 10 percent earned 30 to 40 percent.

The concentration ratios (Gini coefficients) calculated from the same data also indicated a relatively equal distribution of income in the rural regions. These ratios varied from 0.28 in Baghlan to 0.42 in Kunduz. The higher the value of the Gini coefficient, the more unequal are incomes in the regions under consideration. Data on income distribution in Kabul give a concentration ratio of 0.56, representing a relatively higher income concentration.

In rural regions of Afghanistan, income differentials and poverty are usually associated with differences in ownership of irrigated land. In Nangarhar province, per capita irrigated land equivalent was estimated at 0.2 ha with approximately 60 percent of the rural population in absolute poverty. In contrast, per capita irrigated land in Kunduz province was 0.5 ha, with 21 percent of the population living in poverty.

Economic Activities

The net domestic product (NDP) for 1978-1979 was estimated at Af 110.445 billion and total labor force at 4.77 million. The low level of incomes reflected the pattern of economic activity in the country. The majority of the rural labor force was involved in subsistence agriculture and the majority of the urban labor force was involved either in services or in traditional types of small-scale commodity production. Table 7 presents the percentage distribution of net domestic product by economic sectors and the labor force.

Table 7. Net Domestic Product and Labor Force, 1978-1979 (percent)

	Percentage of NDP	Percentage of Labor Force[a]
Agriculture	56.0	53.0
Handicrafts	7.7	18.0
Industry and mining	5.3	1.0
Construction	3.9	1.0
Transportation and communications	3.2	1.2
Trade and commerce	8.8	5.5
Services	8.4	14.7
Other	6.7	5.6
Total	100.0	100.0

[a]It is assumed that between 1976-1977 and 1978-1979, the distribution of the labor force by economic sector basically remained unchanged.
Source: *Macroeconomic Data Development: Phase II*, Vol. 2, Appendixes, Nathan Associates Inc., Table A11-2, 1991. For data on labor force structure, see *Afghanistan: The Journey to Economic Development*, Vol. II, World Bank, March 1978, Table 1-4.

As indicated by Table 7, agriculture was the predominant economic activity. Approximately 53 percent of the labor force was engaged in agriculture, which generated 56 percent of NDP. Output per worker was low, approximately Af 24,740, largely because of traditional farming systems and lack of needed capital. Approximately 30 to 40 percent of land was farmed by landless sharecroppers who constituted a significant part of rural poor.

Handicrafts played a major role in Afghanistan's economy, contributing approximately 8 percent of NDP and providing employment to approximately 18 percent of the total active population. The relative share of handicrafts in both the NDP and employment was significantly larger than that of the modern industries and mining.

The industrial and mining subsector remained small. Before the war, the industrial sector contributed 5.3 percent of NDP and employed only 1.0 percent of labor force. Output per worker in the public and private industries combined amounted to Af 107,700. Despite the considerable amount of investment in public enterprises, the share of these enterprises in industrial value added and employment was very low. Another characteristic of industrial activities was the high degree of concentration in Kabul and a few urban regions in the north. Of the total economically active population, approximately 8 percent were employed in the services sector, which generated 31 percent of NDP. Given the small industrial base of the country, the major portion of employment in commerce and services was in small establishments.

Total employment in the public sector was estimated at 153,000, of which 43,000 were in the central government, 68,000 in the local government, and 42,000 in government enterprises.

Agriculture

Before the war, the agricultural sector contributed approximately 56 percent of NDP and provided livelihoods to approximately 80 percent of the population. However, agriculture was largely subsistence, with food grains occupying approximately 88 percent of total cultivated land. The extent of irrigated and dry farming land is shown in Figure 15 on page 45. Area under the major crops is presented in Table 8.

Wheat was the dominant crop, accounting for 80 percent of rainfed land and approximately 50 percent of irrigated land. It was grown in all provinces, represented 40 percent of consumers' expenditure for food, and accounted for 64 percent of annual cereal production.

Table 8. Area Under Major Crops, 1978-1979 (000 ha)

	Irrigated	Rainfed	Total
Foodgrains			
Wheat	1,300	1,048	2,348
Maize	482	-	482
Rice	210	-	210
Barley	100	210	310
Other foodgrains	42	-	42
Fruits and Vegetables			
Fruits	141	-	141
Vegetables	94	-	94
Industrial Crops			
Cotton	112		
Sugar beet	5	-	5
Sugarcane	4	-	4
Oilseeds	14	36	50
Other crops	75	-	75
Total	2,579	1,294	3,873

Sources: Nathan Associates, *Macroeconomic Data Development: Phase II*, Volume II, Table A II-10, September 1991. Government of Afghanistan Ministry of Planning and Central Statistics Office.

Irrigated wheat, with an average yield of 1,735 kg/ha, represented 80 percent of total wheat production; rainfed wheat, with an average yield of 500 kg/ha, constituted only 20 percent. Total production was estimated at 2.8 million tons, with an average yield of 1,200 kg/ha. In years of good harvest, this level of production was sufficient to cover nearly all domestic needs. According to official statistics, the northern and northeastern regions produced approximately half of the total wheat crop.

Maize was the second most important grain, but occupied only 12 percent of the cultivated area. In 1978-1979, total area under maize was 482,000 ha, with yields around 1,618 kg/ha. It was grown almost entirely on irrigation land and was used both as a human food and as animal feed. It was grown in many parts of the country, especially in the east-central region. Total production amounted to 780,000 tons.

Barley was used as animal feed. The area planted with barley was reported at 310,000 ha and yields at 1,048 kg/ha. The average yield was reduced because of the inclusion of rainfed production, much of it in highlands with short growing seasons. Total production was estimated at 325,000 tons in 1978-1979.

Rice occupied approximately 210,000 ha, with average yields of approximately 2,038 kg/ha. It was grown principally in the provinces of

Baghlan and Kunduz, in the northeastern part of the country. Other major rice-growing provinces include Nangarhar and Laghman in the southeast and Herat in the western region.

Before the war, cotton was a major cash crop and foreign exchange earner. Cotton production was estimated at 132,000 tons on 112,000 ha of irrigated land, giving average yields of 1,179 kg/ha. Almost 60 percent of cotton was produced in the northern and northeastern regions. Approximately 16 percent was produced in the western region, mainly in Herat province, and the remaining 24 percent was produced in the south, mainly in the Helmand Valley.

Sugar beet production was entirely restricted to Baghlan province, the site of Afghanistan's only sugar factory. During 1978-1979, the total production of sugar beet on 5,000 ha of irrigated land yielded approximately 73,000 tons. Sugarcane is restricted to Nangarhar province, where the climate is suitable for its cultivation. Before the war, approximately 64,000 tons of sugarcane was produced on 4,000 ha of irrigated land, mainly for home consumption.

Oilseeds, mainly linseed and sesame, occupied 14,000 ha of irrigated land and 36,000 ha of rainfed land. Production was estimated at 35,000 tons. Oilseeds were exported in unprocessed form as the existing oil extractor facilities were not equipped to process them. A major part of linseed production came from Farah and Badghis provinces. Agricultural experiments showed that sunflower was a relatively easy crop to grow in Afghanistan.

Vegetables were grown throughout most of Afghanistan at different seasons. The most important vegetables are onions, potatoes, tomatoes, lettuce, carrots, and beans, which are grown largely in Kabul, Parwan, Jalalabad, Kandahar, Herat, Wardak, and Bamiyan provinces. Production was estimated at 766,600 tons on 94,000 ha of irrigated land, with potatoes accounting for 20 percent of total area and 32 percent of production.

Fruits, accounting for 10 percent of total cultivated land, are grown in most irrigated regions, particularly in Kandahar, Parwan, Kabul, Jalalabad, and Mazar-i-Sharif. Before the war, grapes, the principal commercial fruit, represented 30 percent of total fruit production and 50 percent of total area. Other major fruits included mulberry, pomegranates, peaches, apples, cherries, and apricots. Citrus fruits and olives were grown in Nangarhar province. Nut trees include pistachio, walnut, and almond.

Even though fodder crops such as clover and alfalfa have not been covered in national agricultural statistics, they are grown in many parts of the country, mainly in those regions with sufficient water for irrigation. It was generally estimated that they occupied approximately 60,000 ha. No information has been available on their production. They were grown in irrigated meadows and as part of the rotation with cereals.

Afghanistan's rural population included approximately 1.2 million farm families with holdings averaging approximately 3.5 ha. Cultivation was mostly by animals, and mechanized farming was limited. The farmers were experienced and hard working and performed exceedingly well for themselves, within the limits of resources and technology available to them.

Before the war, approximately 3.9 million ha of land were cultivated annually, of which 2.6 million ha were irrigated and 1.3 million ha rainfed. However, because of a lack of appropriate irrigation facilities, less than 1.4 million ha received adequate water throughout the year. Although rainfed land occupied one-third of the area cultivated, its contribution to total crop production was less than 20 percent because of insufficient moisture, poor land preparation, poor soils, and lack of nutrients.

Public Health

Public health services available to the people of Afghanistan before the war were inadequate, and the gap between rural and urban services was extremely wide. The infant mortality rate, estimated at 269 for every thousand, was the highest in the world, and the incidence of malnutrition and endemic diseases was high. The maternal mortality rate was reported to be 100 for every thousand births, almost 4.5 times higher than that of other developing countries. However, the increasing use of modern public health facilities and services by the masses had been a positive phenomenon. Eight times as many people used public health services and facilities in 1977 as in 1968.

General Pattern of Diseases

The disease and illness pattern was, to a very large extent, the result of the ecological environment and poor personal and communal hygiene. Deep-rooted cultural and behavioral factors, in addition to the objective factors, also added to the complexity of the situation of proper nutrition and personal hygiene. A detailed socioeconomic survey of 1,800 villagers in northern Afghanistan during 1972-1973 revealed the pattern of illnesses shown in Table 9.

Table 9. Major Diseases, 1972-1973
(percent)

	Winter	Summer
Respiratory illness	25.5	20.6
Digestive illness	19.1	26.1
Skin disease	6.6	7.8
Eye disease	-	4.4
Locomotor system	10.6	5.1
Nutrition related	14.6	15.5
Reproductive related	9.6	10.9
Circulatory	2.9	1.6
Other	9.2	8.5
Total	100.0	100.0

Note: Dashes indicate information that is not available.

Sources: CINAM, *Services for Children within Regional Development Zones—Research and Action, Experimental Activities at the Village Level,* Vol. II, Monographs, UNICEF, Kabul, 1973.

Evidence suggests that this pattern had not changed drastically by 1978-1979. This study and similar studies indicate that 50 percent of the total cases are respiratory and digestive illnesses. Approximately 15 percent of the population surveyed displayed signs of nutritional deficiencies.

Diarrheal diseases appeared to constitute one of the main causes of child morbidity and an underlying cause of malnutrition. Dysentery and typhoid were also extremely common illnesses. According to an epidemiological survey of four villages in the early 1970s, approximately 32 percent of the population was affected by different forms of ascariasis. In the majority of cases, the digestive system illnesses were caused by contaminated water. Another major contributing factor was the generally poor standards of health education.

Tuberculosis was reported to be widespread in Afghanistan, and the appropriate support in the form of trained manpower and equipment for treatment was inadequate. The four village surveys referred to earlier suggested that nearly 50 percent of the population showed a positive reaction to the antigens. Other major respiratory illnesses were colds, coughs, and pneumonia.

The incidence of eye disease leading to blindness, primarily trachoma and Vitamin A deficiencies in children and cataract in adults, was also known to be high. Approximately 20 to 25 percent of children under 10 years of age were reported to be suffering from trachoma. Leprosy was a major health problem, mainly in Bamiyan province.

Malaria was a major health hazard for about one-quarter of the population. Greater population movement between regions of low and high malaria incidence also contributed to the spread of illness. Malaria incidence was high in Kunduz and Takhar provinces in the north, the lowland region stretching from Nangarhar in the east to Farah in the west, and the foothill regions of the Hindu Kush. Rice-growing farmers in these regions were particularly exposed to infection. The lack of maintenance of irrigation canals and drainage systems in certain regions also contributed to the malaria problem.

Health Infrastructure and Services

In 1978-1979, public health infrastructure and services were underdeveloped in Afghanistan, particularly in rural regions. The traditional approaches to health care—usually services at the family, village, and bazaar level—were still deeply rooted in the social and cultural environment. According to a survey in Parwan province during 1976, about 4.6 percent of household income was spent on health, of which almost 30 percent was spent on traditional cure. It usually involved medical practitioners, holy people, herbalists, *dais* (midwives), bloodletters, and the *mullah*.

The formal system, comprising 56 hospitals, 147 basic health centers, and 76 subhealth centers, provided health services to about 25 percent of the population. Table 10 presents indicators of public health.

Table 10. Indicators of Public Health, 1978-1979

Indicator	Number
Facilities	
Hospitals[a]	56
Beds	2,401
Population per bed	6,080
Basic Health Centers	147
Personnel	
Doctors[a]	906
Population per doctor	16,114
Health staff	2,859
Program Coverage	
Malaria (million)	7.5
Immunization (million)[b]	0.9
of which:	
TB (million)	0.7
Basic Health Centers (million)	2.6
Hospitals (inpatients)	0.1

[a]Excludes military hospitals and doctors.
[b]Diphtheria, polio, tetanus, BHC, etc.

Source: Government of Afghanistan, Ministry of Planning and Central Statistics Office.

The distribution of health facilities and personnel was skewed in favor of urban centers. During 1978-1979 approximately 1,167 of the nation's hospital beds, or 57 percent, were in Kabul and the remainder were all allocated at the provincial centers. Similarly, nearly 530 (58 percent) of the 906 doctors operating under the Ministry of Public Health practiced in Kabul.

All medical facilities were run by the government and a few nongovernmental organizations (NGO). All levels of health facilities suffered from the absence or inadequacy of a water supply, latrines, and electricity. Hospitals provided both inpatient and outpatient services. Because of the heavy concentration of health facilities and personnel in urban regions, the majority of hospital users were also the urban population. The distribution of those who used hospitals' inpatient services was also biased. Males accounted for 73 percent of all inpatients in Kabul and 79 percent in provinces, whereas women accounted for 27 percent and 21 percent of all inpatients, respectively.

Hospitals based in Kabul and in provincial capitals offered a wide range of medical services and more qualified health care personnel. A lack of materials and equipment, however, limited the quality of care. Even in Kabul, hospital hygiene did not equal international standards. With the exception of some charges for private rooms and laboratory tests, hospital services were free.

Before the war, there were 147 basic health centers, each covering approximately 1,800 people within a catchment area of approximately 6 km^2. The basic health center was a multipurpose health facility supplying both preventive and curative medical services at the local level. It provided no inpatient services. However, use of basic health centers was limited by a scattered population and inadequate transport facilities; only 6 percent of the total settled population visited a basic health center in 1979. While all basic health centers had doctors, the supply of other staff, such as laboratory technicians, vaccinators, midwives, nurses, and sanitarians, was inadequate. Another serious problem related to the supply of medicines. By 1978-1979 approximately 76 subhealth centers were in place, but were not fully operational because of a lack of personnel and medicines.

Mother and child health care services were available at 27 clinics and hospitals in Kabul and some provincial towns that assisted the mother at childbirth, immunized the child, and provided nutrition supplements under the WFP program. Family guidance services were offered through the Afghan Family Guidance Association. It maintained a network of 40 clinics in Kabul and all provinces. The demand for birth control was strong. From 1972-1973 to 1978-1979, the number of visiting contraceptive acceptors rose from 33,000 to 104,000.

Before the war, a strong malaria control program had managed to significantly reduce the incidence of malaria. The program that was implemented by the Malaria Institute covered eradication and control through

the spraying of breeding areas, the release of larva-eating fish in rice fields, and the distribution of tablets. The population covered under the program in six regions was reported to be 7.5 million.

A major tuberculosis program was also under implementation during 1977-1978. Most patients were treated on outpatient basis, which was cost-effective and reliable. In more developed cases, however, the patients were to be hospitalized. A tuberculosis hospital with 110 beds was completed with assistance from Japan. However, the system was not able to isolate and treat all of the estimated 200,000 sufferers. In many cases, patients who were cured and released contracted the disease again because of poor nutrition, cold weather, and congested living conditions.

Approximately 0.9 million people were covered by the immunization program, which was expanded to include diphtheria, polio, tetanus, smallpox, and tuberculosis. This system was one of the most cost-effective forms of preventive medicine available, particularly for children, but was not fully integrated into the program of basic health centers because of a lack of sufficient vaccinators, vaccine, refrigeration facilities, and, above all, coverage of the population.

Infrastructure

In Afghanistan, roads are the primary mode of transportation for both internal and external traffic. Air transport has played a minor and subsidiary role. The country has no railways. In 1976, the government considered the possibility of constructing approximately 1,800 km of railways with financial assistance from Iran, but this project was discarded because of political instability in both Iran and Afghanistan.

Transport System

The major transportation links are shown in Figure 18. In 1978-1979, approximately 21,000 km of roads existed in the country, with 2,700 km of paved primary roads; 4,000 km of gravel roads; and 14,000 km of earth roads, mostly tracks and trails that are not always passable throughout the year. The combination of rough topography and wide climatic variations resulted in costly road construction and maintenance.

The primary road network in place ended the country's isolation, provided access to the agricultural regions, and linked the major commercial and population centers. However, outside the main system the poor condition and inadequacy of feeder roads linking the rural regions and small towns with the primary roads continued to impede national unification and the development of the rural economy.

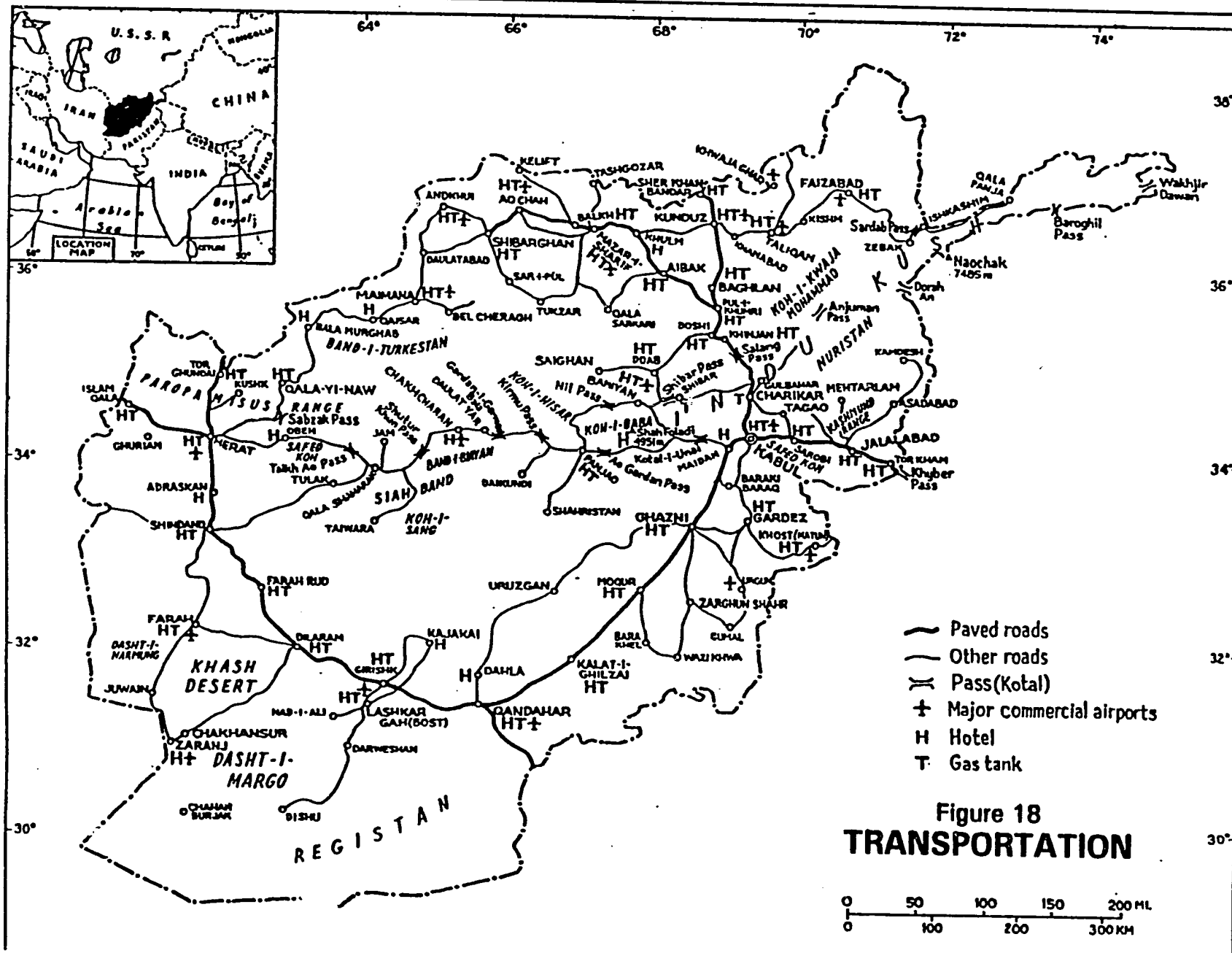


Figure 18
TRANSPORTATION

Source: Louis Dupree, Afghanistan, Princeton University Press, 1980.

The overall road density of 0.03 km of road per km^2 of Afghan land surface placed Afghanistan among the bottom fourth of developing countries. The ratio of roads to cultivated land, estimated at 0.5 km of road per km^2 of land, was still very low. A considerable amount of traffic was also carried by animals, primarily camels, donkeys, and horses, especially over short distances and on many routes not yet covered by the road network.

The most important primary links were the Kabul-Kandahar-Herat highway (1,000 km) and the Kabul-Salang Pass-Mazar-i-Sharif-Jawozjan-Faryab route (700 km). Trunk roads, including those providing access to the neighboring countries, branched off from this primary road network. The secondary roads radiated from the existing circular road into major urban centers, including Kunduz, Gardez, Farah, and Asadabad.

The road from Kabul through Jalalabad and Khyber Pass (224 km) and through Kandar-Spin Boldak (105 km) provided the main access to the transport system of Pakistan and the port of Karachi. The road west from Herat (123 km) crosses the border with Iran at Islam Qala and runs to Meshed on the Iranian railway network. Access to the sea by way of Iran was through the Gulf ports of Khurramshahar and Bandar-e-Khomeini, located more than 3,200 km from Herat. The frequent transshipment of goods and the inadequate port and transport facilities of both Pakistan and Iran limited Afghanistan's access to the sea.

The northern highway through Salang Pass was the main link to the transportation network of the former Soviet Union. Similarly, the road north from Herat (80 km) through Torghandi provided access to the transport system of the former Soviet Union. The Russian railway system had a station 1 km inside Afghanistan at Torghandi and on the Russian side of the Amu Darya River at Termez, which was connected with Afghanistan by means of river barge services to Sherkhan Bandar (Kunduz) and Hairaton (Mazar-i-Sharif).

In 1978-1979, approximately 75,000 major vehicles consisting of 22,000 trucks, 12,000 buses, 31,000 cars, and 10,000 motorcycles and auto-rickshas were operated in Afghanistan. Approximately 60 percent of the fleet was concentrated in Kabul and the rest in the provinces. Despite the concentration of vehicles in Kabul, the rest of the regions were adequately served by trucks and buses. The high growth of traffic during the 1970s was partly due to the fact that motorized vehicles were replacing the more traditional means of transport.

Before the war, the share of privately owned trucks was approximately 90 percent; the government owned only 10 percent of trucks. In 1975, road freight was estimated at approximately 1,300 million tons/km and road passenger traffic at 420 million passengers/km. Of that total, haulage of approximately 93 percent was carried by the private sector and the rest by the public sector.

Entry into the road transport market was free in the private sector. Transportation activities were carried out on a relatively small scale. Some of the individual owners were organized in transport associations.

Although there were enough vehicles on primary roads, transportation on feeder roads was totally inadequate. The poor condition of feeder roads and lack of access roads in the rural regions limited marketing activities and increased unit cost. Transport rates were high in most rural regions.

A road traffic law that established general principles for regulating road traffic behavior was in effect, but no regulations on weights and dimensions of vehicles existed. Trucks and buses were overloaded, and because of weaknesses in vehicle inspection and driver education, accident rates were high.

The following table presents the average daily traffic of different classes of road in 1975, according to the Government of Afghanistan Ministry of Public Works, Department of Road Construction and Maintenance:

	Average Daily Traffic
Eastern Region	
Primary roads	500-1,500
Secondary roads	100-500
Feeder roads	0-100
Other Regions	
Primary roads	100-800
Secondary roads	50-100
Feeder roads	0-50

Domestic civil aviation served a social and administrative function by providing access to regions with poor or nonexistent road connections. In 1978-1979, Afghanistan had as many as 20 airports and airfields, of which Kabul and Kandahar were international airports.

International air transport was exclusively concentrated at Kabul Airport, which was completed in the early 1960s. Kandahar Airport served as an alternative to Kabul when the planes could not land at Kabul Airport because of unfavorable weather conditions. In 1976-1977, the year for which the most recent reliable data are available, Kabul Airport handled 6,000 tons of cargo and 106,000 passengers. It also provided services to 12,000 domestic passengers or 40 percent of domestic traffic. Kandahar Airport handled only 7,000 passengers.

Ariana Airlines operated on international routes and Bakhter Airlines covered the domestic network. Ariana Airlines was established in the mid-1950s with 51 percent Afghan and 49 percent Pan American World Airways

participation and operated as an autonomous state-owned company. Before the war, it had regular flights to major capital cities in Western Europe, India, Iran, and the former Soviet Union.

Bakhter Airlines served provincial airports from Kabul. The main domestic air fields were located in the capital cities of Herat, Bamiyan, Badakhshan, Faryab, Urozgan, and Ghor provinces. However, in most cases, all-weather operations seemed to be impossible because of the lack of radic and aviation facilities. Similarly, most domestic airfields lacked passenger facilities.

Sewerage System

By 1979, the only sewerage system in the country was a small system in Kabul City, which served fewer than 50,000 people. The existing system was old and inadequate for a city with a population of 0.9 million. Because of the lack of a proper drainage system in most rural regions, local flooding was a relatively frequent occurrence during the downpour. The urban regions had no modern solid waste disposal facilities.

The first phase of a sewerage system for Kabul was designed in 1977. However, a lack of resources has prevented its implementation. A small solid waste disposal project for the old part of the Kabul City was implemented in 1976 through the Kabul municipality.

Rural sanitation was also inadequate. A 1976 survey of rural regions in three provinces revealed that the latrines of 3.7 percent of households were in a house and 39.2 percent in the yard, 3.7 percent of households used a hole in the yard, 15.3 percent a hole outside the yard, and 27.5 percent had no facilities at all. From the public health point of view, because the latrines were for the most part shallow, open, and with no water and facilities available for washing, they could be considered a public health hazard. The Helmand and Arghandab Project provided sewerage for eight communities with a total population of about 10,000.

Private latrines were often near other persons' wells. In essence, latrines were used as collection points for night soil, which was subsequently spread on the agricultural fields. The parasite cycle was then completed as humans consumed the food.

Water Supply Systems

To date, Afghanistan has used a small amount of its water resources to provide safe drinking water for domestic needs. Before the war, only about 1 million people, or 8 percent of the country's settled population, had access to piped water. This figure was very low even compared with other least developed countries.

Safe drinking water was a scarce commodity in both the urban and rural regions of the country. Before 1975, when a few modern water supply projects began, safe drinking water was scarce even in Kabul, where piped water was available only to a limited number of households. A survey of 1,725 households conducted by CARE in the early 1970s found that only 13 percent of households had water inside the house, while 30 percent collected water from public taps; the rest of the households drew drinking water from wells, rivers, and other sources.

The first phase of a water master plan for Kabul was launched in 1974, involving two major projects financed by foreign sources. By 1979, the total supply of piped water in Kabul was reported to be approximately 30,000 m^3 per day, representing only 13 percent of potential resources for urban use. The overall water supply system in place served approximately 350,000 people. The coverage and capacity of urban water systems are presented in Table 11.

Between 1975 and 1979, the existing water supply projects in Herat, Kandahar, Jalalabad, and Mazar-i-Sharif were expanded to cover larger numbers of beneficiaries. During the same period, several new systems were installed in a few other towns. These systems had a total combined capacity of approximately 24,000 m^3 of water per day, which, on the basis of 60 liters per person per day, could serve approximately 400,000 people. By 1979 approximately 34 percent of the total urban population had safe drinking water.

Table 11. Capacity and Coverage of Urban Water Supply Systems, 1978-1979

	Capacity (m^3/day)	Population Served
Kabul	30,000	350,000
Mazar-i-Sharif	4,000	66,000
Herat	6,000	99,000
Kandahar	6,000	99,000
Jalalabad	3,000	50,000
Ghazni	3,000	50,000
Charikar	1,000	17,000
Qala-i-Nau	300	5,000
Khanabad	500	8,000
Total	53,800	744,000

Note: Total urban population is 2,130,000, of which 34 percent is served by urban water supply systems.

Source: Government of Afghanistan Ministry of Planning and UNDP, *Kabul Water Supply, Phase II*, Kabul, 1987.

No center for water quality control existed in the country. A small center with a poorly equipped laboratory under the Ministry of Public Health

was responsible for water quality control in Kabul, but there was no control of water quality in provinces.

The existing source of water for urban regions was groundwater from deep wells. Water provided by the system in urban regions was chlorinated, but it passed through broken pipes and became contaminated. Lack of drainage in the street contributed to the population of stagnant-water-breeding insects.

Rural water supply was also inadequate. Some villages had independent sources of water such as springs and *karezes* that were safe and clean. Others drew water from open canals and rivers that were polluted. On the other hand, the Helmand and Arghandab Valley Project provided safe deep-well water for 10 communities with a total population of about 18,000. The pattern of water supply found by a survey of rural regions in three provinces, conducted by Management Services for Health in *The Village Health Worker*, is presented in the following table:

Source	*Percentage of Households Served*
Private well	22.9
Village well	1.6
River	5.9
Jui (Open Canal)	37.8
Spring	12.8
Kareze	19.0
Total	100.0

The water obtained from wells was usually less polluted, but there was no guarantee that it was completely safe. A rural water supply program in Afghanistan began in 1971. By 1978-1979, the Ministry of Public Health, through its Environmental Health Department, installed 55 piped water systems and about 1,000 hand pumps that served approximately 400,000 people, or 4 percent of the rural population. The actual number was probably much lower because 50 percent of hand pumps and 60 percent of power pumps were not fully operational. The management of rural water supply was centralized, and villagers had no responsibility for the maintenance of water supply facilities.

Energy Sources and Uses

Afghanistan's major energy resources are coal, natural gas, hydropower, and traditional fuels, primarily wood and animal wastes. Significant petroleum reserves have been found but, for the most part, have not been developed. The region north of the Hindu Kush is the richest in sources of energy and

mineral deposits. In 1976-1977, the consumption per capita of energy in Afghanistan was the lowest in the world, approximately 43 kilocoal equivalents per capita (kgce/cap), compared with an average for all developing countries of approximately 380 kgce/cap.

Energy Sources

The country's coal reserves have been significant; approximately 100 million tons of proven reserves and 600 million tons of probable reserves. Coal deposits stretch across northern Afghanistan in about nine major reserves. The Darra-i-Suf coal deposits in Samangan Province have so far accounted for nearly 95 percent of the country's coal reserves. According to the Ministry of Planning's *Seven-Year Economic Development Plan* (GOA 1976); *Afghanistan: The Journey to Economic Development* Volume II, Table 9.3 (World Bank); and the Government of Afghanistan Ministry of Water and Power, energy resources are as follows:

Energy Source	*Minimum*	*Maximum*
Coal deposits (000 tons)	100	600
Natural gas ($billion m^3$)	130	150
Petroleum (million tons)	40	-
Hydropower (000 MW)	4	5

The figures for hydropower represent only a fraction of hydropower potential on Darya-e-Panja (Amu Darya). A reconnaissance study of the Darya-e-Panja and Amu Darya, carried out in the mid-1960s, revealed that 8 to 10 hydroelectric sites could be developed in this area with a total capacity of 16 million kW (MacPherson and Fernando 1991).

Systematic exploration of gas and oil started in the mid-1950s with technical and financial assistance from the former Soviet Union. When Daoud came to power for the second time in 1973, he renewed efforts to find oil. Afghan engineers, geologists, and technical personnel undertook the assignment. The explorations soon met with one success after another. In 1975 reserves were discovered at Aq-Darya. A year later, oil of better quality was found at Quasquari and other strikes were made at Bazar Kami and Bilor Ghor, all in the Saripul Shibarghan area of northern Afghanistan. While drilling for natural gas, a larger oil strike was made at Ali Gul near the Turkmenistan border, approximately 200 km west of Saripul, opening the possibility that even larger strikes might be made in the intervening territory. The total estimated reserves of tnese fields is 46 million tons. The geological history of the region leaves open the possibility that major reserves exist in Afghanistan

(Assifi 1982-1983). Given the size of the country, however, the oil and gas exploitation program was limited.

In the mid-1970s, the Government of Afghanistan established the Afghan Oil Corporation and encouraged private sector participation in these activities. According to an agreement signed between the Afghan National Oil Corporation and the French TOTAL Company in 1975, the latter started preliminary geological surveys in the southern region of the country. However, the TOTAL Company ended its activities by the end of 1976 for unknown reasons. During the same period, the British company Tri-Central also contracted for oil exploration in the southern province of Farah. This work was terminated in 1978. A U.S. company, Cities Service, had shown interest in the Dasht-i-Margo area (Helmand-Nimroz). Contracts were drawn up with this company for exploration of the western desert before the 1978 coup.

The natural gas deposits in the northern region of Afghanistan have been the country's most abundant and known energy source. Total gas reserves were officially estimated at 130 m^3, but some reports indicated that total reserves could be as high as 150 billion m^3. Most of Afghanistan's oil reserves also lie in the northern region of the country. Proven oil deposits in 1978-1979 were reported to be approximately 40 to 50 million tons. During 1976, the former Soviet Union developed a proposal for building a 500,000-ton oil refinery in the north, but later withdrew its support. However, little progress to establish the refinery had been made by 1979.

According to official sources, the potential for hydropower generation is 5,000 MW. As of 1978, only about 10 percent of Afghanistan's hydropower potential had been used. Approximately half of the hydropower potential is from the Amu Darya, which separates Afghanistan from the former Soviet Union. The remaining hydropower potential is from the internal rivers listed earlier.

In addition to these sources, traditional fuels, including wood, charcoal, and animal wastes, have been an important additional energy source in the country, but no estimates of their size are available yet.

Energy Uses and Production

The production of coal increased by approximately 61 percent from 135,000 tons in 1971-1972 to 218,000 tons in 1978-1979. However, during this period, production fluctuated considerably because of management problems and manpower constraints caused by low pay for unpleasant work under difficult conditions.

In 1978-1979, the cement plants and larger textile mills used roughly 60 percent of coal produced; approximately 25 percent was consumed by other businesses, including the sugar refinery in Baghlan, the government bakery in

Kabul, and the Jangalak metal works. The remaining 15 percent was used as compressed fragments (briquettes) for household purposes. A comparison of the production of coal and other energy sources in 1971-1972 and 1978-1979 is given in the following table (data on electricity are estimated from official data).[4]

	1971-1972	*1978-1979*
Coal (000 tons)	135	218
Natural gas (m^3)	2,528	2,461
Crude oil (000 tons)	2.5	14.0
Electricity (million kWh)		
Hydropower	398	537
Other sources	25	308
Total	423	845

Production of natural gas, which accounted for the major part of the domestic energy production, was estimated at 2.5 billion m^3. Of this total, only 5 percent was used by domestic industries, primarily the fertilizer plant and the associated thermal power plant at Mazar-i-Sharif that was completed in 1972. The remaining 95 percent of production was exported through a 100-km pipeline to the former Soviet Union. Although the price of exported gas increased from US$5.2/1,000 m^3 in 1967-1968 to US$24/1,000 m^3 in 1978-1979, the overall level of prices paid for the Afghanistan gas by the former Soviet Union was at the lower end of the range of prevailing prices at various locations.

Crude oil production increased to 14,000 tons by 1979. A significant amount was used by the Kabul thermal power plant and government institutions for heating.

Except for the insignificant quantity of domestic crude oil, all petroleum products used for transportation, power generation, and lighting were imported. Total imports increased from 190,000 tons in 1970-1971 to 287,000 tons in 1978-1979, indicating an increase of 51 percent over the period. Gasoline and diesel accounted for 33 percent and 60 percent of petroleum products imported. The decrease in the relative share of gasoline during the 1970s reflected the substitution of diesel oil for gasoline.

In 1978-1979, electric generating capacity was estimated at approximately 360 MW of which 256 MW or 71 percent was hydro, 80 MW or 22 percent

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[4]The data for this tabulation are those shown in Nathan—Berger Joint Venture, *Macroeconomic Data Development: Phase II*, Vol. II, Table A II-32, September 1991; Government of Afghanistan Ministry of Planning, *Survey of Progress*, 1970-1971, Table S-24, November 1971; Government of Afghanistan Central Statistics Office, *Statistical Year Book*, 1988, p. 133.

was steam, and the remaining 14 MW or 8 percent was diesel-generated. The regional distribution of generating capacity is presented in Table 12.

The total production of electricity during 1978-1979 was estimated at 845 million kWh. Of the 500 million kWh sold, approximately 30 percent was for domestic use, 53 percent for industrial use, and the remaining 17 percent for use by government institutions. The supply of electricity was inadequate to meet demands. Only about 6 percent of the population had access to electricity. The major use of power, however, was in the Kabul region, where 61 percent of generating capacity was concentrated.

Table 12. Regional Generating Capacity, 1978-1979

Region	Generating Capacity (MW)	Percentage of Total
Kabul	228	63.3
Mazar-i-Sharif	37	10.3
Nangarhar	14	4.0
Herat	8	2.2
Kandahar	41	11.4
Baghlan	10	2.8
Kunduz	5	1.4
Parwan	8	2.2
Wardak	3	0.8
Other regions	6	1.6
Total	360	100.0

Sources: Government of Afghanistan Ministry of Planning, *Seven-Year Economic Development Plan*, Kabul, 1956, pp. 171-186. UNIDATA, *Balkh Province, A Socioeconomic Profile*, 1991. World Bank, *Afghanistan: The Journey to Economic Development*, Vol. II, 1978.

Virtually no information on traditional fuel consumption is available in Afghanistan. In 1976-1977, the World Bank estimated the overall level of consumption at 34,000 tons of coal equivalent (tce) or 20 kgce per capita. According to these estimates, traditional fuel accounted for approximately 47 percent of total estimated energy consumption during that year.

The primary traditional source of domestic energy for cooking and heating in Afghanistan has been fuelwood. No information on the pattern of wood consumption or requirements is available. Some limited work on wood energy requirements and the consumption pattern was carried out by UN experts in the early 1980s. According to these preliminary estimates, the total requirement for fuelwood in 1978-1979 was approximately 3.5 million tons or 269 kg per capita. Thus, the rate of wood extraction was extremely high, and the country's forestry resources were being seriously depleted as a fuel source. According to some preliminary reports, the urban population satisfied total energy needs to approximately 15 percent from wood energy sources, while the rural population required more than double that level.

Chapter 3

CHANGES IN THE ENVIRONMENT SINCE 1978

Introduction

Accurate quantitative data on the changes in the state of natural resources that have occurred in the environment of Afghanistan since the Soviet invasion in 1978 are lacking. There are a considerable number of general reports that generally describe a somewhat bleak picture of the impacts of the hostilities. This chapter reviews available information; the next chapter presents the likely consequences of the end of the hostilities. Two types of strategies can developed: (1) those to identify data needs and to suggest data-collection methods in both Phase II of this study and when Afghanistan becomes accessible and (2) those to form a framework to protect and improve the environment as well to support the sustainable use of natural resources.

It is known that there has been a large-scale exodus of the population from the countryside, greatly diminishing the rural population. More than 5.5 million have sought refuge in Pakistan and Iran, and an estimated 2 million have left rural regions for the relative security of urban regions inside Afghanistan. Another 500,000 to 1 million are reported to have relocated to remote rural regions, compared with the total settled and nomadic rural population in 1978, which was estimated at 12.48 million.

Central government authority has broken down, its writ being largely confined to the major urban regions. The rural regions have been subjected to a variety of *mujahidiin* authorities, with many regions constituting a shifting battle front. Under these circumstances, control over the rural environment has been limited even further.

Much of the rural infrastructure has deteriorated as a result of war damage or neglect, as has much of the already-limited urban infrastructure. The impact of events since 1978 on the different environmental sectors is reviewed with these thoughts in mind.

Ecology

In theory, reduced human and animal populations during the 15 years of warfare should have allowed some ecological healing to take place. In practice, the effects of the period of hostilities on the ecology appear to be both very mixed and very uneven.

Vegetation

Two types of vegetation, forests and grasslands, are examined.

Forests

As reported in Chapter 2, before the hostilities, forests were being exploited faster than they were being replenished. It was estimated that 10,000 ha of forests were being lost annually. There have been a number of recent reports of the extensive destruction of forests since 1978. According to a mission sent to Afghanistan by the Office for the Co-ordination of United Nations Humanitarian and Economic Assistance to Afghanistan (UNOCA) to undertake an environmental review, all persons from UN Agencies and NGOs interviewed by the Mission, with only one exception, believed that deforestation was occurring at an unsustainable rate (MacPherson and Fernando 1991).

Three types of forest land exist: shrubby forests, pistachio forests, and timber forests of coniferous trees. Shrubby forests grow in many parts of the country and are used for fuelwood. Lower rural populations may have reduced the pressures and shifted stress points on fuelwood supplies reported in the previous chapter. Pistachio forests are used as fruit trees. No specific information on changes in the pistachio forests since 1978 is available. The causes of deforestation of the timber forests—cutting for fuel and structural timber and clearing for agricultural use—are not new. However, social disruptions since 1978, related absence of controls, and the demand for timber in Pakistan appear to have exacerbated the problems.

The extent of deforestation is indicated by a description of the Chamkani Rehabilitation Project (Marshall 1990). It was observed that during the war the forests were badly damaged by bombing and many trees were cut down by the military for security reasons. It is hoped that the impact of war-related destruction of forests will prove to be small in relation to total forest cover. With no governmental body in control to protect hill forests, trees are currently being cut not only for domestic needs but also on a large scale for timber sales in Pakistan. It was estimated that sixty 10-ton trucks of wood pass through the project region into Pakistan every day.

A rough measure of fuelwood-timber consumption in the region was estimated on the basis of per capita usage assumptions from Pakistan.

Fuelwood usage in the North-West Frontier Province and Baluchistan was estimated at approximately 1 m^3 of wood per capita per year, or approximately 700 kg (air-dried). Assuming an average family size of 10 members and an average fuelwood price of PRs 1.00/kg, a family would have to pay (usually in family labor) the equivalent of PRs 7,000/year to meet its fuelwood requirements. Timber for house construction and other uses could increase this amount by at least 50 percent.

Satellite imagery has shown extensive areas of coniferous forest remaining on upper mountain slopes in and around the Chamkani project area. They have become less accessible, but the profitability of selling timber in Pakistan and the absence of any government authority to protect forests is likely to have led to continuing deforestation. Fuelwood was reported to be primarily from two sources: (1) oak forests that are still accessible and are nearby, collected using family labor, and (2) upper coniferous forests taken by merchants as dead and rotten wood, for commercial sale.

A USAID/Pakistan forestry adviser estimates that 200-250,000 m^3 of wood are imported into Pakistan each year.[5] This quantity of wood is equivalent to an annual rate of forest destruction of 2,000-2,500 ha.

Grasslands

In 1978 problems of overgrazing and soil erosion, which are typical of populated rangelands throughout the Third World, were reported. Overgrazing was particularly apparent in winter grazing lands below 1,000 m.

No information concerning changes since 1978 has been found. The exodus of the rural population is likely to have reduced the number of grazing animals, thus reducing grazing. War activities are likely to have interfered with the movements of nomadic people and their herds between summer and winter grazing lands and may have reduced their herds.

The use of pack animals along the principal supply routes of the *mujahidiin* may have increased grazing locally. Minefields are reported to have protected grazing lands in some regions. This protection is likely to be limited to areas around villages and military installations where minefields have been placed. The breakdown of the road transportation system is reported to have resulted in an increase in the use of pack animals and an increased population of camels, donkeys, and horses which has also increased grazing.

The hostilities are likely to have produced negative and positive impacts on grasslands, depending on the region. There is no basis for determining whether the overall pressures of grazing have been significantly

[5]Estimate made by Dr. Gary Naughten, forestry adviser to USAID/Pakistan.

affected by the hostilities. There is a possibility that overgrazing has decreased or at least that stress points may have shifted.

Fauna

No information on the impacts of the hostilities on fauna has been found. Large numbers of armed, often-hungry men are not likely to have been beneficial to game species.

According to MacPherson and Fernando (1991), all of the descriptive accounts of field and village project workers report few local sightings of wildlife species. Occasional wolf and fox sightings are mentioned, particularly in the mountains of the northeast.

MacPherson and Fernando (1991) also report that a quick survey of Kabul fur shops indicates substantial numbers of wolf and fox pelts, along with less numerous pelts of snow leopard and leopard. Strings of duck and other waterfowl are frequently seen in the market of Kabul, indicating continued extensive hunting. Falcons and other raptors have been captured and sold for Arabian falconry or killed. It is reported that birds such as the rare Siberian crane have been captured in Bannu, Waziristan, where there is a traditional trade in capturing cranes to train as domestic pets and sentries.

According to MacPherson and Fernando, it is feared that many of the original values of the six major candidates for protected-area sites may have been lost. Field workers estimate that the most severely damaged areas are likely to be Kole Hashmat Khan, because of its proximity to Kabul, and Bande Amir National Park, because of its high density of human settlement. Ecological values are likely to be intact in Pamir-Buzerg National Park because of its relative isolation in the Pamirs. However, nothing can be certain until field visits are made to all of these sites. Staff from FAO Islamabad and the International Convention on Wetlands and Waterfowl (Ramsar) have expressed interest in assessing the critical wetlands of Ab-i-Estada and Dashte-Nawar when the security situation permits access to these areas.

Population

Afghanistan's entire population has been affected by the war, through casualties or through internal and external dislocation. Sliwinski (1988) reports that most casualties of the war were from the northern provinces bordering the former Soviet Union. Kapisa (Panjsher River Valley), Samangan, Kunduz, Baghlan, and probably Badakhshan suffered the highest number of war casualties. Suffering almost as many casualties were the populations of Faryab and Balkh in the north and Kabul. The proximity of the Soviet border and the military bases surrounding the main truck roads explain the high casualty

rates in these regions. The nature of the land, a flat steppe, would make finding natural shelter against aircraft attacks difficult. The length of the route to the Pakistani border also contributed to the number of casualties.

It is generally agreed that conditions are not yet conducive to a return of dislocated populations, particularly refugees in Pakistan and Iran. The United Nations estimates that 250,000 refugees had returned as of 1990. Most probably pass in and out of Afghanistan, depending on security conditions. Many are working on their farms in Afghanistan while retaining a base in Pakistan. A gradual return of refugees and the subsequent increase in the labor supply are likely as the combination of other inputs becomes conducive to the maintenance of families. NGO programs to date indicate a relationship between improvements to the agricultural infrastructure and refugee return. The major concern is security.

The total population living in Afghanistan in 1990 was estimated at 12.36 million (UNIDATA 1990), compared with 14.61 million in 1978. There were 4.55 million refugees in camps in Pakistan and Iran. Figure 19 shows the refugee population as a percentage of the home population of each province. According to the United Nations, in 1988 there were more than 1 million displaced persons in urban centers including Kabul City, Jalalabad, Mazar-i-Sharif, Ghazni, and Gardez. In addition to the urban displaced population, approximately 500,000 to 1 million people have been forced to seek the relative safety of remote rural regions, especially the mountainous regions in the north-central part of the country (United Nations 1988).

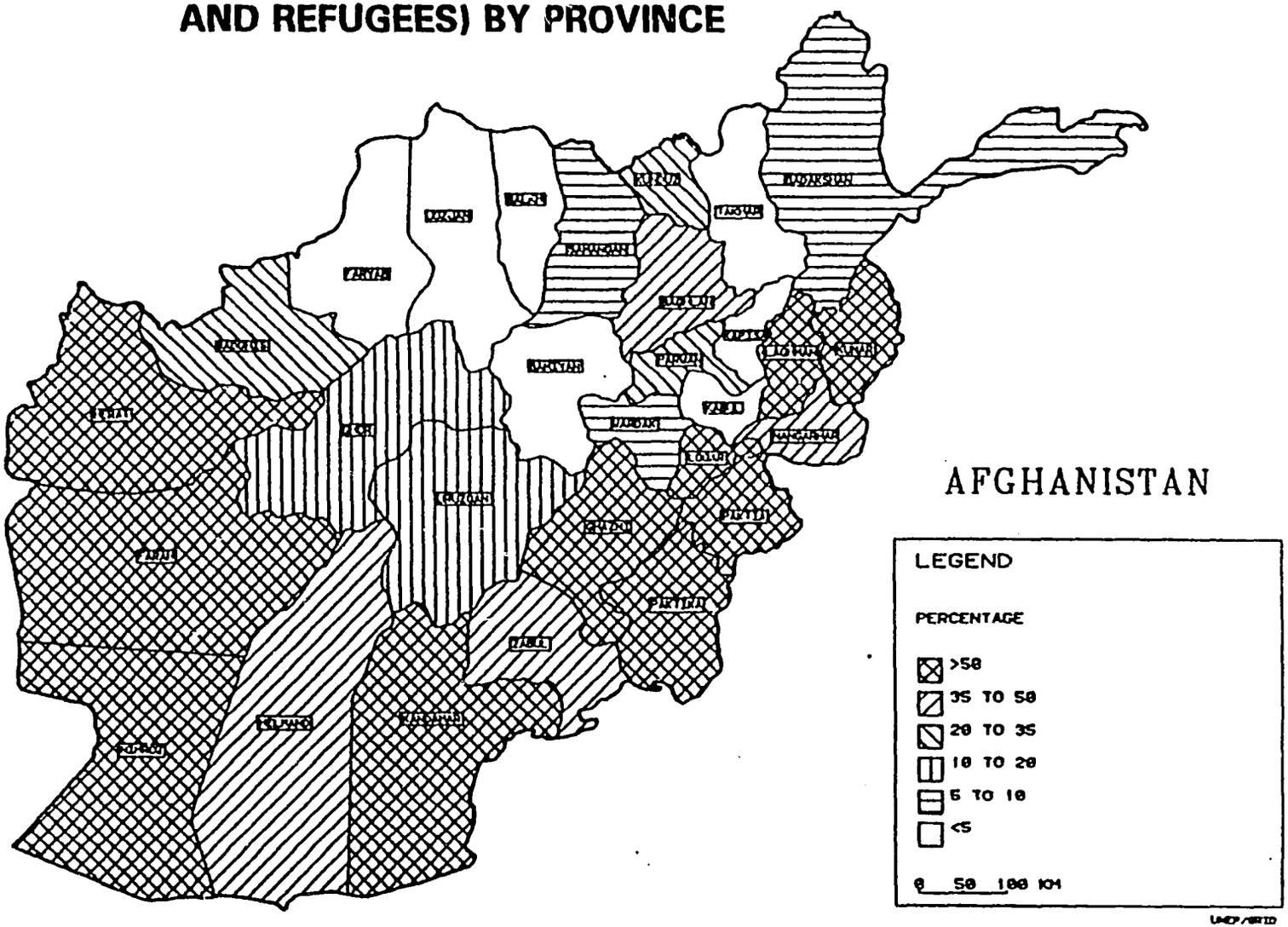
The other major factor that must be considered in the evaluation of potential environmental impacts of refugees returning to their homeland is that more than 1 million children have been born and raised in the refugee camps and have no experience of their parents' original homes. The inhabitants of refugee camps have become accustomed to modern support services, particularly medical services, which were not available in most of rural Afghanistan in 1978. Many of the men who remained in Afghanistan have been employed as fighters rather than farmers or herdsmen. The family members who remained in refugee camps, those in both Pakistan and Iran and those in the urban centers of Afghanistan, have lost touch with the requirements of a precarious rural existence.

The nine long years of struggle in Afghanistan have resulted in the deaths of as many as 1 million people. A survey of refugee populations indicated that more than 60 percent of the dead are men, who have left behind an estimated 700,000 widows and children.

The war will have greatly increased the number of disabled people. The United Nations (1988) estimates that tens of thousands of people have been maimed. In addition, the incidence of polio has increased.

Figure 19

REFUGEE POPULATION FROM PAKISTAN AND IRAN AS A PERCENTAGE OF TOAL POPULATION (i.e. RESIDENTS AND REFUGEES) BY PROVINCE



Source: First consolidated report, Office of United Nation Coordinator for Humanitarian
an[illegible]ance Programs [illegible] Afghanistan, Geneva, September [illegible].

In 1988, the United Nations reported that Afghanistan's education system had practically collapsed. Primary and secondary education, as well as literacy education in rural areas, were reported to be particularly negatively affected. Primary school gross enrollment had decreased from about 30 percent in 1978-1979 to about 18 percent in 1986-1987. Secondary and vocational school enrollment had decreased by approximately 10 percent. In all areas except Kabul City, vocational training and university education were almost nonexistent. Enrollment in vocational schools and institutes of higher education in the capital was reported to have increased from 11,300 in 1978-1979 to 17,000. Although lacking in formal education, many of the men were probably exposed to modern technology for the first time through their experience as fighters.

A.I.D. has been improving education in Afghanistan through its Education Sector Support project over the past 6 years and currently supports more than 1,300 schools with books, materials, equipment, and supplies and provides salary support to more than 7,000 teachers. This should have significantly affected the country's ability to meet basic education needs.[6]

In summary, since 1978 the total population has decreased by approximately 15 percent. If 25 percent of the current population is now urban (United Nations 1988), the urban population has increased by 50 percent and the rural population has decreased by 25 percent (see Table 4). Of the current rural population, 5 to 10 percent have been displaced from their original homes. In a society where women remain in domestic occupations, there is a significant increase in the proportion of dependents, including wives, widows, children, and the handicapped. This population has a lower level of education and greater exposure to modern technology. The problem is likely to be compounded if those who have been educated because they lived in government-controlled regions become politically unacceptable in a future Afghan society.

Socioeconomics

No up-to-date information on current income and income distribution has been found. Therefore comments on general conditions can be made only on the basis of available information and conjecture.

Disruptions to the social and economic well-being of Afghans during the past 12 years have affected all aspects of their lives. It is likely that with resettlement the disruptions will continue, as population pressures force difficult compromises on development strategies.

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[6]Comments of O/AID/REP for Afghanistan on draft Afghanistan Environmental Profile: Phase I, Facsimile dated March 19, 1992.

Current dependence on outside sources of food and the almost total absence of public services are indicative of the Afghans' plight. Progress in re-establishing local economies is being made, principally by NGOs, but the task will take a long time.

Information on which to make a reasonable assessment of current socioeconomic conditions in Afghanistan is very limited; however, conditions normally produced by strife are indicative of probable conditions. A large percentage of the population has been displaced and has moved to refugee camps in Pakistan and Iran, government-controlled cities and towns, or remote rural regions. The 4.55 million refugees in camps outside Afghanistan are living in poor conditions by Western standards, but have roofs over their heads, sufficient food, and reasonable health care—conditions that did not always prevail in their places of origin. Economic conditions have worsened for wealthier refugees from relatively developed and prosperous regions. However, refugees from poor regions and the poor from prosperous regions are likely to be living in improved economic conditions, probably much better than the conditions they will find on return to their war-ravaged homeland. A similar situation may exist among the refugees in Kabul City, where the health and education services of the country are concentrated. Housing is likely to be a severe problem in Kabul. There is no information on which to base postulations about conditions of refugees in other urban centers within Afghanistan. People taking refuge in remote rural regions are likely to be suffering worse conditions than they were in their place of origin; they are probably often short of food and completely lacking in health care and schools.

People who remained in their homes in rural regions will have been largely deprived of services that existed previously, such as education and health clinics. It is reported that gross enrollment in primary schools was only 30 percent in 1978-1979 and only 19 percent of rural people benefited from basic health services in 1978. Therefore some rural people away from war zones and formally outside the network of government services may have experienced little socioeconomic change as a result of the hostilities. At the other extreme, those in relatively prosperous regions that have been the scene of a great deal of fighting are likely to have suffered property damage, including damage to agricultural infrastructure; loss of markets for their produce; and a reduced availability of supplies, in addition to the loss of education and health services. Their socioeconomic status has probably suffered significantly.

Agriculture

The British Agencies Afghan Group offered the following reasons for the reduction in agricultural production in Afghanistan during the 1980s.

- Reduced farm power (people and livestock killed and dispersed, tractors destroyed, and access to spare parts limited);
- Reduced access to government-provided improved seed;
- Reduced access to fertilizer in most regions;
- High price of DAP fertilizer;
- Reduced access to pesticides and herbicides;
- Inadequate maintenance of irrigation systems;
- Destruction of some irrigation systems;
- Vulnerability to attack of land adjacent to strategic regions such as roads and military bases;
- Mining of considerable areas of agricultural land; and
- Reduction in the area cultivated as a result of these factors.

Each item is directly or indirectly war-related. Impacts experienced in the Kunar basin were representative of the rural upheaval experienced in many parts of the country (Anderson 1989). Reports from the region indicated that the irrigation infrastructure suffered severely from damage as a result of the fighting. However, examination of a major part of the region revealed that the damage that occurred in almost all cases had been the result of cumulative neglect of the system's annual maintenance. In addition, damage from the uncontrolled flood flows of the Kunar River and its tributaries had exacerbated the situation. In only a very few cases had the infrastructure actually suffered from direct attacks carried out during the war.

Agricultural life was severely disrupted by the insecurity experienced in varying degrees throughout the valley. Social organizations that had been established for many hundreds of years broke down when many inhabitants fled from the valley. Some of the worst regions of neglect, where the government and *mujahidiin* forces clashed, had not been cultivated for more than 10 years during the 1980s.

With the liberation of the province in 1988, the threat of retaliation from the air by government forces was not removed. Although this threat was still present, many former farmers considered the region sufficiently secure to return to temporarily to plant a winter crop of wheat. However, few considered it safe enough to bring their families back, and most have been satisfied to commute from their refugee camps in Pakistan, a practice that currently prevails in many parts of the country.

In 1989, some land within the Kunar basin was cultivated for the first time for many years, and some main canals in both the Lower Kunar and the Pech valleys were flowing once again. Investigations revealed that the farmers themselves had brought many of the irrigation systems back into production with the assistance of NGOs.

Of long-term concern is the fact that many of the agricultural lands and surrounding hills are still saturated with antipersonnel mines. These are the primary cause of death and a major source of worry of farmers. When vegetation grows in the spring, the mines are particularly difficult to see. For this reason—perhaps more so than the threat of renewed attacks—farmers are reluctant to bring their wives and smaller children back until their regions have been cleared. Many communities have tried to clear the mines from their lands using their own animals, but this is a costly and time-consuming process.

Provinces in northern Afghanistan also suffer from droughts, floods, and shortage of improved seed varieties and fertilizers. However, they host a distinct environmental problem in the form of locust and sunn-pest infestations. The impacts of these infestations have been extensive. In November 1990, the Northern Afghanistan Food Deficit Survey published by the Agricultural Survey of Afghanistan indicated that two-thirds of the farming population in nine northern provinces had insufficient wheat to feed itself for the year. The two worst affected provinces were Jowzjan and Badakhshan, where 81 percent of farmers had to buy wheat to survive and 90 percent of families declared themselves below subsistence (Aighanaid 1991).

It appears that the 1989 locust problem was part of an expanding cycle of behavior that began in the spring of 1986. Baquee and Tacon (1989) report that according to the more elderly farmers, similar cycles of locust infestations had occurred periodically before the war, but the government had always come to their aid and launched a major control program during the early years of an infestation. Cooperation between the former Soviet Union and Afghanistan to control these pests started in the 1950s, with the Soviets providing assistance to prevent the insects from invading their country. The government program employed a number of 4 x 4 vehicles equipped with motorized "power dusters" to apply chlorinated hydrocarbon BHC powder over many of the primary infestation regions.

Reports from Afghan crop protection personnel active in this joint control effort indicate that adequate control was achieved. These "dusting" activities were carried out with government trucks and dusters until about 1984, when war activities became too widespread and intense to continue. Large government stocks of BHC are reported to be in storage in Herat, Mazar-i-Sharif, and Shebeghan (Rann 1991). In 1990, UNDP/FAO conducted a project that expedited the release and movement of BHC to government- and *mujahidiin*-controlled regions for use on locusts.

Wheat cultivation encourages increased populations of locust and sunn-pest. Ample availability of prime feeding regions in Badghis allowed moderate infestations in 1986 and 1987 to multiply epidemic infestations during the summers of 1988 and 1989. Surveyed farmers applied the liquid-based insecticide Methavin (which was shipped into the region by the Swedish Committee for Afghanistan) to adult locusts that were infesting immature crops of wheat. The knapsack (20-liter) spraying of waist-high wheat crops was reported to be a time-consuming and difficult operation. Within days the dead swarm would be replaced by another swarm that continued to devour the crop remaining from the first infestation. Again, more chemical would be applied, and the insects killed would be replaced by a third swarm some days later. By this stage, there was virtually nothing left of the once-thick crop, and the farmers would give up spraying in despair.

The sunn-pest problem is of equal if not greater concern; distraught farmers reportedly complain that they know of no effective control measures. In some regions the infestation has been so severe that farmers have been driven away by continued heavy crop losses. The Swedish Committee for Afganistan's Seventh Agricultural Survey Report characterizes the outbreak of sunn-pest in the north as "a symptom of fragile farming resources where agriculture has been progressively weakened by years of war and its economic control requires long-term solutions which rebuild those resources." The report also states that

> One of the main causes is inadequate draught power (oxen or, rarely, tractors) to plough enough land to sow all wheat in the autumn. Consequently, increasing amounts of wheat have been sown in the spring, a practice in harmony with the sunn-pest life cycle. To rebuild depleted draught power resources will take many years, but other methods such as the use of short season spring-sown wheat (which has the benefit of higher yields) and the use of herbicides in conjunction with depleted power resources can be used in the meantime. Insecticides can also be used to a limited extent, but have not been an absolute or a cost-effective means of control on their own anywhere else in the world where sunn-pest has been a problem.[7]

In summary, locust and sunn-pest infestations have had the following consequences in northern Afghanistan.

- Scarcity of food. The initial effect of the infestations is a drastic reduction in a family's annual food supply. To a subsistent people, the immediate impact is serious hunger. Families that own some marketable resources are forced to trek miles across this essentially roadless region to bazaars where they can buy stocks of imported wheat at inflated prices.

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[7]The Swedish Committee for Afghanistan, The Agricultural Survey of Afghanistan, Seventh Report: North Afghanistan Crop Protection Programme, August 1990, p. 3.

- Migration of the families worst affected. Families who own few or no livestock are very vulnerable to crop failures because they have no source of capital with which to purchase wheat until the following season. After one crop failure, these families are forced to migrate to other regions in search of employment.

- Decline in livestock numbers. All families surveyed by Baquee and Tacon (1989) living within the infestation zones reported that their livestock numbers had been significantly reduced over the previous 2 or 3 years. In particular, they reported sheep flock and goat herd reductions of between 30 and 65 percent. Some complete losses of family flocks and herds were also reported. These families were no longer present, having migrated in search of manual work.

- In addition, both locust and sunn-pest infestations have seriously reduced the quality and availability of cereal straw, so vital in this region to the winter maintenance of livestock. Poor winter nutrition appears to have contributed to the losses of all categories of livestock. The decline in livestock has also greatly reduced milk and meat proportions in families' diets.

- Decrease in area planted. The infestations have led to a widespread loss of confidence in crop farming. This pessimism, together with a shortage of seed, oxen, and manpower, has resulted in significant reductions of crop acreage.

- Inflated wheat prices. In normal farming years, wheat is purchased only by the region's landless families or those families whose land acreage is insufficient to produce their annual requirement. However, insect infestations cause an increasingly high demand for imported wheat, which was being marketed in Badghis in 1989 for prices from 100 to 400 percent higher than wheat prices in Herat city (Af 300/7 kg), just 140 km away from Qala-i-Now, the provincial capital of Badghis.

In 1989, BHC was reportedly supplied free in Herat (as part of the 2,000-ton annual contractual supply to Afghanistan from the former Soviet Union) but by the time it had been transported in commercial trucks from Herat to central Badghis, it was being distributed to farmers for between Af 1,000 and Af 2,000 for a 25-kg bag (Baquee and Tacon 1989). Mixed with soil, one bag of 12 percent BHC powder will "dust" a locust infestation area of 25,000 m^2.

It is believed that any serious overall locust population reduction would take a large-scale aerial spray program with a large trained ground staff. Further study and a stable political situation would determine whether such a program is feasible and cost-effective (Rann 1991). Moreover, it should be

noted that BHC has been banned in many countries—including the United States and the former Soviet Union—because of environmental and human health concerns. It was, however, the only effective insecticide present in quantities sufficient to treat a major outbreak of locusts in northern Afghanistan in 1990.

Human depopulation of the countryside can in itself be a source of environmental problems. As in the case of shortages of animal and mechanical traction, shortages of human labor can lead to environmentally unsound changes in agricultural production practices that have significant environmental impacts.

Public Health

The condition of rural health services in Afghanistan has been characterized in different ways at different times by different observers. The United Nations reported in 1988 that the number of basic health centers and subcenters declined from more than 220 in 1978 to about 90 in 1987. Little was known about the condition of the remaining centers, but it was believed likely that the availability of medicines and trained staff was low. The public health rural infrastructure was believed to be capable of providing basic health services to 10 percent of the population, compared with 19 percent in 1978. The security situation, the lack of incentives to attract and retain qualified staff, and severe shortages of medical supplies and equipment were reported to have contributed to the low efficiency of these services (United Nations 1988).

The A.I.D. Health Sector Support Project, which has been active since 1986, has been helping greatly to overcome the situation described above. Currently it supports 1,685 health facilities, providing salary support and supplies to 3,850 workers at all levels and $1.7 million per annum in pharmaceutical supplies. Knowledgeable observers report that the availability of accessible rural health services currently exceeds prewar levels in the areas covered by this program.[8]

Health conditions in Afghanistan have been succinctly described by personnel of Management Sciences for Health (1990). They reported the following:

- Maternal and child health care services represented perhaps the greatest unmet need.
- Immunization coverage was limited almost exclusively by insufficient quantities of vaccine supplied through UNICEF. Low immunization coverage resulting from inadequate vaccine supplies

[8]Comments of O/AID/REP for Afghanistan on draft Afghanistan Environmental Profile: Phase I, Facsimile dated March 19, 1992.

was the single most important missed opportunity for reducing infant and child mortality.

- Substantial maldistribution of health centers and hospitals inside Afghanistan continued to be a concern for rational health service development. Available health resources information indicated that certain provinces and many individual districts continued to have large numbers of health facilities relative to their estimated population. In contrast, other regions were significantly underserved.

- Treatment registers ("Greenbooks") submitted by Basic Health Workers, the Provincial Health Resources Surveys, and reports from the field all confirmed that diarrheal diseases and acute respiratory infections continued to be leading causes of morbidity and mortality among both children and adults.

- Although community-based health care and facility-based health services continued to develop, major health needs that were not being adequately addressed by existing programs remained. The leading problems included lack of malaria and tuberculosis control, malnutrition, inadequate disability services, and poor water and sanitation.

- Afghanistan's internationally respected malaria control program of the 1970s had been reduced to presumptive treatment of symptomatic patients. Broader preventive efforts, including vector control, was limited by the lack of a strategy, funds, and trained health staff. (According to the United Nations in 1988, the incidence of malaria had reached epidemic levels in many Afghan regions.)

- Tuberculosis (TB) was cited as a major cause of morbidity and mortality among Afghan adults and children. TB treatment and control strategies were clearly defined and several successful local TB control programs were in operation. Expansion of TB control efforts was limited by (1) inadequate funding for antitubercular drugs and (2) lack of medical supervisors and trained laboratory technicians.

- Although impressions of nutritional status suggested considerable variation throughout the country and although firm data are lacking, there was general agreement that malnutrition is a major contributing factor to infant and childhood mortality in some regions of Afghanistan.

The problem of malnutrition was specifically examined in a nutritional assessment that was conducted over a 12-week period during the latter part

of 1990 in three provinces of Afghanistan (Afghanaid 1991). The assessment tools included measurements of the mid-upper arm circumference (MUAC) and screening for clinical signs of undernutrition.

The findings suggested that just over half of the children were either moderately or severely malnourished in terms of energy intake. Clinical signs of iron deficiency anemia and vitamin A and vitamin C deficiency were also noted in a significant proportion of the children examined. In summary:

- Some 10,145 children aged 1 to 5 years were screened in 202 villages,
- Twenty-six percent were moderately malnourished, and
- Twenty-four percent were severely malnourished.

The survey teams visited 36 health facilities en route. They found that

- No facilities for immunization exist;
- The most common diseases are measles, whooping cough, and diarrhea;
- Health facilities range from single-handed clinics to small hospitals with 30 staff; and
- Thirty-two of 36 health facilities complained of insufficient drugs.

The validity of the results may have been compromised by an under-representation of females among children screened; lack of interviews with mothers (the primary caregivers) and the lack of availability of a random sample; and the inevitable subjective element in the observation of clinical signs of undernutrition.

Infrastructure

The deteriorated status of Afghanistan's (rural) infrastructure is the direct result of war destruction, lack of maintenance because of the war, and natural events. The environmental significance of natural events has been dramatically demonstrated by conditions in the Helmand Valley (Assifi 1991). The valley was inundated this year by what appears to be a 100-year flood, which altered the course of the river channel in many places, washing out canal headworks, canals, agricultural lands, villages, and food supplies. Local populations, approximately 20 percent of prewar numbers, were forced to migrate from their homes.

In 1991 the O/AID/Rep cross-border program completed the following rural infrastructure repairs:

Irrigation canals:	VITA 2,700 km; CARE 100 km
Karez repairs:	VITA 378 km; CARE 12.5 km
Roads:	VITA 600 km; ACLU 180 km; CARE 45 km

Even in parts of Afghanistan that have not suffered such a calamity, infrastructure is in a poor state. A valid indicator is the decline in many regions of vehicle transportation. Baquee and Tacon (1989) reported in Badghis province that a large number of pack animals were being used instead of vehicles. The province's population of donkeys and horses, and to a lesser extent camels, had apparently increased during the war because of reduced vehicle transportation over much of the region and the necessity of maintaining food "imports." Trekking trails, typically no wider than a dinner plate, were reported to interconnect the region's villages to each other and to important neighboring centers by a maze of uncharted routes. Without the aid of these pack animals, the majority of villages in Badghis could not exist.

Where there has been incentive, legal or illegal, to rehabilitate roads, vehicle transport has returned. Anderson (1989) reported in Kunar that although the roads were in a poor state when the valley was liberated, they had been improved to almost the same level that existed before the war; this was contradicted by Assifi (1991), who visited the area in 1990 and found the roads to be in a deteriorated state. In many regions antitank mines were causing problems. In some cases the roads were better than had been anticipated because of repairs by private business interests involved in the export of timber to Pakistan. NGOs had also assisted in road repairs. Gully damage, however, is still a problem.

Although road rehabilitation is a primary infrastructural need, this example highlights associated environmental problems that can result from road expansion, including the potential erosion that can be caused by road building directly. Construction in the rainy season or improper construction methods can leave soils exposed unnecessarily. Improper drainage can ruin roads and have adverse impacts on adjacent lands. Even in low-rainfall regions, if the drainage system is improperly designed, a short but intense rain can erode large swaths downslope of the drainage ditches. Large-scale destruction also can occur through slips and landslides in steep regions. Erosion damages land and vegetation resources, and erosion can also cause serious sedimentation and siltation problems in nearby surface waters.

Domestic infrastructure in Afghanistan has always been minimal. Few regions had a potable/piped water supply before the war. Most people in irrigated regions relied on canals that pass through main villages in valleys.

The greatest private loss to farmers in most regions has been loss of their houses, because of either the lack of maintenance or the bombing.

Although the farmers are able to repair the walls themselves, they do not have access to roofing material. Because of a shortage of timber and the high prices encouraged by cross-border sales, traditional roofing timbers are beyond the means of most communities. These prices, and those of any alternative technology that might be adopted, may be another factor influencing the rate of return of the refugees. Alternative technologies for producing roof beams deserve careful consideration.[9]

The repair of domestic and irrigation infrastructure influences the permanent return of refugees, but it is far from being the only factor. All farmers interviewed by Anderson (1989) stated that security from bombing was the overriding factor. Most are content to return to Afghanistan, cultivate their lands, and return to Pakistan. At harvest time they return with their elder male family members. Depending on the yield of their harvests and the level of security, they decide whether they should start rebuilding their homes with a view to returning permanently. Only the farmers with reasonable land holdings (20 to 30 jeribs) seem prepared to take the risk, and even they are not sure that the time is right to bring their families back.

Except for a limited and old system serving approximately 50,000 people in Kabul, no sewerage system existed in Afghanistan before the hostilities. Information about whether this system is still functioning is not available.

Even before the invasion, urban water supply systems were limited to a few regions of Kabul. No information on the current conditions of these systems is available.

Energy

The dependence of Afghans on wood for fuel was discussed in the chapter on forest resources, which noted that soil degeneration caused by deforestation is principally the result of the inexorable demand for fuelwood. Wood accounts for at least 80 percent of the country's domestic energy supply (Balcome-Rawding and Porter 1989). The extensive and constantly increasing use of fuelwood for cooking and heating, along with the war's devastation, have left many forested regions ecologically devastated.

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[9]Using reinforced concrete in place of wooden roof beams is a possibility. O/AID/Rep advises of an appropriate technology which it believes can compress plastics of all kinds into strong roof beams at relatively low cost, using widely available plastics offal (Comments of O/AID/Rep on draft of Afghanistan Environmental Profile: Phase I, March 19, 1992). The feasibility of these and other apparently suitable technologies should be confirmed before major financial commitments to them are made.

As the population of Afghanistan's cities and towns increases, so does the need for wood for fuel and construction. Alternative energy sources, such as briquetted coal, oil, and electricity, have been introduced over the years but they are in limited supply in the cities and nonexistent in outlying regions. In regions where shortages of wood are severe, the population has resorted to extracting grasses and shrubs along with their roots from the earth.

Afghanistan has large reserves of conventional modern energy resources that have not been significantly damaged by the hostilities. The country has proven natural gas reserves of 120 to 150 billion m^3. Actual reserves are likely to be far greater. Exploitation was geared to export to the former Soviet Union. Gas is currently not shipped on a regular basis to the republics of the former Soviet Union, but most wells are in the hands of the government and are believed to be intact. The gas fields are in the north, and there is no national distribution grid. Oil exploration has been limited, and only limited fields have been discovered. However, the local geology makes the existence of deposits likely in the five major sedimentary basins:

1. Karakum Basin in northwest Afghanistan
2. Afghan-Tajik Basin to the northeast
3. Tirpul basin to the west of Hoard
4. The Helmand Basin
5. The Kundar-Urgun Basin in the south.

Total hydroelectric potential for Afghanistan is estimated at 2,500 MW, not including the massive canyons of Badakhshan through which the Amu Darya flows, which would greatly increase the hydroelectric potential of the region. The country's current actual electrical output capacity, however, is estimated at 400 MW. Hydropower accounts for 256 MW, thermal power for 48 to 60 MW, and diesel-generated power for the rest (Balcome-Rawding and Porter 1989).

Because of the war and the successful attacks of the *mujahidiin* against power stations and lines, only a small percentage of the installed capacity can be used. The condition of the power stations and the extent of repairs necessary to make them operational are unknown. Power shortages in Kabul during the winters of 1988 and 1989 were severe. Two million people reside in Kabul. Even before the war, when the population was less than 1 million, electrical shortages were frequent. To offset this shortage, the Kabul regime has purchased hundreds of diesel generators to cover some of their electrical supply needs.

Chapter 4

MAJOR ENVIRONMENTAL CONCERNS

Introduction

This chapter addresses both direct and indirect environmental concerns. Direct concerns pertain to the condition of the environment; indirect concerns pertain to factors that inhibit actions to protect the environment and promote the sustainable use of natural resources. Direct concerns include problems such as the condition of the forests, grasslands, and public health. Indirect concerns include the absence of a national government in control of the whole country, the educational level of the people, and the state of irrigation and other agricultural infrastructure, roads, and communications on which effective action depends.

Major environmental concerns are related to conditions during two time periods: (1) now and (2) the period when hostilities substantially cease and resettlement of people begins in earnest. The underlying issues during both periods are of responsibility to a longer-term future when Afghanistan must live with decisions that may have been made considerable urgency.

Data

The first obstacle is the almost complete lack of comprehensive and accurate data on which to base a workable strategic plan. As described previously, there is a great deal of anecdotal data but little firm information, particularly on the state of natural resources such as the forests, grasslands, and wildlife.

Direct Concerns

Vegetation

Two types of vegetation are examined: vegetation and grasslands.

Forests

Existing Conditions. Proper management of natural forests can and should support sustainable production of a range of products, protect watersheds from erosion and flooding, conserve biological diversity, and provide livelihoods. Forests that are managed properly can furnish a continuous supply of timber and other commercial products indefinitely. Maintaining an area under forest cover controls erosion, stabilizes slopes, moderates stream flows, protects aquatic environments, maintains soil fertility, preserves wildlife habitat, and provides nonwood forest products that are important to local economies and households.

The antithesis of good management practices has occurred in many parts of Afghanistan, and the results are evident. Forests have been degraded to secondary forest growth, scrub, or wasteland. Inadequate or entirely absent forest management has allowed erosion to spread, hydrology patterns to be disrupted, genetic resources to be diminished, and socioeconomic problems to intensify.

Environmental degradation resulting from the current cutting of trees has been particularly serious in provinces bordering Pakistan. Timber harvesting directly affects water resources. Surface runoff increases after harvesting, leading to larger and more rapid storm surges in rivers. Decreased infiltration and groundwater recharge and increased evaporation and storm runoff in the wet seasons affect base flow, lowering stream flow in drier periods. Increased erosion increases sedimentation in rivers and lakes. Stream crossings for logging operations cause direct sediment increases. Logging also affects wildlife by destroying habitat, cutting up migration corridors, increasing poaching pressures and problems of noise and pollution, and causing hydrologic changes that affect aquatic systems. The greater runoff has arguably contributed to a decline in water available in the *karez* system, limiting the amount of irrigation water available and further reducing agricultural production.

As previously explained, before the hostilities, forests were being cut down faster than they could regenerate. Since that time there have been reports of extensive cutting of the timber forests, especially those near the Pakistan border. There has been little, if any, reforestation. Shrub forests used for fuelwood in depopulated regions may have recovered somewhat. The most likely scenario is a significant loss of the timber forest lands present before the hostilities. The probable size of remaining forests in

remote or inaccessible regions is not known, but it is likely that sufficient forests remain to warrant preservation. No reports of the existing conditions of the pistachio and shrub forests are available, but it is possible that they have recovered somewhat. The scenarios for them parallel those developed for grasslands.

Impacts of Resettlement. Roof beams are essential in Afghanistan's earthquake zone. Outside the earthquake zone, particularly in southern and western regions of the country, arches are frequently used as a form of roof support. Figure 20 shows the geographical distribution of the variety of typical Afghan housing construction. Regions in which wooden house walls are common (generally near forests) form a relatively small percentage of the country's area, but are particularly important for refugee return.

Houses in the border province of Kunar are built of timber. This province has been the scene of much fighting, and many houses there have probably been destroyed. It also contained a large proportion of the country's timber forests and is a region in which timber cutting has occurred on a large scale for export to Pakistan during the hostilities. Houses throughout the east and northeast are traditionally built with timber or wooden roofs.

Trees grown under irrigation (mostly poplars), rather than natural forests, are the sources of wood for housing in areas of Afghanistan that are remote from forests. Many irrigated trees have been destroyed either by cutting or as a result of the deterioration of Afghanistan's irrigation systems. Reconstruction and resettlement will create a heavy demand for timber from forests, to be used to replace and repair damaged structures. Reopening roads will open access to currently inaccessible regions. Resettlement will also result in pressure to exploit all types of forests and trees as a source of fuelwood and cash income.

Grasslands

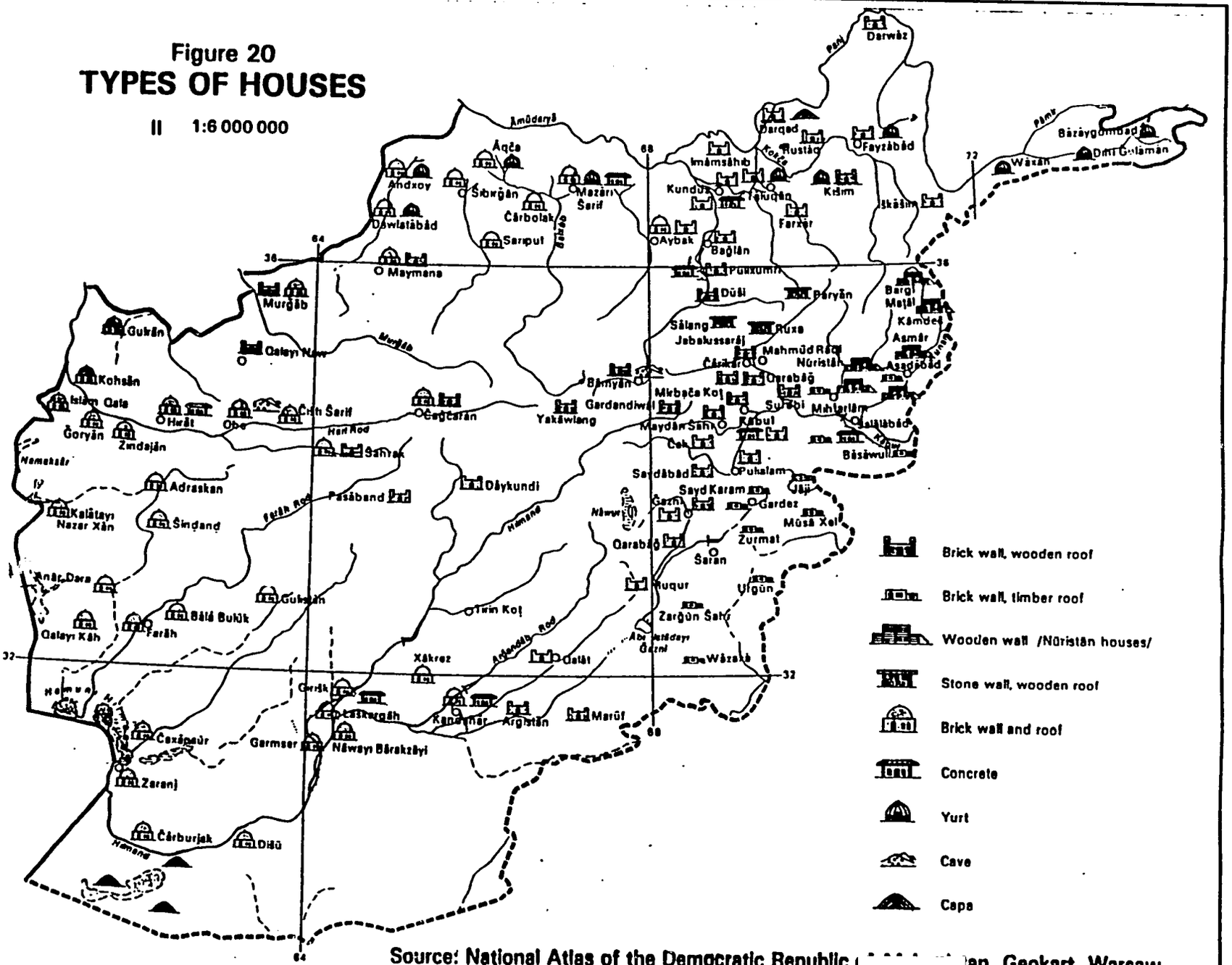
Existing Conditions. At the time of the invasion, Afghanistan was reported to be suffering from overgrazing, especially in winter grazing regions below 1,000 m in elevation, resulting in desertification in parts of the country. There is no information from which to determine whether this process has continued at the same pace, slowed, or ceased since the invasion. As discussed previously, overgrazing leads to reduced productivity of grasslands and loss of soil that results in long-term degradation.

To combat grassland degradation, grazing needs to be controlled. Extensive livestock production, particularly pastoralism, is an appropriate and sustainable form of land use. In fact, grazing and rangeland vegetation are co-adapted; both undergrazing and overgrazing (which results in the growth of woody plants and large, unpalatable grasses) reduce the productive potential of a region. Grazing helps maintain soil fertility and physical soil

Figure 20

TYPES OF HOUSES

1:6 000 000



Source: National Atlas of the Democratic Republic [illegible]an, Geokart, Warsaw.

characteristics by the depositing of dung. Also, the germination of certain plants is enabled or enhanced when seed is passed through the digestive tract of animals. Livestock production, therefore, represents a system of land management in marginal regions that can maximize food production with minimal input while maintaining the productivity of the ecosystem.

One or more of the following four scenarios may characterize range conditions in Afghanistan:

1. The rate of overgrazing, soil erosion, and desertification may have increased because of a failure to apply range management practices and an increase in the use of pack animals to carry munitions and replace lost road transport.[10]

2. Overgrazing may be continuing, but at a slower rate than before the Soviet invasion.

3. Grazing may be in effective balance with the carrying capacity of the rangelands, maximizing the processes of fertilization and regeneration.

4. Grazing may have effectively ceased in some areas, allowing plant life to recover but without the benefit of the regeneration and fertilization afforded by proper grazing.

All four scenarios may exist in different parts of the country. As mentioned previously, regions adjacent to lines of commerce and communication and regions in which people have taken refuge may have suffered extensively. In other regions the process may have slowed or ceased. Regions that have become effectively depopulated will probably have recovered somewhat, including the extensive minefields to be found throughout the war zones.

Impacts of Resettlement. Resettlement of people and their herds in rural regions will obviously greatly increase the pressures on rangelands. Conversely, the re-establishment of road links, cessation of hostilities, and return of refugees from remote rural regions will decrease grazing in some regions. Some information about the place of origin of refugees in Iran and Pakistan is available. No similar information has been found on internal

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[10]Except along major lines of communication and in remote regions settled by refugees from war zones, this scenario is unlikely because such a large proportion of the rural population have left their homes, often with their herds, and pressures on grasslands should therefore have decreased. (In 1988, the United Nations reported that 2 million domestic animals were in refugee camps.)

refugees, but anecdotal information indicates that some knowledge about their places of origin may be available.

Wildlife

Existing Conditions. There is no information about the existing condition of wildlife, but it is suspected that large mammals are largely confined to remote uninhabited regions.

Impacts of Resettlement. Resettlement may increase pressure on wildlife.

Soil Erosion

Soil erosion is a natural process that has been greatly accelerated by human activities. It can be caused by livestock rearing, agriculture, deforestation of mountain slopes, and construction. It is likely to be a particularly severe problem in Afghanistan because the country is mountainous. Soil erosion leads to a loss of land productivity, loss of or damage to agricultural fields, sedimentation of rivers and streams and consequent damage to aquatic life, and siltation of lakes and reservoirs.

Existing Conditions. Soil erosion has probably followed the pattern of overgrazing, deforestation, agriculture, and road construction. Deforestation and the associated construction of logging roads are reported to have continued at a rapid pace, accelerating soil erosion in the timber forest regions near the Pakistan border. Conversely, soil erosion may have decreased in woodlands and grasslands that have been depopulated. The abandonment of fields and irrigated and dry farming areas is likely to have increased the rate of erosion. The collapse of abandoned canals and terraces will lead to gullying and erosion. Ploughing in dry farming areas helps to retain soil moisture, reducing runoff and erosion.

Impacts of Resettlement. Unplanned resettlement in rural regions is likely to accelerate soil erosion, while properly operated farming systems could reduce it.

Pesticides

As discussed in Chapter 3, extensive infestations of locusts and sunn-pest are reported. The use of BHC, a pesticide banned in both the United States and the former Soviet Union, is reported as a means to control it. This poses a potential danger to the health of the population and the environment. The impacts of using BHC have not been investigated. According to the Swedish Committee for Afghanistan, the seriousness of the outbreaks are attributable, at least in part, to altered agricultural practices and other effects of wartime conditions.

Public Health

Existing Conditions. Chapter 2 discussed the large-scale breakdown in rural health services, epidemic levels of malaria in malaria-prone regions, and an increase in endemic diseases such as tuberculosis. Many people, particularly those who have taken refuge in remote rural regions, suffer from nutritional problems. Depopulation and lack of maintenance causes water ponding in irrigated fields, resulting in breeding grounds for mosquitoes and an increase of malaria and other water-borne diseases.

Impacts of Resettlement. Rural health problems are likely to be exacerbated by the return of large populations with significant health problems to rural regions without adequate health services.

Environmental Infrastructure

Existing Conditions. Safe drinking water systems are lacking in both rural and urban regions. Centralized urban sewerage systems are virtually nonexistent.

Impacts of Resettlement. Resettlement is unlikely to change the situation but will require at least the rehabilitation and expansion of existing systems.

Energy

Existing Conditions. Wood accounts for at least 80 percent of the country's domestic energy supply (Balcome-Rawding and Porter 1989). The extensive and constantly increasing use of fuelwood for cooking and heating and the war's devastation have left many forested regions ecologically devastated.

As the population of Afghanistan's cities and towns increases, so does the need for wood for fuel and construction. Some alternative energy sources, such as briquetted coal, oil, and electricity, have been introduced over the years but they are limited in supply in the cities and nonexistent in outlying regions. In regions where shortages of wood are severe, the population has had to resort to extracting grasses and shrubs with their roots from the earth. Dung is also used. The use of dung deprives rangelands of needed fertilization and therefore tends to be environmentally damaging.

The end of the war and the eventual return of refugees will be accompanied by an increased need for construction timber and especially for fuelwood, further straining Afghanistan's forestry resources. The majority of the refugees are from those regions where the last forest sites are located. If prompt action is not taken and clear and concise planning is not implemented, further devastation will result.

Impacts of Resettlement. Resettlement in rural regions will lead to increased pressure on forests and rangelands.

Air Quality

No information on air quality problems in Afghanistan has been located. Air quality problems may not currently be serious, but the burgeoning populations of urban centers, and Kabul in particular, pose a threat to air quality. Because Kabul is in a mountain valley, it is prone to air quality problems. The return of peace is likely to significantly increase the population, and therefore the use of motor vehicles and fuel for heating and cooking. This issue needs to be investigated further.

Indirect Concerns

When peace is eventually achieved, Afghanistan will face an enormous reconstruction task with fewer qualified experts than it had before the invasion. Some experts may be politically unacceptable because of their former associations with the government. There will be few experts to support labor-intensive services in rural regions, and it will be hard to attract and retain good staff in these regions.

The resettlement of large numbers of refugees in rural regions will, as previously discussed, add substantially to the pressures on natural resources. In particular there will be a great demand for timber for reconstruction and repair. People returning from refugee camps may well initially suffer a significant level of deprivation and are unlikely to receive much support from stretched government services. Such deprivation is likely to aggravate the problems of resource degradation in rural regions.

Chapter 5

POTENTIAL MITIGATION MEASURES

Introduction

This chapter examines the situation and possible approaches to mitigating principal environmental concerns. It also addresses data needs and means of obtaining data to support a rational policy.

The major issue overhanging any plan is the resettlement of as many as 6.5 to 7 million refugees (4.5 million in camps in Pakistan and Iran, 2 million in urban regions in Afghanistan, and 0.5 to 1 million in remote rural regions) in a country with a current population of approximately 12.5 million. Many of these refugees have been uprooted for as long as 10 years, and more than 1 million were born as refugees without any experience of their parents' original homes.

Afghanistan is in transition from a historically feudal, rural-based society to what will eventually become a modern urban society. Labor shortages are currently reported in many agricultural areas. Nevertheless, with an expanding population and the availability of modern labor-saving agricultural technology, it is unlikely that the existing land can efficiently carry the existing population in addition to the return of all refugees. The return of substantial numbers of refugees without the reconstruction of infrastructure and the implementation of sustainable farming systems is likely to cause significant additional degradation to the environment, reduce Afghanistan's long-term ability to feed itself, and place an added strain on the country's weak institutional systems.

The current efforts of A.I.D., other donor agencies, and NGOs are aimed primarily at the rehabilitation of agricultural systems, particularly the irrigation systems that produce the bulk of the country's crops. However, these meritorious efforts are not extensive enough to accommodate the resettlement of the entire refugee population.

Much current thinking concerning resettlement reflects the notion that most of Afghanistan's internal and external refugees "will" or "should" ultimately return to their places of family origin in the countryside. Such thinking is frequently accompanied by the premise that substantial numbers of refugees "won't" or "shouldn't" return until political, security, and economic conditions are favorable. That premise assumes that refugees will have good alternatives: that they will be maintained by international donors or others for as long as is necessary to establish acceptable return conditions or that they have other means for sustaining themselves until the way is paved for their reinstallation in the Afghan countryside.

Prospective political, security, and economic conditions are very difficult to predict. However, whatever the potential configuration, responsible environmental analysis should challenge any notion that automatic balancing mechanisms can be counted on to establish a favorable equilibrium between returning refugees and Afghanistan's environment.

Farmlands, rangelands, and forestlands have optimum configurations of human utilization, as do cities and towns. Given the shocks and changes affecting Afghanistan and its population since the communist coup in 1978, assumptions concerning the size, location, and time of refugee return deserve careful scrutiny in order to develop an effective strategy to protect the environment.

The simplest and most direct way to reconcile the environmental implications of resettlement is to focus on the carrying capacity of the land, looking at the country as a whole, its various regions, and its individual localities. At this time, the study team doubts that the country can sustain its environmental endowment and support its total population, inside and out, without substantial investment and sustained support for resettling Afghans over a period of at least a decade. Given the current state of preparations for resettlement, the present and prospective environmental problems of the cities will need particular attention. Uncertainties concerning return scenarios are of course inevitable. Under the circumstances, development officials and prospective decision-makers can most effectively prepare themselves to protect Afghanistan's environment by assembling and analyzing information on the human carrying capacities of the land.

This report does not undertake to recommend a single solution, but rather indicates possible program directions and suggests areas of further investigation in order to develop a coordinated policy to resettle people that will protect the environment while maximizing the long-term benefits to the people.

Policies for Resettlement and Reconstruction

In 1978 the estimated sedentary and nomadic rural population of Afghanistan was 12.5 million. Today the estimated rural population is 9.3 million (based on 75 percent of the UNIDATA 1990 in-country population estimate), of which 500,000 to 1 million are displaced from their homes. There are 6.5 million refugees in camps in Iran and Pakistan and in the urban centers of Afghanistan. The vast majority of these are reported to be from rural regions. Assuming that all return home, the rural population could increase to approximately 15 million. No study has been undertaken to support this view, but it is reasonable to postulate, on the basis of the degradation of the environment by the 1978 population, that if such a large population returned, it would overload the land. Therefore, the first priority is to determine the carrying capacity of the land.

The capacity of rangelands and dry farming lands is limited. Investments will be needed in rural education, health services, rangeland management, and agricultural support in order to create conditions that will bring an expanded rural population into better balance with its environment.

The irrigated regions, which provide the bulk of the food production, can presumably be expanded in terms of both production and extent, given the necessary investments and inputs. The first priority is the rehabilitation of existing and former irrigated areas. Another necessary major input is the development of water resources. Afghanistan has an estimated developable hydroelectric capacity of 5,000 MW (including a portion of the Amu Darya) compared with an installed design capacity of 537 MW. Hydropower, a sustainable form of energy production, is environmentally sound in principle. Hydropower schemes can often be combined with irrigation in multipurpose river basin development schemes. New small-scale hydropower, mini-hydropower, and micro-hydropower[11] sites and schemes should also be carefully considered, as appropriate. These potentials need to be investigated fully. As part of such investigations, the potential negative environmental impacts of specific projects, such as effects on agricultural development,

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[11]Opinions differ on the definition of "small", "mini", and "micro." An industry publication defines "small" as less than 10 MW, "mini" as less than 1 MW, and "micro" as less than 0.1 MW. See "Small Hydropower Resources Survey," *International Water Power & Dam Construction* (Surrey, U.K.: Vol. 43, No. 5, May 1991), p. 27. Development agencies often limit the definition of "small" to less than 5 MW. See K. Goldsmith, "The Case for Small Scale Hydropower," *International Water Power & Dam Construction* (*op. cit.*, May 1991), p. 12.

flooding of human settlements and natural areas, impacts on aquatic life, and public health concerns, need to be investigated.[12]

The return of refugees to their homes can be controlled to a limited extent. Each family is likely to make its own decision about whether and when to return, on the basis of changing circumstances. Issues such as security, prospective economic benefits, and opportunities for children are likely to play a part. Incentives and disincentives can be provided to guide resettlement in a desired pattern, but these are limited by political acceptability and available funding for resettlement purposes. Strategies that take these constraints into account will have to be developed. It is likely that a significant number of refugees will not willingly return home because they will have lost familiarity with their homeland and may perceive their refugee status as an economic improvement.

A major constraint on the successful resettlement of such a large population will be the lack of trained cadres to support services. Once a national government has been established, there is likely to be relatively little incentive for available cadres to go to remote regions when conditions in urban regions, particularly Kabul, are likely to be much better.

These considerations emphasize the necessity for an economically, administratively, and environmentally sound strategy of developing policies that seek to match the return of refugees to the carrying capacity of the land and the redevelopment of the irrigation system. The question is raised of how to address the problem of refugees who do not return to the countryside. If they are not integrated as quickly as possible into a modern urban economy, they may remain refugees for generations. Unfortunately, most are poorly equipped socially and educationally for this integration, and many are likely to become urban slum dwellers with little contribution to the economy but a substantial contribution to political instability. However, they may well cause less long-term damage to the environment as urban slum dwellers than as similarly poverty-stricken rural dwellers.

A combined policy of supporting rural development to maximum carrying capacity of the land and simultaneously encouraging economic development in urban regions is needed. The major short-term constraint is support in a resettlement program. However miserable the refugee camps are, they do provide basic requirements of food and medical services at no cost or effort to the inhabitants. Resettlement support must therefore include,

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[12]With respect to small hydro schemes, see the account of the International Conference, "Small Hydro, 1990" held in Kuala Lumpur, Malaysia in *International Water Power & Dam Construction* (Surrey U.K.: Vol. 43, No. 2, February 1991), pp. 37-46, particularly the remarks of K. Goldsmith, former Inter-Regional Advisor to United Nations on Small-Scale Hydropower, and S. Husebye of the Norwegian Water Resources and Energy Administration.

at least, food supplies until agricultural systems can be put into operation, construction materials and equipment for reconstruction, seeds and fertilizers, medical services, roads, and the necessary technical assistance to people who may have lost their familiarity with farming techniques.

The implementation of an effective and environmentally sound resettlement program, such as the one described, will require the return of peace, the formation of an effective national government committed to such a resettlement program, and a major aid program from the world community. There is good reason to doubt that any of these requirements can be met in the near future. The impact on the regional environment of a failure to meet these requirements has not been studied, but is of significant concern. Sadly, potential scenarios include the spread of strife to Pakistan and the forced expulsion of refugees without any plans for their reception.

The major short-term constraint on rural development is water availability; the primary constraint in urban regions is affordability of energy. Multipurpose river development can provide both. A national study of Afghanistan's water resources is needed to determine an economically sound plan for their development that will address the needs of both urban and rural regions. Water resources will be addressed in another report.

A major threat to the environment is the national need for firewood as an energy source for both heating and cooking. This need will not diminish if refugees are relocated in urban regions; in fact, demands for high-quality wood from timber regions relatively close to Kabul could increase. Providing alternative energy sources to rural people so soon will be difficult. Various programs have been proposed to provide alternative fuel, including coal briquettes, bottled gas, and electricity production from renewable energy sources, for cooking and heating for urban dwellers. Some have even been implemented. The issue of fuel for urban dwellers deserves a high priority. If coal briquettes are to be promoted, the question of air quality also needs to be addressed. Smokeless briquettes could be manufactured.

A concentration of people in urban regions will necessitate planning and developing infrastructure to accommodate them. Environmental standards must be developed and implemented if water quality and air quality are to be protected. The cost of providing adequate environmental infrastructure including water supply, sewerage, and waste disposal will be very high. Major problems in financing such systems must be confronted. Master plans that prioritize the needs for infrastructure in the development of urban regions are needed. In addition, national standards should be established for such issues as air emissions from vehicles and on-site disposal of sewage.

Recommended Environmental Guidelines

The multiple specters of political instability, extreme poverty, and ecological disaster loom large over Afghanistan as they do over much of central Asia. Prospects for an extended period of political turmoil pose substantial challenges to environmental programs, as they do for refugee resettlement and national reconstruction activities.

According to the *World Development Report* 1992,[13] the stakes in formulating and executing sound environmental policies can be very high, as illustrated in Exhibit 1. As the World Bank points out, the Aral Sea, which relies heavily on water from the Amu Darya River, is dying. While Afghanistan itself does not yet face an environmental crisis of the magnitude of the Aral Sea disaster, serious problems nevertheless impend. Such problems are much less expensive—in terms of financial assistance and human lives—to prevent than they are to cure.

Afghanistan's poverty, political instability, and environmental deterioration are a vicious circle. Reversing the pattern requires vigorous action on the environmental and other fronts.

General guidelines for the Government of Afghanistan follow. More detailed measures should be identified in Phase II of the Environmental Profile, in other studies, and in governmental deliberations. Recommended guidelines for environmental action are as follows.

1. The Government of Afghanistan, with support from donors, should address problems of environmental policy, regulation, and institutional responsibility immediately.

The introduction of environmental policies, regulations, and institutions should not be deferred until the Government of Afghanistan has full control over the countryside, a process which may take many years. An appropriate environmental program can and should be initiated in cities and rural areas over which the Government is able to exercise authority. Some measures should be implemented immediately. Others can be identified now as part of an environmental strategy that can be put in place as soon as conditions permit.

2. Local populations should be involved in designing and implementing environmental programs.

Environmental quality is prized in all societies, but circumstances and preferences differ. Local participation in design and implementation increases

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[13]The World Bank, *World Development Report 1992: Development and the Environment*, (New York: Oxford University Press, 1992), p. 38.

Exhibit 1. The Aral Sea: Lessons from an Ecological Disaster

The Aral Sea is dying. Because of the huge diversions of water that have taken place during the past 30 years, particularly for irrigation, the volume of the sea has been reduced by two-thirds. The sea's surface has been sharply diminished, the water in the sea and in surrounding aquifers has become increasingly saline, and the water supplies and health of almost 50 million people in the Aral Sea basin are threatened. Vast areas of salty flatlands have been exposed as the sea has receded, and salt from these areas is being blown across the plains onto neighboring cropland and pastures, causing ecological damage. The frost-free period in the delta of the Amu Darya River, which feeds the Aral Sea, has fallen to less than 180 days—below the minimum required for growing cotton, the region's main cash crop. The changes in the sea have effectively killed a substantial fishing industry, and the variety of fauna in the region has declined drastically. If current trends continued unchecked, the sea would eventually shrink to a saline lake one-sixth of its 1960 size.

The ecological disaster is the consequence of excessive abstraction of water for irrigation purposes from the Amu Darya and Syr Darya rivers, which feed the Aral Sea. Total river runoff into the sea fell from an average 55 cubic kilometers a year in the 1950s to zero in the early 1980s. The irrigation schemes have been a mixed blessing for the populations of the Central Asian republics—Kazakhstan, Kyrghyzstan, Tajikistan, Turkmenistan, and Uzbekistan—which they serve. The diversion of water has provided livelihoods for the region's farmers, but at considerable environmental cost. Soils have been poisoned with salt, overwatering has turned pastureland into bogs, water supplies have become polluted by pesticide and fertilizer residues, and the deteriorating quality of drinking water and sanitation is taking a heavy toll on human health. While it is easy to see how the problem of the Aral Sea might have been avoided, solutions are difficult. A combination of better technical management and appropriate incentives is clearly essential; charging for water or allocating it to the most valuable uses could prompt shifts in cropping patterns and make more water available to industry and households.

But the changes needed are vast, and there is little room for maneuver. The Central Asian republics (excluding Kazakhstan) are poor: their incomes are 65 percent of the average in the former U.S.S.R. In the past, transfers from the central government exceeded 20 percent of national income in Kyrghyzstan and Tajikistan and 12 percent in Uzbekistan. These transfers are no longer available. The regional population of 35 million is growing rapidly, at 2.7 percent a year, and infant mortality is high. The states have become dependent on a specialized but unsustainable pattern of agriculture. Irrigated production of cotton, grapes, fruit and vegetables accounts for the bulk of export earnings. Any rapid reduction in the use of irrigation water will reduce living standards still further unless these economies receive assistance to help them diversify away from irrigated agriculture. Meanwhile, salinization and dust storms erode the existing land under irrigation. This is one of the starkest examples of the need to combine development with sound environmental policy.

the likelihood that the environmental measures adopted will be suitable and effective. A realistic environmental program that takes local views into account can demonstrate the Government of Afghanistan's will and capability to pursue common objectives and thereby enhance the political and economic reintegration of the country.

3. Projects that combine positive economic and environmental effects should be given high priority during resettlement and reconstruction.

Public and private investments in projects such as water supply, sanitation, and soil conservation can have positive net economic benefits even when environmental benefits are not considered. Such "win, win" projects should be assigned a high priority during resettlement and reconstruction.

Given the possibility that the government's span of control in remote areas may be limited for some time to come, urban and village drinking water supplies merit particular attention. Well drilling, preceded by suitable technical analysis of effects on aquifers, is one activity that may have considerable potential for the private sector in Afghanistan.

4. Unfavorable environmental impacts of resettlement and reconstruction projects, along with suitable mitigation measures, should be clearly identified.

Resettlement and reconstruction projects should be environmentally sustainable, as well as sound in other respects. Large-scale projects deserve special scrutiny, particularly those that move substantial numbers of refugees; irrigation; land clearing; mineral development projects; and the manufacture, transportation, and use of pesticides. Mitigation measures should be included where unfavorable environmental impacts are foreseen and when they emerge during the course of implementation.

5. The Government of Afghanistan should avoid subsidies, legal preferences, and institutional perquisites that impede attainment of environmental objectives.

Whatever the geographical limitations of its authority, the new Government of Afghanistan will have control over most state enterprises, the allocation of environmental responsibilities within its own ministerial structure, and its own budget. Simply curtailing the privileges of government-owned industries, eliminating subsidies, and encouraging competition can have a beneficial effect on the environment.

The Government should not provide water, fuel, and agricultural input subsidies to consumers and farmers. State industries should be required to use resources more efficiently. Replacing state monopolies by private sector market competition not only encourages efficient use of resources but also permits the government to become a more objective environmental regulator.

6. Land and water ownership rights should be clarified. Local private or communal ownership of resources usually should be preferred over state ownership, but innovative combinations of local and national control for protection of environmental assets should also be considered in suitable circumstances.

Resources to which people have cost-free access—such as air, water, forests, and rangelands—are much more likely to be depleted or degraded than those that are more tightly held and exclusively utilized. Tenant farmers and absentee landlords may lack incentives to sustain and improve the land. Control by those who permanently reside on the land and have a long-term stake in the continued productivity of a resource usually provides a strong motivation for its maintenance and preservation. Conventional state ownership has seldom been effective in protecting commonly used resources in the

Third World. It is likely to be particularly ineffective under Afghanistan's present circumstances.

Recent experience in some countries suggests that national and local efforts at resource preservation can be combined effectively; Nepal and Zimbabwe have integrated conservation and development projects that use buffer zones around protected areas to generate income and limit encroachment. Reliance on guards and patrols to preserve forests and ecological areas is being supplemented with protective measures devised and implemented by local communities. Regulation of the environment has deep roots in the traditional practices of Afghan communities. There are significant potentials for combining traditional methods with others in Afghanistan as well.

7. The Government of Afghanistan should use economic criteria and market mechanisms to achieve environmental objectives whenever feasible.

"The polluter pays" is a sound principle wherever it can be well defined and consistently enforced. Stumpage fees fully equivalent to replacement costs should be exacted in forests that the Government is able to control. A scheme under consideration in Thailand would finance disposal of hazardous wastes from charges levied on waste generators. Such a scheme is probably too complex for Afghanistan's circumstances, but simplified variations could be considered in the future.

The market mechanisms most suitable to Afghanistan's present circumstances appear to be those of adopting policies that permit the prices of important goods to reflect their full normal costs. Irrigation water, nitrogen fertilizers, pesticides, coal, gas, petroleum, and electricity are good candidates for this treatment.

8. The government should promptly address major threats to public health, particularly those posed by inadequate water supplies, poor sanitation, or improper disposal of hazardous waste in Afghanistan's cities.

Conditions that could cause epidemics or major public health problems should receive prompt attention in the form of remedial action and regulation. Projects should be identified for priority donor assistance.

An effectively executed program of action and regulation can demonstrate that government authority and resources are being used to protect the health of all groups in the community and to allocate shared resources fairly. Conversely, inability to deal with public health problems could be regarded by the population as inability to govern.

Public health regulations should include standards that are generally understandable and attainable. Once issued, they should be enforced uniformly.

9. The government should establish a framework for heading off future urban environmental problems, particularly those that may be expected to affect Kabul.

Resettlement plans to the contrary notwithstanding, the process of refugee return could result in a rapid expansion of the population in Afghanistan's major cities, particularly Kabul. Population increases could lead to a host of environmental problems, which would in turn add to future political instability. If the basic structure of urban pollution control is not established early, it is likely to produce insuperable problems in the future.

Measurements of air quality in Kabul should be undertaken promptly. Consideration should be given to applying rudimentary standards for controlling noxious emissions from vehicles to forestall heavy investment in fleets that violate such standards.

In the past, Afghanistan exported to the former Soviet Union almost all its offtake of natural gas, a fuel that has fewer deleterious environmental impacts than biomass and coal. Air quality in Afghanistan's cities should be taken into account in assessing alternatives for the future use of Afghanistan's natural gas resources and in examining the possibility of connecting Kabul to gas wells in the north by pipeline.

10. The Government of Afghanistan should specify the environmental responsibilities of its Ministries and subsidiary organizations and establish a central capability to set environmental priorities and monitor progress toward attaining environmental objectives.

A central capability within government, however austere at the start, should set environmental priorities and monitor progress at arm's length from implementing agencies. Environmental objectives and accountability should be established for ministries that have key responsibilities in areas such as public works, agriculture, water resources, and industry. Area-wide coordination of projects and regulations should be undertaken for urban areas, watersheds, and river basins, when feasible.

Environmental programs will require public funding, specialized technical skills, and competence in writing clear and enforceable regulations. Foreign assistance in these areas is required in the short run. Training programs should prepare Afghans to undertake these responsibilities on their own as soon as possible.

Training

This report has indicated a combination of needs for extensive institution building for a population that has a reduced educational capacity as

a result of the hostilities, compounding its already low level of basic education and shortage of trained cadres in 1978. The measures outlined previously will require many professionals skilled in environmental management and a capability to provide field-level understanding of environmental issues and techniques for sustainable use of natural resources. A training program starting now could help to provide the personnel needed when the hostilities cease.

Chapter 6

USE OF THE GIS DEVELOPED UNDER THE ASSP

Data Available from the Existing Program

A geographic information system (GIS) is a means of coding various types of geographic information into a computer base. This information could cover anything from population data to elevation contours. Each set of data is known as a layer. Each layer can be retrieved and displayed in tabular or map form and can be combined with other layers for a particular type of analysis. For example, if population and contours are recorded, the population densities of regions with a slope of less than 5 percent could be displayed. Quite obviously, the value of a GIS system is dependent on the amount and accuracy of the data stored. In the case of Afghanistan, the availability and accuracy of data are limited.

A GIS was established by the Office of the United Nations Coordinator for Humanitarian and Economic Assistance Programmes relating to Afghanistan (United Nations 1988). Although intended to be an extensive system, it was limited to population data (UNIDATA 1990). Because no accurate population estimates for Afghanistan exist, the estimates in the database have an accuracy range of ±30 percent (Helms 1991).

A more extensive GIS is being developed by A.I.D. contractor DAI/Earthsat under the Agricultural Services Support Program (ASSP). The DAI/Earthsat GIS was reviewed under this task order in order to determine its applicability to the environmental analysis of Afghanistan. This system stores the following data.

Population
- Population by district
- Population adjusted for refugee loss
- Home regions of refugees in Pakistan

Wheat production
1991 estimate

Climate
Growing degree days
Chilling hours
Snowpack 1990-1991

Physical data
1990 landcover:
Irrigated agriculture
Rainfed agriculture
Forest
Barren land
Water
High density settlements
Drainage basins
Soils
Roads
Canals
Karezes

Political
Districts
District centers
Provinces
Bazaars

The population data are likely to suffer the same problems of accuracy as the UN data.

The ASSP contract and its outputs are specifically aimed at agricultural support. Therefore, the ASSP tends to concentrate on key agricultural areas and presents data about these areas on a micro scale rather than on a countrywide basis that would be of value in environmental analysis.

The data source of primary interest for environmental study is the landcover map currently being prepared by Landsat Thematic Mapping (TM) remote-sensing data. This map is expected to provide an accurate delineation of the forest cover, particularly of timber forests.

Unfortunately, it cannot provide valuable information on the state of the grasslands—the Landsat image signal for healthy grassland in a dry period cannot be distinguished from that for poor quality grassland in a rainy period.

Data That Could be Obtained from Further Development of the Program

Data about both forests and grasslands are important in the development of an environmental program for Afghanistan. As discussed previously, the existing GIS program is producing a landcover map that will delineate current forest cover but not grasslands.

Extensive discussions were held with DAI subcontractor Earthsat to determine how the GIS could best be adapted to the needs of environmental analysis. Three areas were identified: grasslands, forests, and urban expansion.

Because the existing Landsat-based landcover maps will not provide meaningful data on grasslands, Earthsat suggested the Advanced High Resolution Radiometer (AVHRR) data as an alternative. These data, which come from a weather satellite, have been available twice a day since 1978 and cost relatively little. By selecting a series of days spread over four months following the rainy season over each of the 14 years from 1978 to 1991 inclusive, a good evaluation can be made of trends in the grassland quality and productivity over the period of the hostilities. The AVHRR provides a measure of the level of chlorophyll in plant life, which is in turn a good measure of quality of grasslands. By combining the signal strength with the extent of grasslands cover, a good measure can be made of trends in grasslands quality between 1978 and 1991. The resolution is only 4 km, compared with 30 m for Landsat TM data, but this is not considered important. By comparing the AVHRR-generated assessments with rainfall data, an estimate can be made of the relationship between variations in rainfall, human activities, and the status of the grasslands.

A comparison of forest cover in 1978 with 1991 would be valuable; it would determine the extent of removal of timber forests and indicate whether any extension of scrub forests has occurred as a result of the lower demand for fuelwood. Earthsat has therefore proposed to undertake an analysis of 1978 forest cover based on Landsat MSS data with the 1990-1991 landcover data already in the GIS database.

Using the same comparison of 1978 Landsat MSS with current data, it will also be possible to determine the level of expansion of the major cities that is due to the influx of refugees, which will be useful in planning rehabilitation programs.

There are only two types of remote-sensing mapping systems commercially available now: the U.S. system, Landsat, and the French SPOT. The SPOT satellites commenced operation in 1985; only the Landsat was available in 1978. The Landsat system used in 1978 was the multi-spectral scanner (MSS). The current system is known as the Thematic Mapper (TM). The differences between the MSS and TM systems are (1) the MSS has a

resolution of about 80 m whereas the TM has a resolution of 30 m and; (2) the MSS picks up signals in four wavebands; the TM picks up signals in seven wavebands. Data from the two systems are comparable, allowing interpretation of changed conditions.

Remote sensing can be used in two forms, digital or false-color photography. In the digital form each pixel is coded for the strength of reflectance in each waveband. A computer program can be used to determine ground cover using a statistical interpretation. This requires "ground-truthing" in order to relate specific signals to types of ground cover and to calibrate the interpreting program. In false-color photography, specific colors are allocated to certain wavebands and a visual interpretation can be made. This approach was taken by Earthsat to determine the 1990-1991 land cover and offers the only approach considered practical at this time. Once data have been purchased, they could be used for computer-based digital interpretation at a later date.

The waveband used to identify vegetation is in the infrared spectrum because chlorophyll (found in plants) has a high reflectance in this waveband. Timber forest borderlines are clear in this imagery; shrub forests are less clear, but can be interpreted with 80 percent accuracy from false-color imagery. Therefore, Landsat imagery is the only method of determining the extent of change in forests and woodlands between 1978 and the present.

Grasslands cannot be interpreted from Landsat photography as easily because their concentration of chlorophyll is largely dependent on recent rainfall. Landsat imagery is judged to be too expensive to be used in the interpretation of a series of images over time, which is necessary to define the condition of grasslands. The AVHRR was proposed by Earthsat because it is less costly and can therefore be used to produce a time series of interpretations from which trends can be discerned. These can be compared with rainfall data. Because of the paucity of weather data available from Afghanistan, both in terms of continuity of recording and local coverage, the value of the comparison with rainfall has yet to be established. The AVHRR (contrary to the implication of its name) uses an infrared sensor with a relatively low resolution of 4 km. This resolution is adequate for the proposed statistical interpretation of grasslands condition on a regional basis. It is proposed that (1) the years be ranked in order of the intensity of rainfall and (2) the regression coefficients for both the linear relationship and best-fit curves be determined. A high coefficient will give greater confidence in an interpretation of the impacts of depopulation on grasslands, which will assist in overall planning. Final interpretation and planning will have to be undertaken later with local ground surveying. No other form of remote sensing we have identified could provide similar data.

GIS and Environmental Information in Perspective

There is a tremendous lack of data to guide repatriation of refugees in a manner that minimizes environmental damage and loss of resources. Remote sensing, in the absence of ground-truthing, has distinct limitations, but it remains the most promising source of readily available objective information.

The geographic information system installed and used by DAI/Earthsat provides a useful framework that can be updated continually as new data are received or new interpretations are made. In the case of remote-sensing information entered in the system, the basic data (satellite imagery) remain unchanged, but their interpretation can be altered substantially.

Interpretation of satellite imagery is much further advanced in some areas than others. Forest cover can be interpreted with a reasonable degree of accuracy, even given limitations on ground-truthing. A comparison of satellite imagery in 1978 and 1992 could remove or substantially reduce doubts concerning the pace and extent of deforestation experienced by Afghanistan. Technology for assessing rangelands is significantly less advanced. Earthsat has proposed the use of relatively inexpensive AVHRR satellite imagery to obtain multiple images over the entire 1978-1992 period. Trends identified through the interpretation of these images would be compared with rainfall data. The technique is experimental but merits the Mission's serious consideration.

The quality and reliability of information derived from converting satellite imagery is generally dependent on (1) ground-truthing, (2) the technical expertise and country knowledge of persons interpreting images received, and (3) the availability of information from other sources with which interpretations of satellite imagery can be compared and contrasted.

Some ground-truthing is about to be carried out under an FAO project, which could provide inputs both for ASSP and Phase II of an environmental assessment. Even with a *mujahidiin* government installed in Kabul, however, it is by no means clear how soon it will be possible for anyone to gain access to enough areas of Afghanistan to carry out sufficient ground-truthing to permit the full potential of remote sensing to be used. Ground-truthing should be given early priority whenever feasible.

Use of satellite imagery will remain important long after it becomes possible to gather information by other means, including aerial and ground surveys, because of its advantages in terms of coverage, technical quality, and cost for particular purposes. Because imagery over a considerable span of years is now available, its interpretation permits the recovery of a historical perspective, which is important to analysis of environmental trends.

Specialists who have knowledge of Afghanistan need to be involved in the interpretation of satellite images: a forester in the case of forest resources; a range management specialist in the case of grasslands. Computer technicians, geographers, and development generalists can help, but they often encounter difficulty when they attempt to interpret data without detailed technical knowledge of the subject matter and the country.

During a period of reduced budgetary resources, it is particularly important that funds expended on gathering and interpreting information on Afghanistan be invested wisely. Long-term and short-term strategies should be developed for dealing with information needs pertaining to environmental issues, particularly those that are directly related to refugee return and the carrying capacity of the land.

If pertinent, objectively verified data are important to impending decisions but are not available, the Mission should seek opinion estimates from persons with knowledge of Afghanistan and its environment and people. A range of views should be sought and compared to the extent possible under these circumstances. A comprehensive program of gathering and analyzing information should be developed for the long term—one that integrates data from all sources and informs both environmental and development planning.

Chapter 7

RECOMMENDATIONS FOR FURTHER ACTIONS BY A.I.D.

Afghanistan Environmental Profile—Phase II

The need for a second phase of this study was envisioned at the time that this delivery order was issued. Phase I was foreseen to lay the groundwork for Phase II. The issues of particular concern identified at this stage are related to resettlement and reconstruction. Specifically, they include the following.

- The carrying capacity of the land to absorb rural dwellers without depletion of natural resources.

- Development of a policy to coordinate the return of people to rural areas with the availability of support services to ensure that resettlement can proceed without overtaxing natural resources. Such support could include temporary food supplies, the rehabilitation of existing irrigation systems or the construction of new ones, the provision of agricultural inputs such as hybrid seeds, fertilizers, and credit, and the provision of agricultural extension services and training. It is postulated that to allow people to return to rural areas at a rate faster than they can be supported will lead to the accelerated depletion of resources and possibly starvation, followed by migration to urban areas.

- Restrictions on the flow of people to rural areas may lead to an increased flow to urban areas, indicating that the environmental problems of urban areas should be given higher priority than was necessary before the war.

- Reconstruction will create a greater demand for construction timber, increasing the demand on the already depleted forest resources and possibly leading to the deforestation of remaining accessible regions. This indicates that high priority should be given to the development of alternative building materials, such as

reinforced concrete. The dissemination of new construction techniques and the distribution of necessary materials to rural areas are important areas for attention.

- The hostilities have reduced the already meager pool of qualified personnel in environmental and related fields, and competing demands will be high during a period of resettlement and reconstruction.

These findings are generalized observations based on an analysis of a weak database. It is recommended that the Phase II study focus on providing as much data and analysis as possible to support or refute these findings and to provide the basis for the development of environmentally sound policies for resettlement and reconstruction.

Access to Afghanistan is currently restricted, and the recommendations for the Phase II study are based on the premise that this problem will continue for the foreseeable future. Therefore, the proposed Phase II outline is based on data from external sources—specifically remote sensing and information from organizations and individuals who do travel to Afghanistan. Although A.I.D. does not currently permit its personnel or contractors to visit Afghanistan, other agencies do so on a regular basis. The United Nations maintains five field offices and four mobile units in Afghanistan (United Nations 1990). Data used in this document are based on published sources. It is suggested that far more information could be obtained by direct contact with the local commanders, members of *shuras*, government officials, and other persons in Afghanistan.

The primary purpose of the environmental profile is to assist A.I.D. in reviewing its programs for environmental soundness and to assist in their design.

An outline for the proposed Phase II study is presented in Appendix A.

Environmental Review of A.I.D. Programs

Because A.I.D. programs are, by definition, designed to assist the people of host countries, there is a tendency to believe that they are naturally environmentally sound. This, unfortunately, is not always the case. The issues of concern have already been addressed. A list of these issues follows.

- The impacts on natural resources of the return of refugees, taking into consideration refugees' limited skills to survive in the countryside and the support available to assist them in resettlement.

- The likelihood of significant permanent movement of the population to urban regions, either before or after they have ravaged the country's natural resources or, conversely, the likelihood that many will remain in refugee camps or move to new ones for the foreseeable future.

- The lack of skilled Afghan cadres to address the complicated and highly technical issues of environmental conservation.

A.I.D.'s policies and programs for Afghanistan are constrained by rapidly changing global strategic priorities generated by the breakup of the former Soviet Union, the realities of the political and security situation within Afghanistan, and the country's relations with its neighbors. Under such circumstances, the Mission program is likely to be under continual review and subject to continual changes in direction. Therefore this section can only provide guidelines for principles to adhere to and a framework for developing policies. It is suggested that the following framework be used to review A.I.D. programs.

1. Programs that increase sustainable employment and the use of natural resources within Afghanistan should be encouraged. This includes well-designed rehabilitation and expansion of irrigation systems and assistance to refugees to re-establish an environmentally sound, self-sufficient, and balanced rural-urban population structure.

2. Programs that provide incentives for refugees to return to rural regions without any corresponding effort to provide them with sustainable employment over a period of years should be subjected to careful environmental review because they could lead to the irreversible depletion of natural resources. The UN-sponsored program between July 1990 and April 1991 under which refugees turning in their ration cards received 300 kg of wheat and PRs 3,300 appears to fall within this category. Rehabilitated and secure regions that offer the prospect of sustained support for transition are likely to be filled quickly.

3. The UN is addressing the high mortality rate of women during childbirth and of infants in Afghanistan. A priority program in family planning is needed if population pressures are to be controlled.

4. Programs focused on preparing people for and increasing urban employment should be encouraged.

5. Programs to improve education and specifically to train cadres in environmentally related skills should be encouraged.

Areas that have not been mentioned include forest management and reforestation. Both are highly necessary, but whether Afghanistan will have the resources to administer such programs successfully in the near future is questionable. There is a danger that the implementation of an inadequate program will do more to institutionalize corruption than to protect the forests.

Development of an Environmental Management Plan

An environmental management plan should be one of the outcomes of the Phase II profile. It should cover

1. Development of programs to increase the use of natural resources in a sustainable way.
2. Development of programs to improve the urban environment.
3. Development of programs to meet the institutional and regulatory needs of Afghanistan.
4. Establishment of achievable long-term goals in all areas of environmental concern, including
   - Rural infrastructure rehabilitation,
   - Rangeland management,
   - Forest protection/reforestation,
   - Wildlife protection,
   - Water resources development,
   - The urban environment,
   - Regulatory programs, and
   - Institutional development.

Specific Environmental Programs Recommended

Assessment of Forests and Grasslands

The recommendations for the use of remote sensing data for the assessment of forests and grasslands are presented in Chapter 6.

Water Resources

A comprehensive study of Afghanistan's water resources is recommended as soon as conditions allow free access for investigations. The purpose of the study is to fully develop the untapped potential of the country's rivers to support the maximum sustainable level of agriculture and provide renewable sources of clean, inexpensive power for industrial development. There may be a conflict between the demands for electricity and water needs for irrigation. However, less than 10 percent of the country's hydropower is currently developed. Resolving any such conflicts and developing a system that satisfies both electricity and water needs for the foreseeable future should be relatively easy and is an objective worth pursuing. As appropriate, this study should identify potential impacts of water-related projects on downstream environments in other countries. The Aral Sea area, which relies in part on the waters of the Amu Darya and is experiencing severe ecological problems, merits particular attention. The study should include

- Development of plans for the reconstruction of existing water resources projects to match their 1978 condition
- A detailed study of available resources including the identification of specific sites for dams and hydroelectric power stations for further study
- A study of land available for irrigation, a preliminary feasibility study for its development, and an estimate of the population it could carry
- A study of the problems of soil erosion and siltation and recommendations for their minimization
- A preliminary economic study of the multipurpose river developments, including
  - A benefit/cost analysis for irrigation,
  - An assessment of power demands,
  - A benefit/cost analysis for power, and
  - A preliminary financial plan indicating funding levels necessary and potential sources of public and private funds
- An environmental study to identify potential negative impacts and a plan for minimizing them.

Training and Institutional Building

It is recommended that A.I.D. develop a training and institution-building program in the environmental field. The program would identify suitable candidates and provide training for them in a suitable location. Among the activities that should be investigated is the feasibility of undertaking environmental awareness programs within the refugee camps.

Pesticides

The use of BHC for the control of locust and sunn-pest is an issue of concern. A.I.D. has a high level of expertise in the control of such pests, and it is recommended that A.I.D. initiate a program to control these pests in a safe manner.

Population Control

Current A.I.D.-funded programs in family planning have not been investigated, and family planning is a difficult issue for outsiders to address in a Muslim country. However, population growth is one of the greatest threats to environment, and to the extent feasible it is recommended that A.I.D. family planning programs for be Afghanistan be promoted.

Appendix A

PROPOSED OUTLINE FOR AFGHANISTAN ENVIRONMENTAL PROFILE

1. Existing Environmental Conditions
   - Natural Resources
     - Grasslands
       - Extent
       - Quality
       - Trends
       - Carrying capacity
     - Forests
       - Extent
       - Rate of deforestation
       - Sustainable extraction rate
       - Level of threat to remaining forests
     - Water Resources
       - A synthesis of currently available information including the A.I.D.-funded task currently being prepared
   - Population
     - Updated information on population and current and likely future population movements
   - Socioeconomics
     - Updated information with special reference to:
       - The condition of irrigated agriculture
       - Industry and potential industrial development
       - Use of pesticides and safe means of controlling locust and sunn-pest infestations
   - Public Health
     - Updated information on ongoing public health programs and their impact on health
     - Status and problems of family planning programs
   - Environmental Infrastructure
     - Plans and programs for water supply and sewage treatment

Energy
Updated information

2. Major Environmental Concerns
   Natural Resources
   A full discussion of the concerns over the depletion of grasslands and forests based on an assessment of current conditions and carrying capacity and updated information on population movements
   Urban Environment
   Public Health
   Public health conditions
   Pesticides
   Population growth and family planning
   Institutional Development and Training
   Updated information on availability of expertise
   Needs for environmental awareness
   Needs for personnel

3. Potential Mitigation Measures

4. Recommendations for Further Action by A.I.D.

Appendix B

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