Section I
Environmental Issues

2

CHANGE OF CLIMATE IN THE HINDU KUSH REGION—FACTS, TRENDS, AND NECESSARY OBSERVATIONS OF THE ENVIRONMENT

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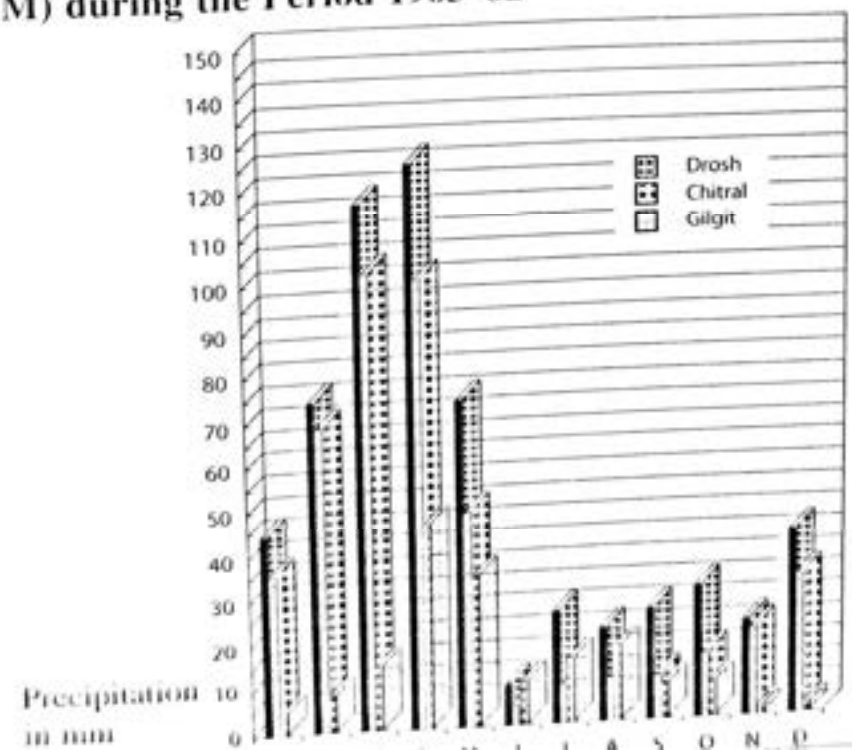
During my last visit, at the Second International Hindu Kush Cultural Conference in Chitral in 1990, I gave a brief survey of the feature and the physical geographical conditions of Chitral. Meanwhile, scientific knowledge of the regions east of Chitral has been highly developed, especially in the Gilgit and Karakoram areas and as a result of the Pakistani-German research project 'Culture Area Karakorum.' Recently, we have pursued increasing research into the physical geographical conditions as well as their relation to human activities. In this context, we obtained especially interesting and important results relating to the easterly neighbouring area of Chitral (see references). In regard to the climate, special local stations for short-term meteorological and climatological observations were installed. But we still hold only general data about the region of the Hindu Kush on both sides of the Pakistan-Afghanistan border from the very few official meteorological stations of Pakistan and Afghanistan. Based on this data the figure of the mean monthly precipitation at Drosh and Chitral Town shows the general situation (see Fig. 2.1).

Fig. 2.1 Monthly Mean Precipitation at Drosh (1465 M), Chitral Town (1480 M), and Gilgit (1460 M) during the Period 1965–82



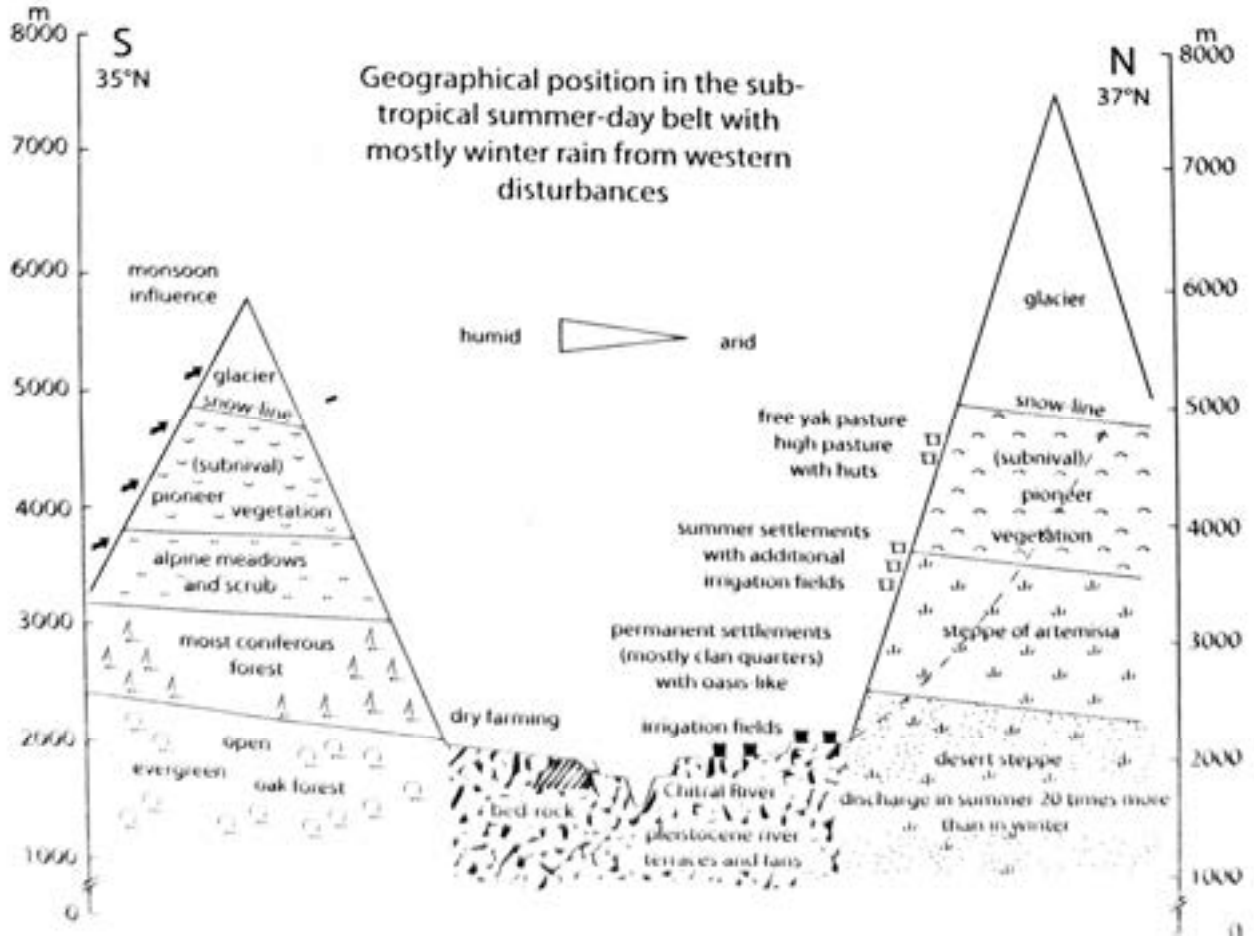
At my university in Berlin we interpreted separately the meteorological station records concerning the regional and long-term variability of precipitation in the high mountainous areas of Northern Pakistan and the bordering regions, and the relationship between climate parameters and river discharge (see Haserodt, Kolb, and Reimers).

With regard to this brief contribution to the conference today about climate changes in the Hindu Kush region, I could only take the recorded period between 1965 and 1987 because of different periods of the available climatic records at the few stations in the Hindu Kush region, some missing values, and the necessity of comparison (see diagrams). In the climatological context, these twenty-three years are very short and this period is not enough for us to draw general conclusions about the long-term trends of change.

Nevertheless, we are able to see a connection between the records of the stations inside Chitral (Drosh and Chitral) and the records of the high-located stations in the Afghan Hindu Kush west of Chitral in this period.

In the area of Chitral we can indirectly recognize very clearly the regional change of climatic conditions by observing the distribution of natural vegetation in the landscape as an indicator (see Fig. 2.2). The change of natural vegetation in a horizontal direction from south to north, from the coniferous forest to the Artemisia steppe, and also in a vertical direction in the area of southern Chitral, from the dry, semi-arid valley bottoms like steppes over the evergreen oak trees to the moist coniferous forest, and to the alpine meadows in the high areas results from the influence of climatic conditions, especially annual precipitation (see Fig. 2.2). The influence of humid air currents originates mainly from southern directions, which can be verified by comparing the records of the meteorological stations of Drosh and Chitral (see diagrams).

Fig. 2.2 Profile of the Geographical Structure of Chitral



Both official meteorological stations in the area of the Chitral District, Drosh in the south, and Chitral Town in the centre, are valley stations and therefore generally dry (average yearly precipitations about 640 mm at Drosh and 440 mm at Chitral). Nevertheless, they both represent generally the monthly, yearly, and regional distribution even at the bottom of the valleys. In contrast to the area of Chitral Town the precipitation of the area of Drosh is more widely distributed. But all over the region a small number of synoptic meteorological events often influence the annual rainfall sums decisively. The well-known considerable interannual variability of precipitation is remarkable in the station records.

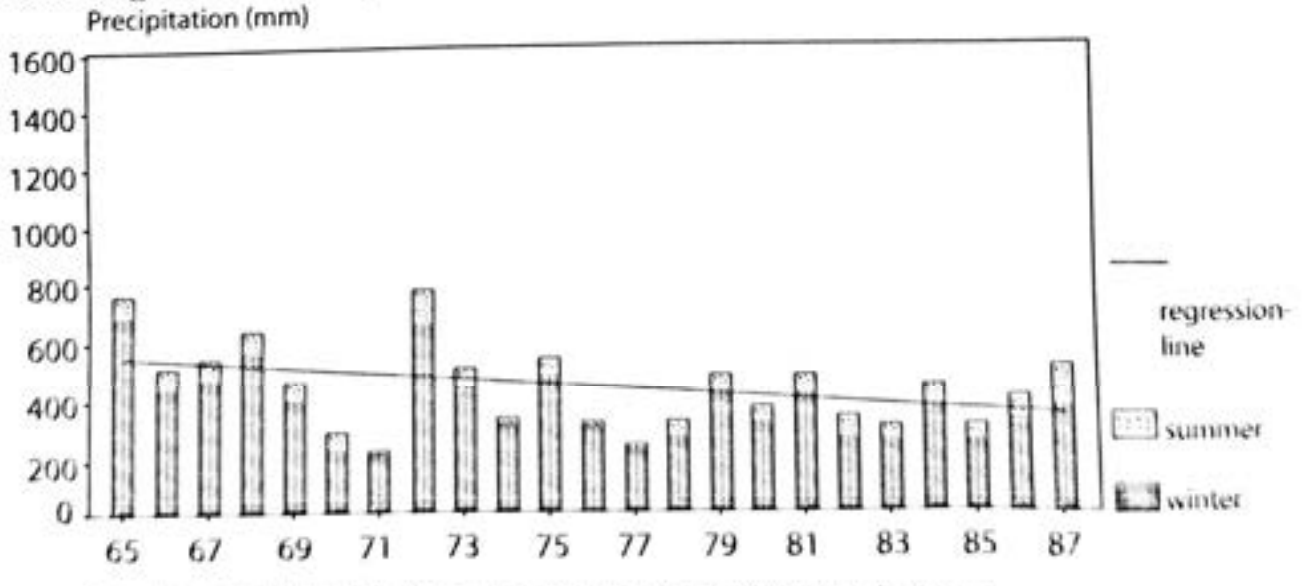
Both kinds of different topographical locations of meteorological stations in the Hindu Kush region, the valley stations in Drosh (1511 m) and Chitral (1499 m) on the one hand and the two high-located stations in the Afghan Hindu Kush at the Salang Pass (3172 m and 3366 m) on the other, show the same parallel development in their long-term records of yearly precipitation sums (see figs 2.3–2.6):

During the 1960s, 1970s, and 1980s the records and their precipitation figures and regression lines extrapolated from the special interannual variability marked a general regression line with a decline of the yearly precipitation sums.

However, the trends of long-term development of climatic factors during the test period at the station Drosh are similar to both the station Chitral and the high-located stations of the Afghan Hindu Kush at Salang North and Salang South. The long-term development of annual sums of precipitation at the valley station Chitral Town shows an average regression rate of yearly 2.2 per cent from the middle of the 1960s until the end of the 1980s. That means that during the twenty-three years a decline of about 45 per cent took place. At the southern valley station Drosh we find the same features during the same period: the rate of average annual regression amounted to 1.5 per cent, which indicates a lesser regression but with the same direction of decline (see figs 2.3 to 2.6).

If we look at the high-located stations in the Afghan Hindu Kush at Salang North (3366 m) and Salang South (3172 m) we have a similar situation during the same period. The rate of average annual regression of precipitation amounted there to 1.4 and 2.8 per cent (see figs 2.5 and 2.6). That means that at these high-located stations in the region of the Afghan Hindu Kush also, during the same test period of twenty-three years between 1965 and 1987, a regression of precipitation with about 51 per cent decline at Salang North and about 64 per cent at Salang South took place.

Fig. 2.3 Long-Term Development of Annual Sum of Precipitation (Mm) Chitral (1499 M)



Development of precipitation average decline 9.7mm/2.2 per cent/per year

Fig. 2.4 Long-Term Development of Annual Sum of Precipitation (Mm) Drosh (1511 M)

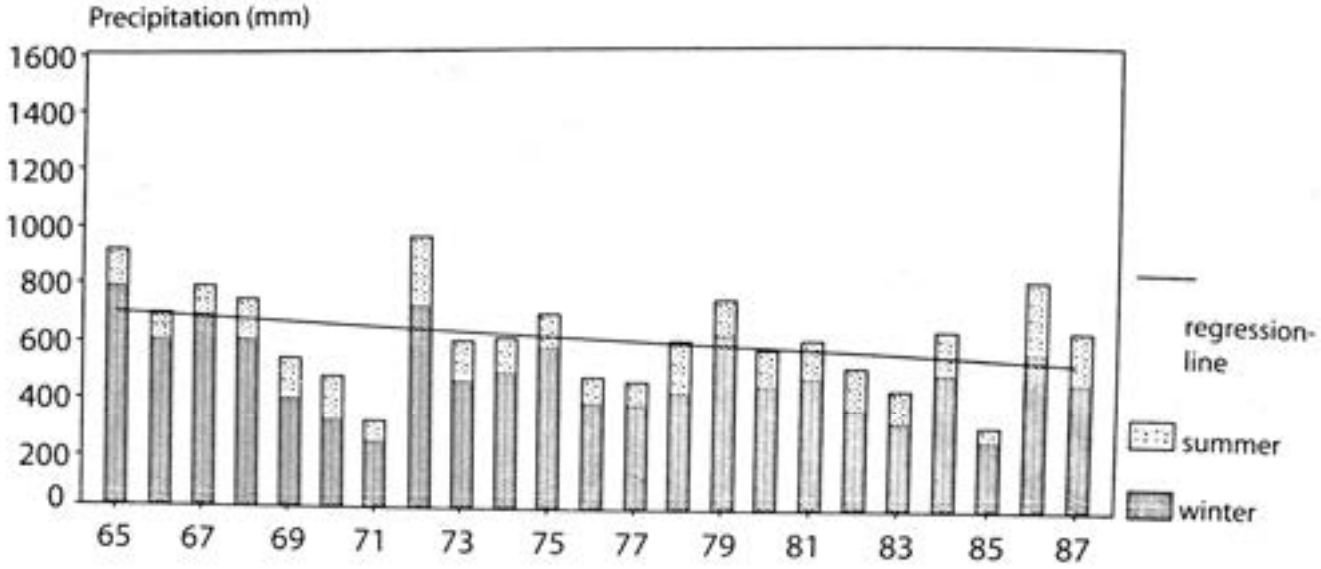


Fig. 2.5 Long-Term Development of Annual Sum of Precipitation (Mm) Salang North (3366 M)

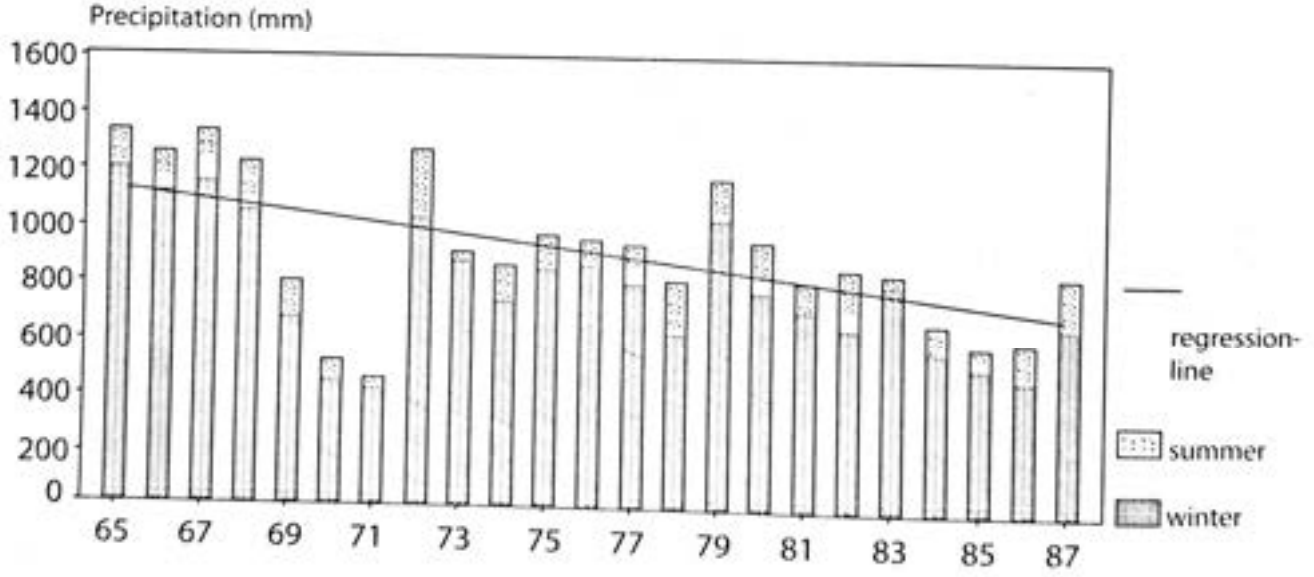
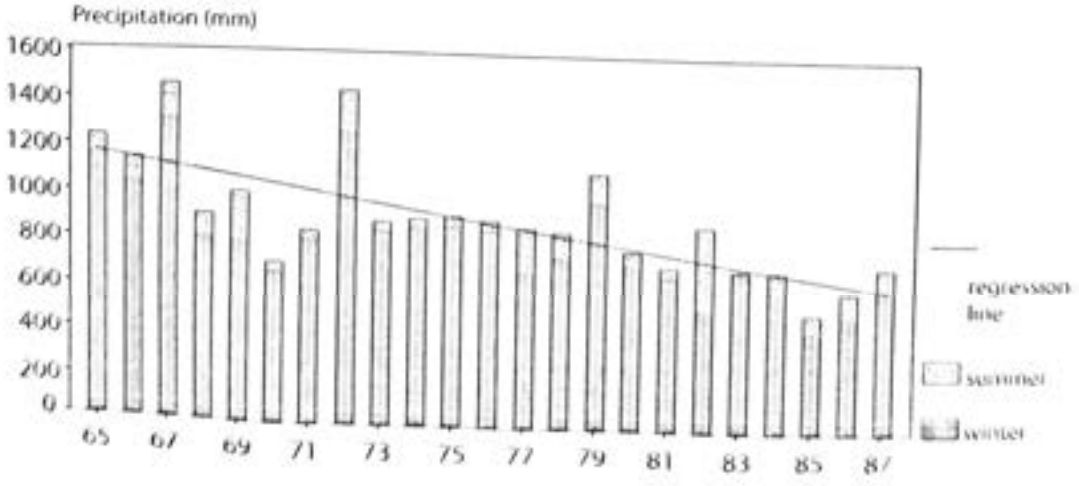


Fig. 2.6 Long-Term Development of Annual Sum of Precipitation (Mm) Salang South (3172 M)

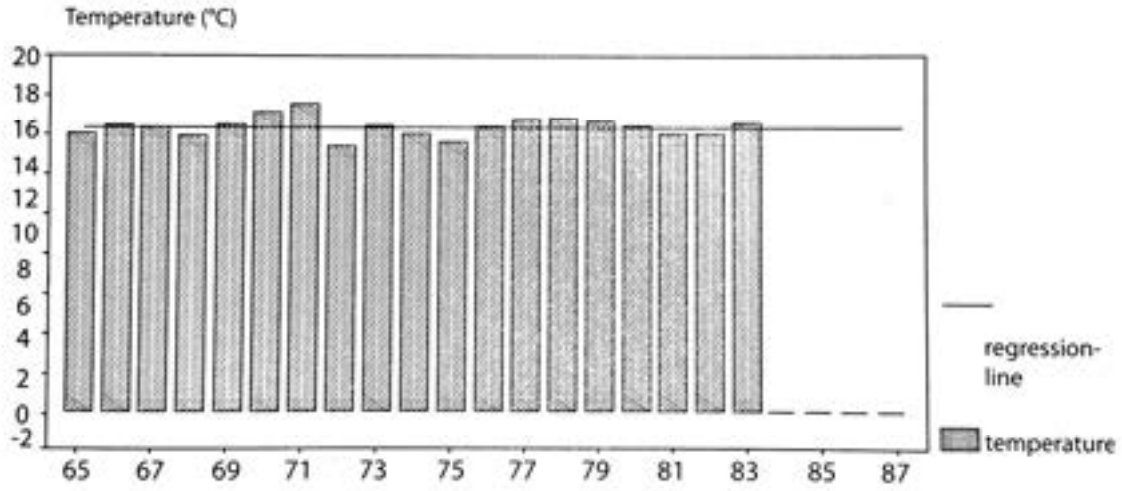


The data and diagrams of the single years at all four stations show remarkably high comparability in the variation of the yearly total amount of precipitation, especially between Chitral, Drosh, and Salang South. This can also be seen regarding the amount of winter/spring precipitation (see diagrams). Generally we can realize: throughout the whole test period and all over the four stations the interannual variations of total amount of precipitation is highly defined by the annual variation of the winter/spring precipitation (December to May).

Trends in the annual mean temperature as seen in the records and figures of the four stations are not so strongly comparable with the remarkable trends and percentages of change of the precipitation sums.

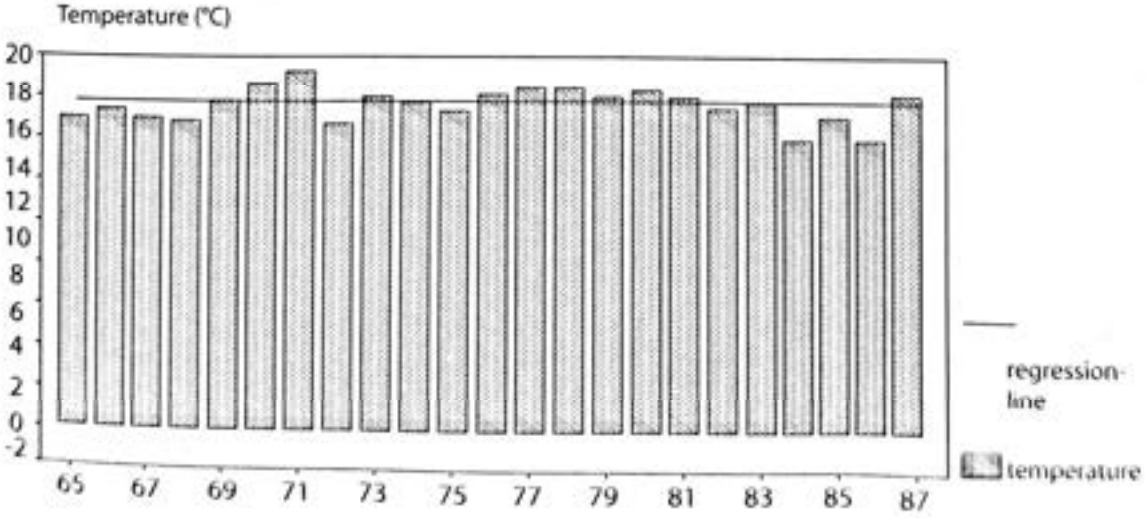
In comparison with the trends of the decline of precipitation in the twenty-three year testing period, we can recognize lightly inverse trends of development of the air temperature at the Salang stations with an increasing line (see figs 2.7 to 2.10). But in the same period, at Drosh and at Chitral, the yearly mean temperature declines lightly in their regression line. The values of most of the single years show that the yearly mean temperatures are lower when the data and figures of precipitation show high precipitation sums.

Fig. 2.7 Long-Term Development of Real Annual Mean Air Temperature (°C) Chitral (1499 M)



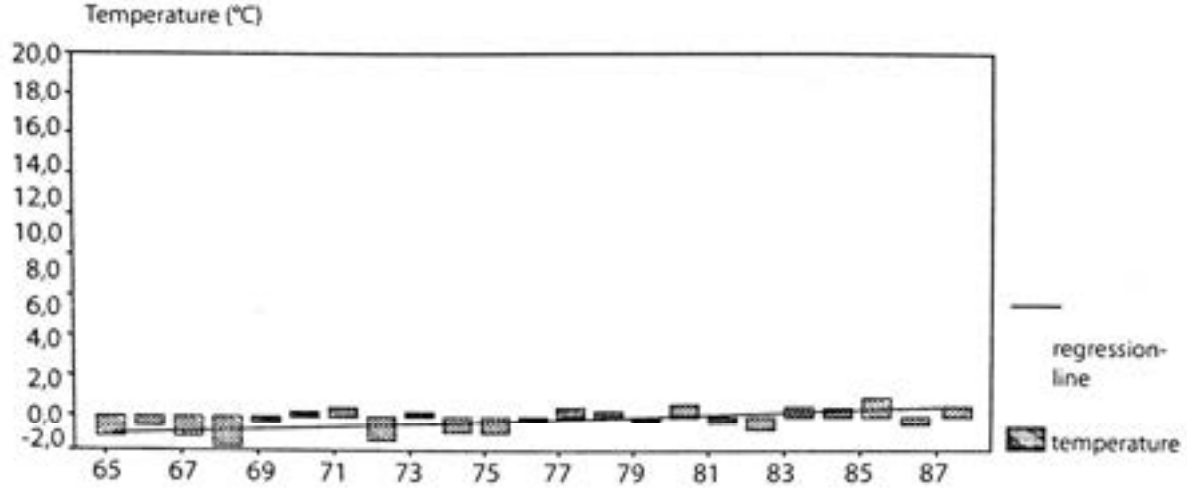
Development of temperature: average decline 0,002°C per year

Fig. 2.8 Long-Term Development of Real Annual Mean Air Temperature (°C) Drosh (1511 M)



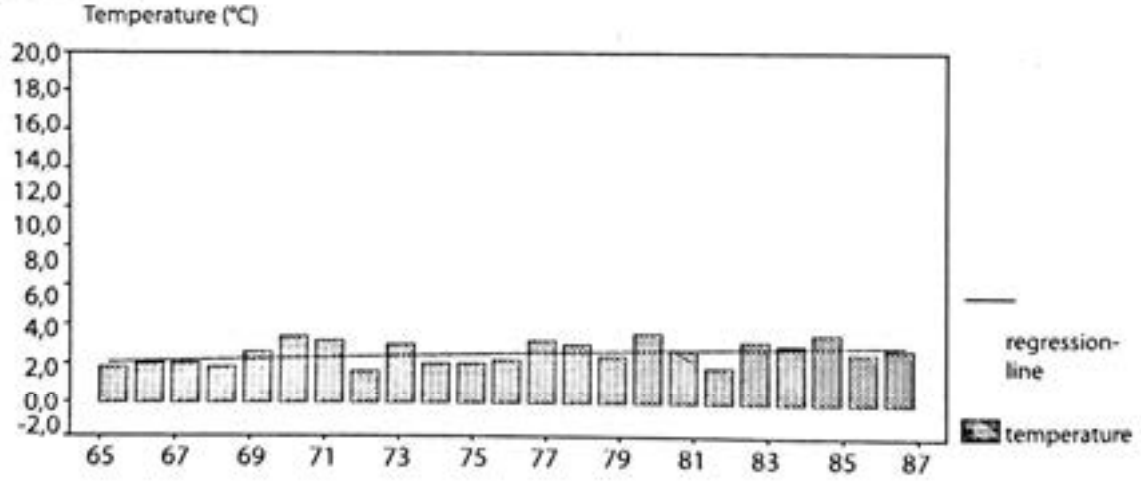
Development of temperature: average decline 0,043°C per year

Fig. 2.9 Long-Term Development of Real Annual Mean Air Temperature (°C) Salang North (3366 M)



Development of temperature: average of increase 0,06°C per year

Fig. 2.10 Long-Term Development of Real Annual Mean Air Temperature (°C) Salang South (3172 M)



Development of temperature: average increase 0,036°C per year

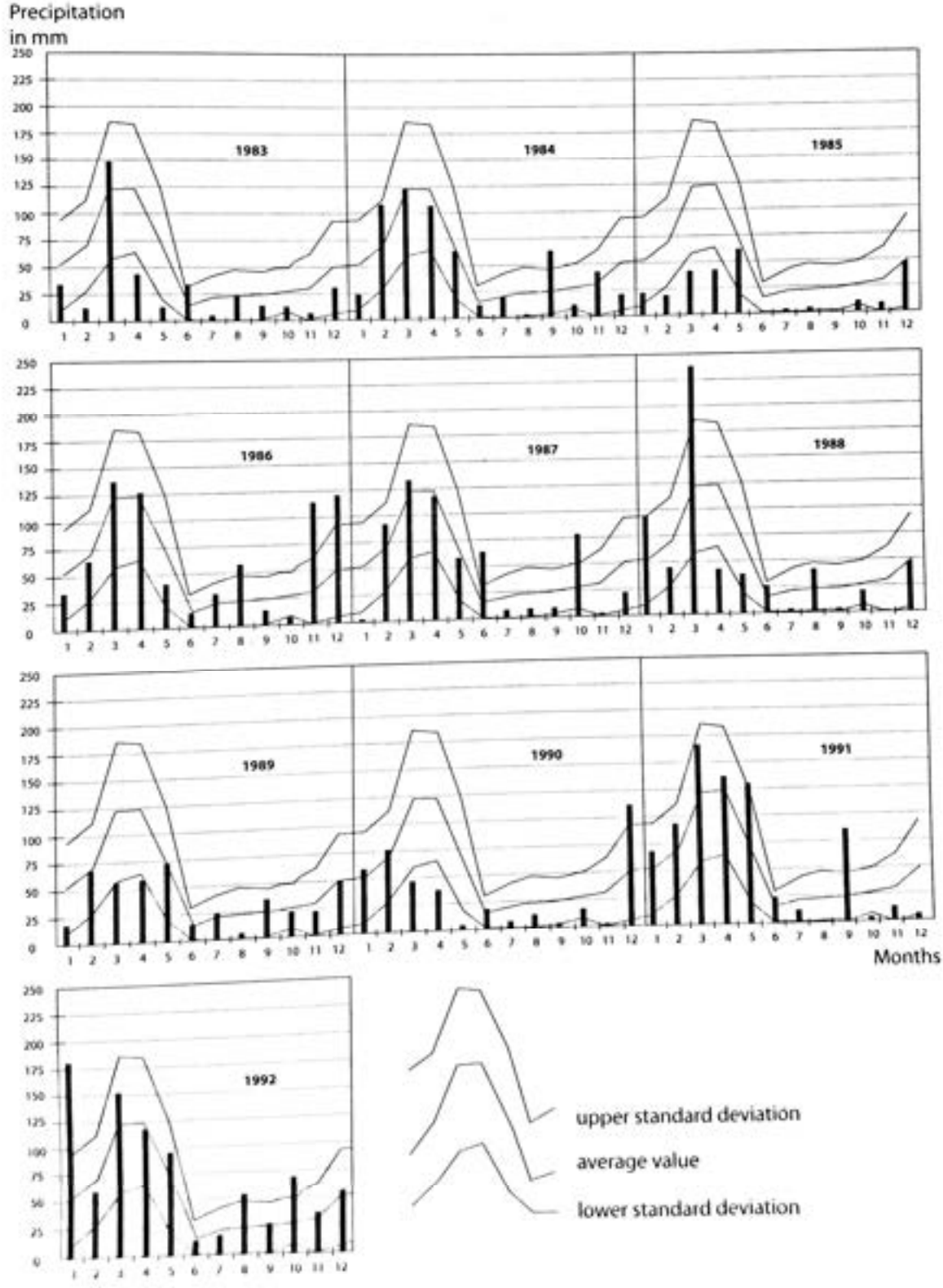
If we compare the discussed station records with the interregional relations to the east we recognize that the data of climate changes are closer between Chitral and the Afghan Hindu Kush than between the Gilgit-Karakoram western Himalaya region.

With respect to the excessive rainfall in Northern Pakistan, causing catastrophic floods and landslides like those in September 1992, and their relation to long-term trends of change in the climatic conditions of the Hindu Kush region, it may be said that such events with such disastrous dimensions all over Northern Pakistan up to the high mountainous area are rare and have little effect in the area of Chitral (see Fig. 2.11 for precipitation at Drosh, September 1992).

Nevertheless, in Chitral, as proved by me, Reimers (1994), and the analysis of the weather and climate records of the last half century, this event only ranges in the series of marginal monsoons which produced extreme summer and late summer precipitation and affected the high mountain area in the Hindu Kush in different years (for example, July 1959, September 1960, July 1964, July and September 1966, August 1968, September 1970, July and September 1972, August 1975, July 1978, August 1979, July 1981, September 1984, August 1986, and

September 1991). It can clearly be seen that in these cases the synoptic meteorological that reason is the superposition between western upper air troughs and monsoon depressions on a lower level also affect the Hindu Kush region.

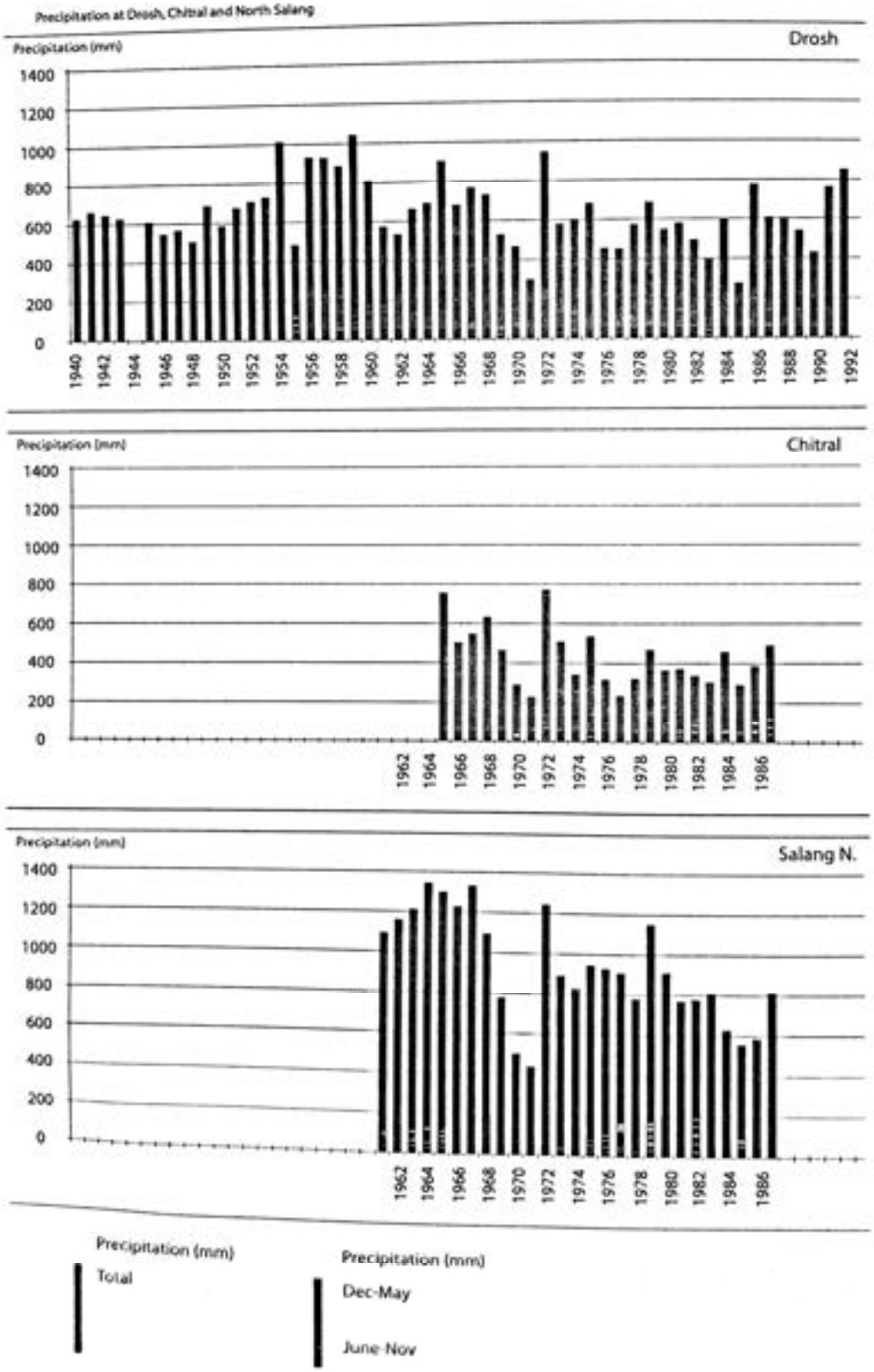
Fig. 2.11 Monthly Sums of Precipitation at the Hindu Kush Valley Station of Drosh between 1983 and 1992 with Mean Annual Changes (1955–92) and the Monthly Standard Deviation



Source: Reimers 1992 and Pak. Met. Dep. 1993b

We should be careful in speculating with respect to more long-term trends of change of climate. If we look at the data and figures of yearly precipitation sums, for example, at Drosh, in the past, we see during the 'forties relatively uniform yearly precipitation sums with a small regression and in the 'fifties remarkably increasing sums of the yearly precipitation (see Fig. 2.12).

Fig. 2.12 Precipitation at Drosh, Chitral, and Salang North

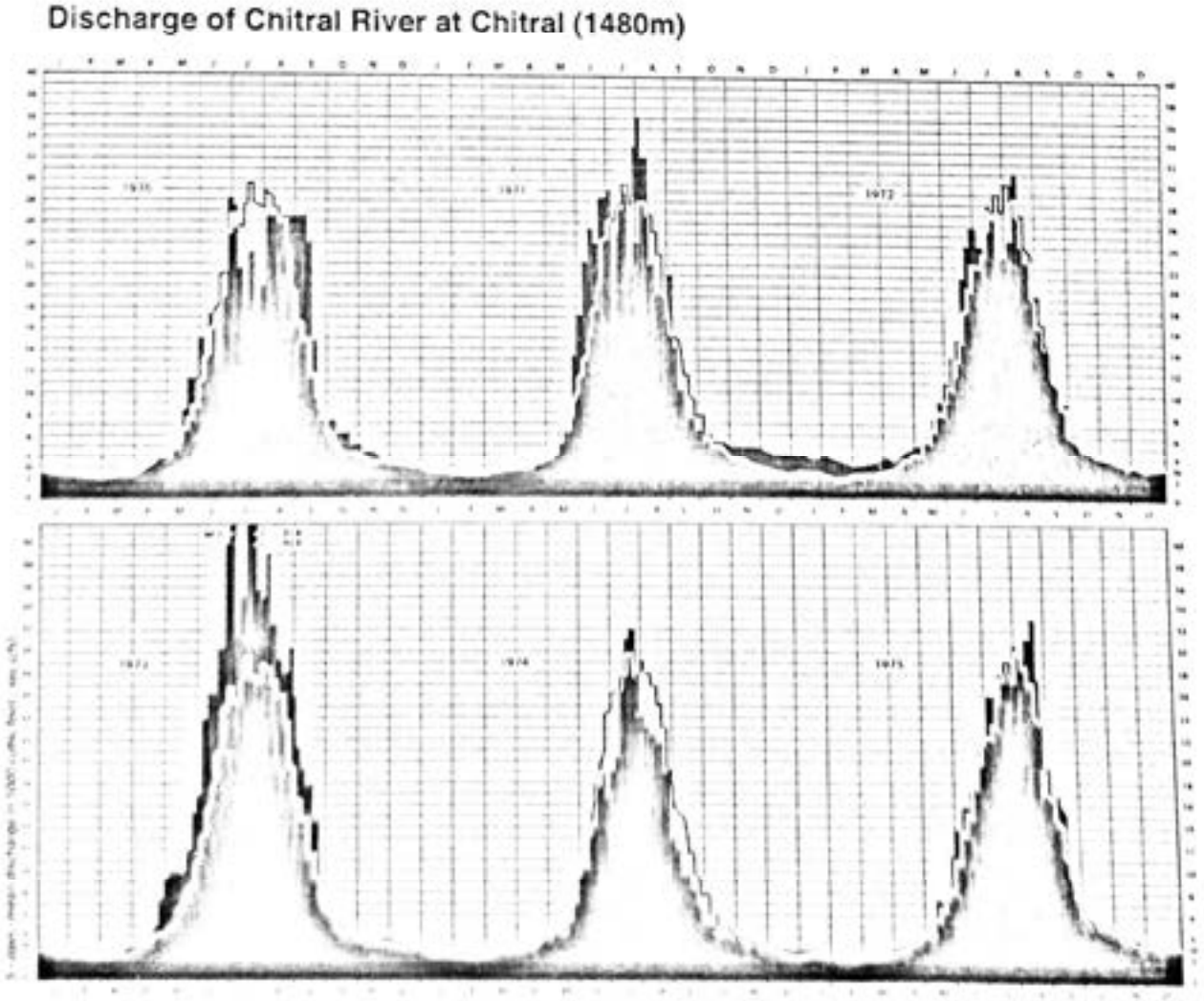


And if we look at the beginning of the nineties (see other figure of Drosh) it seems that in 1991 and 1992 a new period with an increase of precipitation starts.

Unfortunately, comparable data at the other stations of the same period were not available. But I think we would see the same trends as discussed.

The relationship between climatic parameters and the discharge of the Chitral River shown by the figures of daily and monthly data marks generally a high degree of correlation between the sunshine duration with high temperatures and the quantity of discharge because of the influence on glacier melting processes in the catchment area (see figure). We all know that the Chitral River reaches the highest runoff during the summer months from May to September and not during the months of the highest precipitations in winter/spring time between October and April (see Fig. 2.13). So the relationship between the different quantities of runoff because of glacier melting and the percentage of glaciated catchment areas is evident. The catchment area of the Chitral River over the Chitral gorge contains 20 per cent of the glaciated area (Hunza River 40 %, Gilgit River 7 %). Therefore, the average summer runoff between May and September reaches up to 70–80 per cent of the yearly total discharge because of the important yearly melting processes of the glaciers in that time.

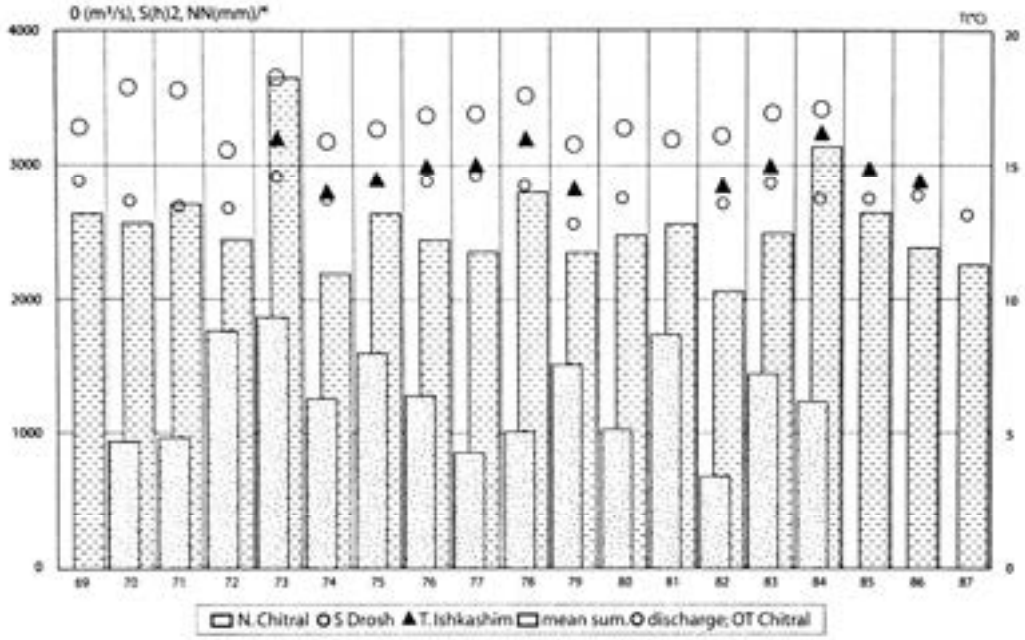
Fig. 2.13 Discharge of Chitral River at Chitral (1480 M)



On the other hand, there is also a dependent relationship between the precipitation of the preceding winter months and the amount of precipitation in the form of snow in the heights because of storage. Sometimes, the highest summer discharge after a high precipitation amount

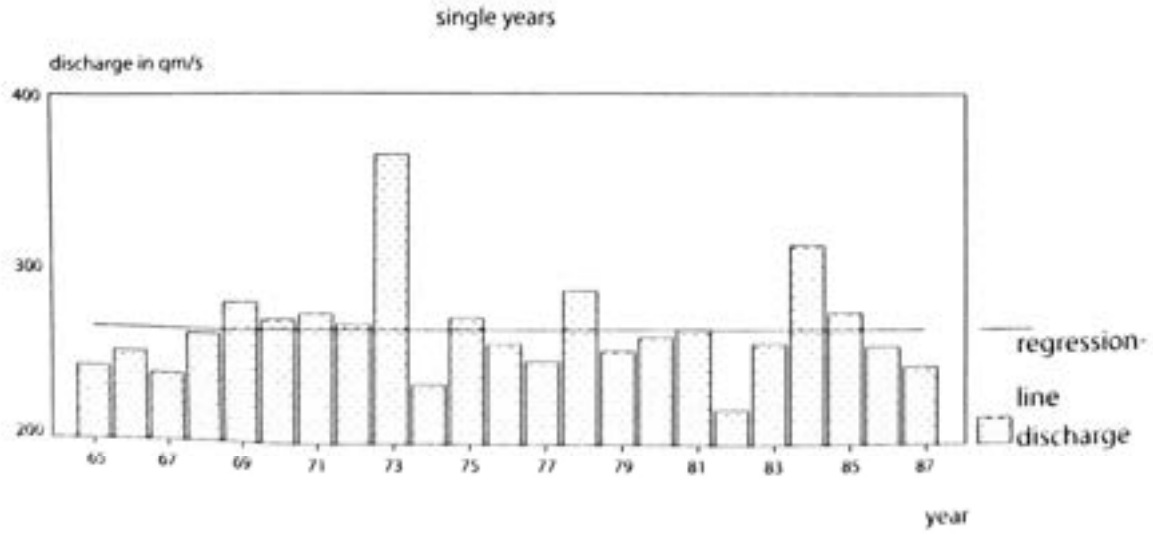
during the winter/spring season is noticed even in the next but one year because of long-term storage of this precipitation as high snow cover. This occurred, for example, in the years 1972 and 1973 (see Fig. 2.14).

Fig. 2.14 Interdependence of Mean Summerly Discharge of the Chitral River (1969–87) and the Precedented Sums of Winterly Precipitation (Oct.–Apr.) at the Station Chitral (1970–84) the summerly temperatures (May–Sep.) at Ishkashim (1973–85) and Chitral (1969–84), and the Duration of Sunshine in Summer (May–Sep.) at Drosh (1969–87)



The values of total yearly river discharge in the single years show little or no interdependence with the values of the annual mean air temperature during the same single years (see diagrams). The different values with the remarkable year-to-year variations (for example, the high value in 1973) are affected by different factors. Most of the influence is provided by the dependence of the values of sunshine duration in the glacier-covered catchment areas in the months of May, June, July, and August (see Fig. 2.15). We are not able to recognize a long-term regression line in the river discharges compared with those of the development of precipitation or the development of the yearly mean air temperature.

Fig. 2.15 Total Amount of Discharge at Chitral



In Chitral and also at many sites of the Afghan Hindu Kush the potential of the cultivable land especially at the old Pleistocene gravel fans in the valleys depends on the availability of irrigation water by channels with their sources not from the main river but from side valleys because of the topographical conditions high above the main valley river levels (see Fig. 2.16).

Fig. 2.16 Limited Cultivated Land on a Deeply Eroded Pleistocene Alluvial Cone between Kagoozi and Maroi (Central Chitral), about 1760 M High: In Front: Mastuj Main River

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For example, many oasis-like sites in Lower and middle Chitral (see figure), also in the area of Lotkuh and in the area between Torkhow and Yarkhun, receive their irrigation water from side valleys with spring water and with catchment areas which are not glaciated but snow-covered in winter and spring time even up to the mostly rainless period in June and July. Therefore, the height of snow cover and the length of the snow-cover season in the catchment area are very important. In such locations problems with the early seasonal shortage of irrigation water often exist because of the early termination of the snow melting period and of dried-up springs. Consequently also interannual changes of the length of snow-cover periods are important for the long-term use of irrigation fields around the villages and especially in such topographical locations.

Of the same importance is the interannual variation of precipitation and the possibility of trends of its change in the small *rabi* dry farming area of southern Chitral and in some places of the Afghan Hindu Kush. Therefore, watching the trends of change is necessary in regard to the dry farming area and the possibilities of their long-term use.

Naturally effected change of vegetation, especially in regard to the trees, needs more time than only one generation of people and more than the time we need to be able to compare them with the recorded climatic data in the whole Hindu Kush region. But if we compare these questions with results of the Karakoram-Himalaya (see references), we would find methods to observe different kinds of environmental change.

On the one hand we have to see changes in the environment in the context of changes in some natural physical geographical conditions. But on the other hand, the influence of man-made factors is also remarkable. Besides the discussed climatic conditions it is important to focus on the interactions between human beings and environment.

In this context only long-term observations and comparisons will be helpful. So, for example, we do not have exact ancient photographs or maps or records about the former scenery at different sites. But some elder inhabitants, for example, *babas*, in any village are able to report about the former extensions of more forested areas even near the villages like the vegetation step of oak trees (*Quercus ilex*) or *Juniperus*, especially in southern or central Chitral. Most of the change is effected by man-caused deforestation and by overgrazing in connection with livestock increasing for more than a hundred years, not only in the area of southern and central Chitral but all over the Hindu Kush and the Karakoram-Himalaya region. Conditions for grazing on the high pastures and also on the lower pastures, for example, in Chitral on the great Karo Lasht plain, have changed. This is an important additional field of environmental change and requires other special studies, observations, and discussions, like the studies in the eastern neighbouring regions (see references).

Memories of natural hazards like heavy, torrential rainfall with floods and blocking by landslides or heavy snowfall causing hazardous avalanches are, in addition to other researches and official reports, an important source of information.

Small-scale environmental inventories should be made. Teachers and schoolboys of the middle and high schools, on their own or in connection with agriculture experts or village organizations of the Aga Khan Rural Support Programme (AKRSP) in Chitral District, could, for example, make notes on such hazards providing data on the damages at the different sites. Often, additional remarks would prove helpful.

Such small-scale, long-term environmental observations should also include the registration of non-spectacular events, such as more systematical observation of the beginning of the yearly seasonal water shortage of side valley streams in the case of schools or offices at such sites or at the beginning of very early snowfall (in the harvest season) or the registration of the daily temperature throughout the year (in the shadow, with simple thermometers always at the same fixed hour), by these small-scale local climate stations in addition to the few official stations. The yearly marking of the glacier snouts, for example, sideward on big boulders with data would also be helpful.

All these observations, registrations, and notices should be collected at specific places. They will be helpful sources of general knowledge and information on the environment of the region and also assist in answering questions of change in natural conditions.

The main points in conclusion are:

1. The period of long-term registration of comparable climate data of the whole Hindu Kush region (by the few meteorological stations) is still too short to give general answers about long-term trends of development like a half century or more. But for a short-term period of a quarter century (1965 to 1987) at the four main stations in the Hindu Kush region we are able to make comparisons and present meaningful results.

2. At the dry valley stations of Drosh and Chitral Town inside Chitral and also at the high located humid stations Salang South and Salang North in the Afghan Hindu Kush with their more than two times higher precipitation there are generally the same long-term trends mainly with the comparable average decline of annual sums of precipitation. During the same period at those stations we recognize the same direction of trends with precipitation decline and only a small change in the average yearly temperature at Chitral and Drosh and increasing temperatures at Salang North and Salang South.
3. In regard to the relationship between climatic parameters, river discharge, and the possibility of agricultural land use around the oasis-like settlements with irrigation and in the *rabi* dry farming areas, the amount of winter/spring precipitation and the length of the period of snow cover in the heights with their possibilities of interannual and long-term changes are important. This is important especially in the areas where gravel fans are distributed with the fields located high over the glacier-water-influenced main rivers and irrigated only by spring water and snow melting water of their own catchment area.
4. Climate-influenced long-term change in natural vegetation is difficult to observe because it needs more time and knowledge. But we are able to see very clearly man-influenced ecological change like deforestation and long-term overgrazing. The ecological situation should receive more attention and protection through the economic use of natural resources.
5. To make the inhabitants more sensitive to such ecological and environmental questions and to support scientific research we should have more small-scale observation and registration of natural events and change in natural conditions by the inhabitants themselves. So teachers, schoolboys, and village organizations and other authorities in the different sites of the area of Chitral should collect information to compare it with results of the whole region. To compare it with present-day conditions we should also systematically acquire information from the elder inhabitants, like *babas*, in the villages about the former situation. All such activities would be helpful in gaining knowledge about the general history of the area even in the environmental field.

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3

PROTECTED MOUNTAIN AREAS IN PAKISTAN: THE CASE OF THE NATIONAL PARKS

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In the last twenty years, Pakistan has gazetted three northern mountain areas as national parks. Chitral Gol National Park, in Chitral District of the North-West Frontier Province, comprises the 7750 hectare watershed of Chitral Gol, immediately west of Chitral Town. Khunjerab National Park, in Gilgit District of the Northern Areas, comprises 2269 square kilometres in the Gojal Tehsil on either side of the Karakoram Highway (KKH) from Dih to the Pakistan-China border at the Khunjerab Pass. The Central Karakoram National Park is mostly in Skardu District of the Northern Areas, but also includes area within Gilgit District. The park's area has not been surveyed, but comprises the Baltoro, Panmah, Biafo, and Hispar glaciers and their tributary glaciers. Each park has a separate history, but all share a fundamental gap between usage and control. This basic inequity underlies the unique problems of each national park. When ownership and usage are separate, there is a resulting lack of sufficient control over resources by either party (Romm 1987). Until this conflict is resolved, effective management remains impossible.

Prior to the full incorporation of the Northern Areas and Chitral into Pakistan between 1969 and 1974, the areas that are now designated as Chitral Gol, Khunjerab, and central Karakoram national parks were part of the local princely states: Chitral, Hunza, and Shigar. Chitral and Hunza were independent states under the suzerainty of the *maharaja* of Kashmir (IOR R/1/1/3688(2): 33). Shigar became a vassal state of the *raja* of Skardu in the late sixteenth century, and Skardu then became part of the Kashmir state in 1884 (Hasrat 1995: 251).

In Chitral, Mehtar Aman-ul-Mulk declared Chitral Gol as his private hunting preserve in 1880. Markhor (*Capra falconeri cashmiriensis*) were the prized game. The *mehtar* maintained several bungalows for his use and for guests, as well as cultivating some land and orchards. The *mehtar* allowed nearby villagers to collect firewood, graze some livestock in areas away from his hunting bungalows, and cut some wood for timber.

The Khunjerab grasslands came under the control of the *mir* of Hunza in the late eighteenth century. The *mir* allocated grazing rights to villagers, and in turn received from them a tax consisting of livestock and livestock products. The *mir* controlled hunting in the area, as well as any transborder trade with China. The *mir's* livestock grazed in the Khunjerab pastures, tended by designated shepherds, who sent livestock when ordered and livestock products to the *mir* at his palace in Baltit, Hunza (IOR R/2 (1079/253): 60–67).

In Baltistan, the pastures along the Biafo and Baltoro glaciers were grazing grounds for villagers of the upper Braldu valley who were subjects of the *raja* of Shigar. However, the *raja* exerted little control over the remote Braldu valley. The villagers of the Braldu were effectively left alone to tend their livestock in summer pastures along the glaciers (K.I. MacDonald, personal communication).

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These situations of usage can be characterized as ranging from closely controlled, but still shared usage in the case of Chitral, to more loosely controlled shared usage in the case of Hunza, to locally controlled and used in the case of Baltistan and the Braldu valley. The degree of control exerted by the ruling prince over each area corresponds to the distance of the royal residence from the area.

These relatively stable situations changed when the princely states were merged into Pakistan in the early 1970s. Lands previously controlled by the rulers were declared to be state property. However, local people interpreted the abolition of princely rule as allowing them to cut wood and graze animals where they wished. The loss of control by local rulers also led to an increase in hunting. When wildlife biologist Dr George Schaller came to Pakistan in 1974 to survey wildlife, he became alarmed at the low numbers of unique species, and recommended the establishment of protected areas for their preservation (Schaller 1979). To protect the markhor in Chitral Gol and Marco Polo sheep (*Ovis ammon poli*) in Khunjerab, Chitral Gol was declared a wildlife sanctuary in 1971 and Khunjerab a national park in 1975. Chitral Gol was declared a national park in 1984. Interestingly, Schaller did not recommend the central Karakoram to be a national park because it had comparatively low numbers of wildlife.

These areas also became increasingly more accessible. The KKH, highways, and link roads were constructed and air service increased (Kreutzmann 1991). All three areas have experienced an increase in the number of visitors, both foreign and domestic. Hunza and Gilgit are major tourist destinations, as well as trade centres; Skardu is a world-class mountaineering destination, as well as an important military centre, and Chitral draws over 3000 foreign tourists each year, as well as many domestic tourists.

With this increase in access, the mountain pastures, valleys, and wildlife habitats, previously valued for centuries as grasslands and woodlands, have now become the objects of desire of a number of competing interests—resort hotels, adventure tourism, big game hunting, mountaineering, conservation organizations, and the military, to name a few (Mock 1989, 1995; Kreutzmann 1993). Each group is interested in maximizing its return from usage of the area. The traditional usage of the villagers also figure into the equation. Each group of users vies to exert control over the areas, and each group has its own ideas as to how the areas should be managed. The relevant point for management is that effective management must take into account the needs of all user groups and develop strategies for cooperation between them (Renard & Hudson 1992). For example, in Pakistan, parks have largely been concerned with protection. Yet protected area managers throughout the developing world have realized that protected area management must be coupled with social and economic development if biodiversity is to be conserved (Wells at al. 1992). This approach to management is only just beginning to find a foothold in Pakistan.

In addition, the rigid, prescriptive structure of Pakistan's national parks precludes any direct role in planning and implementation for local people. The existing legislative basis for national parks excludes many types of usage. Pakistan's 1975 national park legislation is similar to the 1978 definition formulated by IUCN–The World Conservation Union. Although the IUCN definition has since changed considerably to incorporate new thinking on park management, the Pakistan definition remains unchanged (see Table 3.1). The park structure presently in place in Pakistan actually amplifies conflict, as exemplified by the history of court cases in Chitral Gol (see Table 3.2) and in Khunjerab (see Table 3.3). In Chitral, there is an ongoing twenty year history of litigation between the government and the ex-*mehtar* of Chitral, Saif-ul-Mulk Nasir (Malik 1985). The ex-*mehtar* claims Chitral Gol is his private property, whereas the government claims it is state property. Local people have now joined the lawsuit, claiming their right to Chitral Gol. The case, as of June 1995, is still before the

courts. In Khunjerab, the government attempted to ban traditional grazing, but failed to offer sufficient compensation to local communities (Wegge 1989; Mock 1990; Bell 1991; Slavin 1991; Knudsen 1992). Villagers obtained a court order in October 1990 to permit them to continue grazing. But in 1991, the Khunjerab Security Force (KSF), a police organization, forcibly evicted them from the park. These lawsuits and police actions are symptomatic of the gap between usage and control, as well as of the distance between decision makers in Pakistan's capital, Islamabad, and the actual protected areas.

Recent developments in Khunjerab may point to a way ahead. The management plan currently under review by the federal government follows an approach termed co-management. Co-management implies that all involved parties work together as equal partners in decision making as well as implementation. This requires the government to share power and responsibility for protected area management with local communities and other user groups (Sneed 1992). This approach holds forth the possibility of harmonizing the issue of usage and control. Co-management does not require authorities to give up or transfer legal jurisdiction, but it does demand that they equally share decision making power with all other user groups, including local communities, and respect and enhance the rights, aspirations, knowledge, skills, and resources of all user groups.

Of course, the burden also falls on the users. They can no longer simply be users, but must take responsibility for the results of their use, and learn how to participate in the management of the area and how to work with other users.

The Central Karakoram National Park, established in late 1993 (Notification No Admin-III–II [28/93]), hopefully will not be plagued by the set of problems of Chitral Gol and Khunjerab. IUCN, a main proponent of the park, has declared that local people are at the heart of this park. A workshop was held in Skardu in September 1994 to discuss management planning. But at the workshop, government representatives refused to make a commitment to share potential revenue from park entrance fees with the surrounding villages.

It seems unlikely that the exercise of government control over these mountain parks will resolve conflicts resulting from multiple users. It seems equally unlikely that the exercise of private control can resolve the conflicts, or bring to bear the needed resources and expertise to effectively manage these areas. Given the competing interests of today's multiple user groups, a traditional, village-based, common property regime is also impractical. Rather, a joining together of all user groups and individuals, together with the government, in a co-managed approach that links conservation with development appears to be the best approach for managing these areas today. The sad result of an unwillingness or inability to do so will be the loss of unique ecosystems and species—a loss for Pakistan and for the world.

Table 3.1 Existing Legislative Basis for National Parks in Pakistan

Northern Areas Wildlife Preservation Act (1975)

Section 2.k.

'National Park' means comparatively large areas of outstanding scenic merit and natural interest with the primary object of protection and preservation of scenery, flora and fauna in the natural state to which access for public recreation, education and research may be allowed.

Section 7.

Acts restricted in a national park. No person shall:

i reside in a national park;

ii hunt, kill or capture, or be found in circumstance showing that it is his intention to hunt, kill or capture any animal in a national park;
iii carry any fire arm or other hunting weapon in a national park;
iv introduce any domestic animal or allow any domestic animal to stray into a national park. Any domestic animal found in a national park may be destroyed or seized by, or on the orders of an authorized office, shall be disposed of in accordance with the instruction of the Chief Wildlife Warden;
v cause any bush or grass fire (except at designated places) or cut, destroy, injure or damage in any way any tree or other vegetation in a national park;
vi cultivate any land in a national park;
vii pollute any water in, or flowing in a national park;
viii introduce any exotic animal or plant into a national park;
ix pick any flower or remove any plant, animal, stone or other natural object from a national park;
x write on, cut, carve, or otherwise deface any building, monument, notice board, tree, rock or other object, whether natural or otherwise, in a national park;
xi fail to comply with the lawful orders of an officer while in a national park; and
xii discard any paper, tin, bottle, or litter of any sort in a national park except in a receptacle provided for the purpose.

North-West Frontier Province Wildlife Protection, Preservation, Conservation and Management Act (1975)

Section 16.

National Park

1. With a view to the protection and preservation of scenery, flora and fauna in the natural estate, Government may, by notification in the official Gazette, declare any area which is the property of Government or over which Government has proprietary rights to be a national park and may demarcate it in such manner as may be prescribed.
2. A national park shall be accessible to public for recreation, education and research subject to such restrictions as Government may impose.
3. Provision for access roads to and construction of rest houses, hostels and other buildings in the national park along with amenities for public may be so made and the forest therein shall be so managed and forest produce obtained as not to impair the object of the establishment of the national park.
4. The following acts shall be prohibited in a national park:
   i. hunting, shooting, trapping, killing or capturing of any wild animal in a national park or within three miles radius of its boundary;
   ii. firing any gun or doing any other act which may disturb any animal or bird or doing any act which interferes with the breeding places;
   iii. felling, tapping, burning or in any way damaging or destroying, taking, collecting or removing any plant or tree therefrom;
   iv. clearing or breaking up any land for cultivation, mining or for any other purpose; and
   v. polluting any water flowing in and through the national park.

IUCN Categories of Protected Areas (1978)

II. National Park
To protect outstanding natural and scenic areas of national and international significance for scientific, educational, and recreational use. These are relatively large natural areas not materially altered by human activity, and where commercial extractive uses are not permitted.

IUCN Categories of Protected Areas (1994)

II. National Park
Protected area managed mainly for ecosystem protection and recreation. Natural area or land and/or sea, designated to:

a. protect the ecological integrity of one or more ecosystems for present and future generations;
b. exclude exploitation or occupation inimical to the purposes of designation of the area; and
c. provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

Table 3.2 History of Court Cases Involving Chitral Gol National Park

Date	Private Property Regime	State Property Regime	Common Property Regime
1880	Mehtar Aman-ul-Mulk declares Chitral Gol his private hunting preserve.		
1953 Mar. 19	Agreement between *mehtar* of Chitral and governor general (president) of Pakistan that *mehtar* retains his personal property, including Chitral Gol, when he surrenders sovereignty over Chitral State to the Government of Pakistan.		Villages surrounding Chitral Gol share grazing, firewood, and timber rights of usage in Chitral Gol.
1961 Nov. 3	Letter F.3 (9)-F.II/61 from deputy secretary Ministry of States and Frontier Region to secretary Government of West Pakistan Home Department reaffirms that Chitral Gol is the private property of Saif-ul-Mulk Nasir.		
1969 1971 Nov. 13		Chitral State merges into Pakistan. Government of NWFP constitutes Chitral Land Dispute Inquiry Commission.	
1971 Dec. 23		Chitral Gol (19,112 acres) is declared a wildlife sanctuary for five years by commissioner of Malakand Division.	
1974	Distribution of Property (Chitral) regulation 1974. Law Department affirms 1953 decision of President of Pakistan.		
1975 Jul. 31		Government NWFP Home and Tribal Affairs Department Order No 10/31-SOTA, II (HD)/73 declares that all forests, *charagahs*, and *shikarghahs* are state property and identifies 73 *chakorams* (26.5 acres) in Chitral Gol, bearing an annual income of Rs 12,000, as property of ex-*mehtar* of Chitral, Saif-ul-Mulk Nasir, and remaining land as state property.	Public concession, regulated by government, is granted to villagers to: (a) obtain dry firewood; (b) obtain timber for private use under a permit; (c) graze cattle.
1976 Mar. 29	Court of Joint Secretary, Chitral Land Dispute Inquiry Commission, Board of Revenue, NWFP, Peshawar, rules in favor of deletion of 73 *chakoram* limit to personal property of Saif-ul-Mulk Nasir.		

1976 Aug. 2		Sheikh Mohammad Rashid, chairman, Federal Land Commission, sets aside 29 March 1976 ruling by joint secretary.	
1979 Jan. 25		Government of NWFP declares Chitral Gol a permanent wildlife sanctuary.	
1981 Dec. 16			Government of NWFP gives double timber quota, two mini-hydel stations, and priority for staffing in Chitral Gol wildlife sanctuary to villagers affected by same.
1982 Jan. 25	Justice Qaisar Khan (retired), chairman, Tribunal Land Disputes, dir., Swat and Chitral declares invalid 2 August 1976 ruling by chairman, Federal Land Commission.		
1983 Aug. 3	Saif-ul-Mulk Nasir vs Government of NWFP begins in Court of Senior Civil Judge Chitral; runs to 3 November 1994.		
1984 Oct. 18		Chitral Gol is declared a national park.	
1986 Feb. 6		Rs 2,050,000 is paid to deputy commissioner (DC) Chitral by Forestry Division (Wildlife), NWFP, for acquisition of 73 *chakorams* from Saif-ul-Mulk Nasir	
1987 Oct. 31			Senior civil judge Chitral rules that since Saif-ul-Mulk Nasir recognizes rights of people of Goldor, Sangor, Maklanda, and Jang Bazaar, they need not be party to suit of Saif-ul-Mulk Nasir.
1988 Jun. 14	Peshawar High Court dismisses federal government Writ Petition 592 against deletion of 73 *chakoram* limit.		
1989 Jul. 27	Saif-ul-Mulk Nasir letter to DC Chitral requesting all income from Chitral Gol be given to him, including markhor hunting royalties.		
1990 Jan. 17	Supreme Court of Pakistan dismisses federal government petition against deletion of 73 *chakoram* limit.		

1991 May 28	Notification of Home and Tribal Affairs Department deletes word '*chakoram*' from Order No. 10/31-SOTA, II (HD)/73.	
1992 Apr. 18		Ghulam Mohammad of Balach village, adjacent to Chitral Gol, claims ownership of property in Chitral Gol and rights to graze cattle and collect firewood.
1992 May 20	Senior civil judge Chitral dismisses application of Ghulam Mohammad.	
1993 Feb. 10	Saif-ul-Mulk Nasir proposes operating Chitral Gol as private game sanctuary.	
1993 May 11		District judge sets aside 20 May 1992 dismissal and orders senior civil judge to record evidence and decide application of Ghulam Mohammad.
1994 Nov. 3	Court of Senior Civil Judge Chitral rules that Chitral Gol in its entirety is personal property of Saif-ul-Mulk Nasir and that declaration by government as a wildlife sanctuary is illegal. Court also rejects application of Ghulam Mohammad.	
1995 May 22		Court of District and Session Judge, Chitral. People of Goldor, Sangor, Maklanda, and Jang Bazaar vs Saif-ul-Mulk Nasir and the Government of NWFP, appealing decision of senior civil judge Chitral of 3 November 1994. Villagers petition to have Chitral Gol recognized as common property and that they have equal rights with Saif-ul-Mulk Nasir, including rights to any royalty fees. Court cancels 3 November 1994 decision of senior civil judge Chitral, makes villagers a party in that case, and sends it back to senior civil judge Chitral.

Table 3.3 History of Khunjerab National Park

Date	Private Property Regime	State Property Regime	Common Property Regime
Prior to late 18th century			Kirghiz and Wakhi share pasture usage.
Late 18th century to 1974	*Mir* of Hunza allocates grazing rights to local communities and controls hunting and trade with China.		*Mir* of Hunza's shepherds and local communities share usage for grazing.
1974		Hunza State merges into Pakistan.	
1975 Apr. 29		Khunjerab National Park declared.	
1975		Conservator of Forests, Northern Areas, makes oral agreement with villagers using Khunjerab pastures to provide Rs 5000 per household per annum as compensation for loss of pasture rights in Khunjerab National Park.	
1986			KKH opens for foreigners over Khunjerab Pass.
1988		Directorate of Khunjerab National Park established.	
1989 Jun.		International workshop on the management planning of Khunjerab National Park recommends strict enforcement of ban on grazing in Khunjerab Pass core area.	
1990 Aug. 4			Temporary injunction issued against government interfering in grazing rights of villages (Sost, Nazimabad, Sartez, Gircha, Jamalabad, Morkhun, Galapan) until civil suit is settled.
1990 Oct. 15			Court of Civil Judge 1st Class No I, Gilgit, orders all parties to maintain status quo as of summer 1989 (Civil Case File No 64 of 1990).
1991 May		KSF evicts all shepherds from Khunjerab Pass core area	
1992 Jan. 5			Agreement between local communities and Northern Areas administration to jointly manage park, share revenue, and provide employment for local communities.

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4

JUNIPER—AN ENDANGERED PLANT OF THE HINDU KUSH REGION

*Mumtaz Hussain Shah**

Introduction

Juniper, also known as red cedar, belongs to the Cupressaceae family of the Coniferales order of plants. Coniferales are of great economic and ecological importance all over the world and make most of the world's forest cover. Most of their species are found in the colder regions. Juniper is a well-known conifer which includes a number of species varying in shape and size. Some of these are *Juniperus communis, J. wallichiana, J. polycarpa and J. horizantalis*. These species are well-distributed all over the temperate zones and even grow in the Arctic areas. Juniper grows in very cold and dry climatic conditions. In Pakistan it is found in some high altitude areas of the western and northern mountainous regions. The Hindu Kush area is one of the places in Pakistan with large numbers of this plant. Here it is found at altitudes between 6000 and 12000 feet. One of its species, *J. horizantalis*, (locally called *rišoki sarūz*), which creeps along the face of the hill, grows on altitudes where nothing else can grow. Juniper is the only conifer found in the upper part of the Chitral valley, which receives very little rain during the summers.

Present and Past Situation

Within living memory, thick forests of juniper covered the mountains in the dry part of the Hindu Kush. But now one would have to climb a great deal or travel for at least a day to have a look of this tree. All the juniper forests have vanished within the last half century. Now one can hardly find a cluster of trees which can be labelled as a forest. Only low-growing shrubs and solitary trees can be found on the hills. The inhabitants of the Buni Gol catchment area used to gather their firewood from the nearby hills some twenty years ago. In those days one had to walk for an hour to reach the part of the forest where dry wood of the dead trees was available. This part of the jungle, locally called *chirdu* or the broken-down part, receded higher and higher year by year until it vanished into the mountain summits. Then came the turn of the green trees to face the same tragic fate without completing their natural life. While collecting data for this study, I asked some wood collectors if there was a juniper forest left in the mountains. I was told that there was none; not even a few trees of considerable size. The destruction can be imagined from the following incident narrated by a villager.

> One day while on a tree felling trip we came across a big Juniper tree. This was big enough to be cut down with our axes. We were still wondering how to deal with it when one of us came up with the

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idea of burning it down. It was then lighted and to our amazement the tree burnt for at least two days and then fell into pieces. Though most of it had burnt into ashes yet there remained enough wood for all of us and of course the charcoal as well.

There are even recorded incidents of dynamite explosives being used to uproot larger trees. All these methods of destruction show that no one has any regard for this precious tree. Our governments have never bothered to do anything for the conservation of this tree. There are even cases where government functionaries have themselves caused great damage to this national wealth. In the village of Lasht Yarkhun, a man showed us a big pile of logs which he had harvested from a nearby forest. The man was allowed to do so by an official in the district administration so that he could build a new house to entertain visiting government officials. In the upper part of Yarkhun valley, government servants receive cash payment in lieu of firewood supply from the government. But all these government servants continue to meet their firewood requirement from the hard-pressed patches of juniper forest.

The negligence and malpractices on the part of the people and the government have reduced our juniper forest to near extinction. Although some patches can still be found in remote valleys such as Yarkhun valley, their condition is not satisfactory. Our government has been doing something to save juniper forests in Balochistan, but here in Chitral nobody has ever raised this issue.

Juniper and the Ecosystem

Juniper, being the only tree growing on the dry mountains, plays a key role in the ecosystem of the Hindu Kush area. In the upper parts of Chitral valley it is mainly responsible for holding the soil on the slopes. Without these trees the soil and rocks cannot stand in the face of strong winds, rain, and avalanches. Soil erosion in the upstream areas results in high floods in the rivers and flooding of the streams and dry *nallahs*. Juniper's bark and green leaves also provide fodder to the ibex and markhor during the winters when all the shrubs and grass are under deep snow; without a considerable juniper forest cover, one cannot hope for the survival of either ibex or markhor in these mountains. The fact that juniper and ibex are found in the same climatic conditions is enough to prove that juniper is essential for the survival of ibex in the area.

Juniper and Human Life

Juniper is a tree with a number of commercial uses all over the world. Its wood, being more durable than any other wood when in contact with soil, is best for making fence posts. Its aromatic scent makes it a good moth repellant and the wood is used for making chests and cupboards. Juniper berries are crushed to extract the juniper oil used in the production of gin. This oil is also used in medicines and perfumes. But unfortunately no one in Chitral has ever made any of the above uses of this plant. We have already burnt down all our forests in the fireplaces and the blacksmiths' kilns, and of course, some have used the ashes of its leaves and bark to make *naswar*.[1] I could detect very few cases of juniper being used as timber wood. But some of the houses built with this timber were really magnificent. In the past its twisted wood was used to make the frame for the *daf*, a popular musical instrument music. But *daf* is a rare thing to see these days.

Juniper and Society

Owing to their great dependence on juniper, the people of these areas have developed many customs, rituals, and beliefs attached to this tree. It is believed to be the abode of mountain fairies. Its green branches are burnt in the house to expel ill spirits from the home. Major John Biddulph, in his book the *Tribes of the Hindu Kush*, has recorded many customs and rituals in Gilgit and Chitral in which juniper plays an important role. One of these was the *chilli* festival, which centred round the sacred *chilli* or juniper tree. He even sees some evidence of juniper worship among the pre-Islamic people of Gilgit. The shamans of Kalash valley and Gilgit inhale the smoke of burning juniper foliage in order to become able to make prophecies and foretell events.

Today all these customs, rituals, and beliefs are disappearing not only because of cultural changes in the society but also due to the extinction of the juniper itself. Now, even a shaman can hardly find juniper to perform his ritual.

Quest for Survival

Ours is a fragile ecosystem. The severe climatic conditions and lack of rain makes the area very unsuitable for the growth of trees. Yet trees like juniper have adapted themselves to these conditions and easily grow here although their growth is very slow. Once these slow growing trees are lost, replacement is very difficult. The prospect of survival of this plant seems to be remote when we see that the issue is still not given due consideration. However, here are some proposals for the conservation and revival of this endangered plant:

1. Juniper species found in the Hindu Kush area should be included in the *Red Data Book of Pakistan*.
2. A complete ban should be imposed on cutting of juniper trees in the whole region.
3. A national park should be set up in some juniper growing part of the region, where juniper and many other species of wildlife may enjoy protection. One of the areas suitable for this purpose is the upper part of the Yarkhun valley where not only does the juniper need protection but also the ibex and marmot are threatened.
4. As people in many parts of the region depend on juniper for their fuel requirements, they should be provided with alternative means of energy, for example, hydroelectricity, solar energy, bio-gas, and gas cylinders, on subsidized rates. For further incentive to the people, road communication facilities and employment opportunities should also be provided.
5. Last but not least, the government and the NGOs should come forward to promote awareness of environmental issues among the people of the area. There is a general trend of giving less importance to environmental problems in developing countries. It is generally argued that environmentalism is a luxury that only the West can afford. But if we are to achieve progress, we have to choose between development and sustainable development. The latter will be a better choice. Another common argument is that talking of nature is superfluous when human beings themselves do not enjoy protection. To this objection, there could hardly be a better answer than the one put forward by the duke of Edinburgh, who said, 'There are some who still argue that man is more important than nature as if it were a straight choice between the two. It is not a case of nature or man. It is nature and man. If nature does not survive neither will man.'

NOTE

1. *Naswar* is a powdered preparation of tobacco to be placed under the tongue.

5

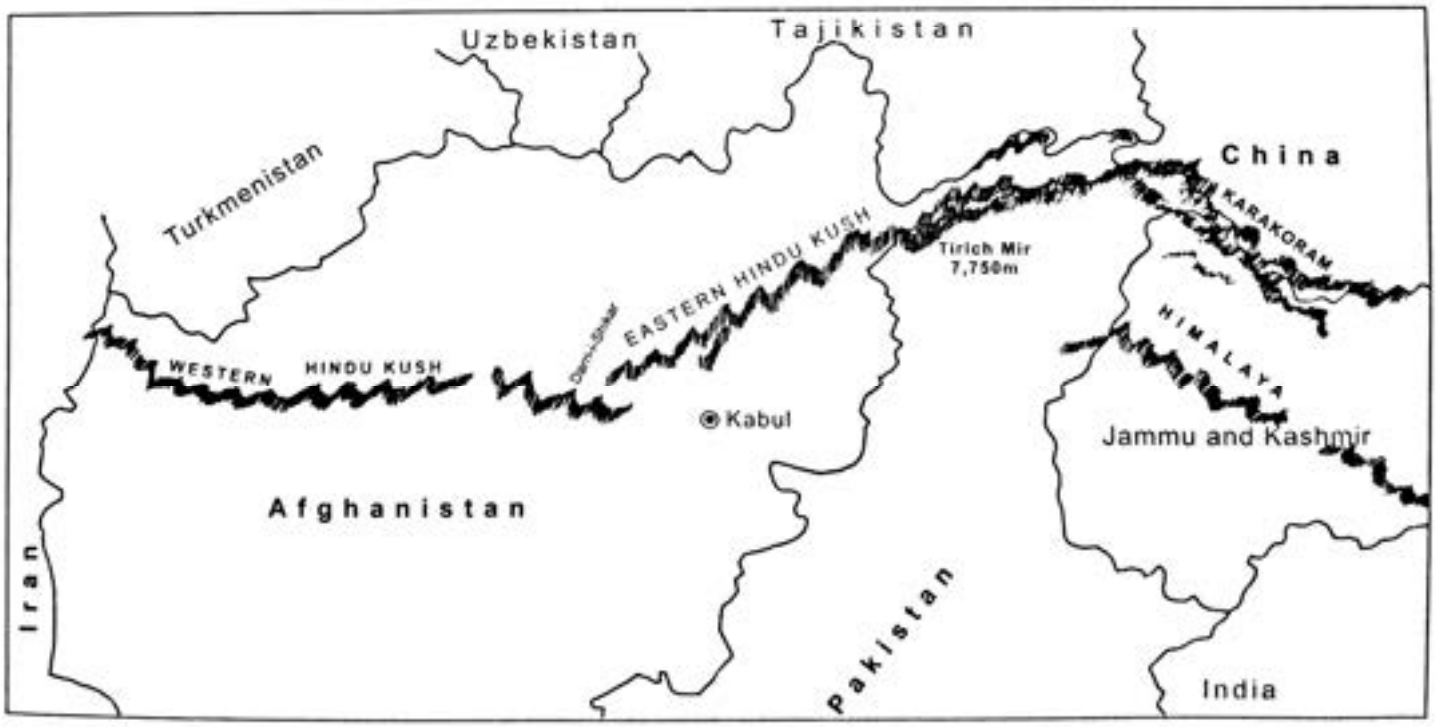
THE CONIFER FORESTS OF THE HINDU KUSH IN EASTERN AFGHANISTAN: THE CHALLENGE OF THEIR CONSERVATION

*Ismael Nasri, Thierry Delobel, and Jean Braud**

Introduction

The Hindu Kush is one of the most famous mountain ranges in South Asia. Most of it lies in Afghanistan. Until recently, its eastern part was covered by dense conifer forests (Fig. 5.1). However, seventeen years of war in Afghanistan have created a vacuum over the control of the forests. They are now depleted by logging and animal grazing. The most visible effects of the rapid deforestation taking place are land erosion and the increasingly frequent and destructive floods.

Fig. 5.1 Extension of the Hindu Kush Range



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In 1989, the Mission pour le Development des Economies Rurales en Afghanistan (MADERA), an European non-governmental organization, initiated the Afghan Social Forestry Project (ASFP). The aim of this project was to help village communities in eastern Afghanistan protect their forests. The project activities have included the protection of young trees in conifer forests, the replantation of barren areas with fast growing tree species, the making of village-forest inventories and maps, and an awareness programme about forest protection. These have been implemented by foresters and village-based forest agents. Although funding has been limited and erratic since 1989, the project has achieved significant results.

However, facing the reality that in many locations rural people need to exploit their forests to improve their economic conditions, the project is shifting emphasis from mere forest protection to sustainable management of the woodlands. Although a handicap for enforcing rules, the absence of a central government authority provides the opportunity to work directly with the local communities. The aim is for these communities to assume greater responsibility for a sustainable management of their forests.

The conservation of the forest in Afghanistan is a long-term concern that must be addressed today. The natural forests are a source of income that can be used to support the revival and further development of the rural economies. The forests are part of an integrated ecological system which forms the basis of these economies. They are a resource base that should be preserved for the benefit of both present and future generations of Afghans. For this, it is crucial that appropriate measures are implemented to stop the smuggling of huge quantities of timber across the Afghan-Pakistan border. The international community currently working for the rehabilitation of Afghanistan should also show more interest in helping the Afghan dwellers of the Hindu Kush better conserve their natural heritage.

The Hindu Kush Range

Geographic Features

A branch of the Himalayas, the Hindu Kush is one of the most lengthy, highest, and most famous mountain ranges in the world. The mountain uplift resulting from the subduction of the Indian and Arabian plates is still very active.

The Hindu Kush is divided into two main parts:

- The east Hindu Kush, which lies from the end of the Himalayan Range through Kalam and Chitral in Northern Pakistan to in central Afghanistan Darrai Shakari
- The west Hindu Kush (known as Alburz Koh) which continues on Afghan territory through Samangan, Bamyan, Balkh, and Jozjan in the west

In Afghanistan, the Hindu Kush is like a large natural wall which separates the northern and southern parts of the country. Streams flowing through the narrow valleys feed the river Kabul in the southeast and the river Amu in the north.

Climatic Features of the Hindu Kush

The Hindu Kush has a continental climate which is strongly influenced by topography and the monsoon coming from the Indian Ocean.

The difference between summer and winter temperatures is great. Highest temperatures occur in the months of May and June before the refreshing effect of the Asiatic monsoon is felt. The lowest temperatures are recorded in January and February when cold winds from the Caspian Sea blow. The 11 degree Celsius July isotherm forms the theoretical upper limit of the forest in the Hindu Kush at 4000 metres above sea level (FAO/UNDP 1981). Eternal snow covers the mountains above 4500–5000 metres above sea level.

The monsoon moving northwest-ward along the Himalayan range reaches the Hindu Kush in the beginning of the summer. It brings substantial rains (more than 1000 mm in the mountains) in the eastern part of the Hindu Kush. The influence of the monsoon on the west Hindu Kush is minimal and the terrain and vegetation is dryer. The monsoon rains stop in September. The winds from the Caspian Sea also bring some rain in winter and early spring.

Main Characteristics of the Hindu Kush Forests

On the northern slopes of the Hindu Kush, from Badakhshan to Badghis provinces, woodlands of edible pistachio trees (*Pistacia vera*) and almond trees (*Amygdalin bucharica*) are still common between 600 and 1800 metres above sea level. However, they have been severely degraded by the people and their animals. At higher altitudes, the forest is dominated by the juniper tree (*Juniperus excelsa*).

The southern slopes of the Hindu Kush are characterized by another species of pistachio tree, the nonedible 4–6 metre high *Pistacia atlantica*. They are limited in number, however.

While the pistachio and juniper trees dominate the woodlands of the northwestern parts of the Hindu Kush, the oak (*Cedrus* spp.) and conifers forests dominate the mountain slopes in the east. According to available information, the conifer societies cover about 212,000 hectares of land in eastern Afghanistan. This area is distributed by province as follows:

Table 5.1 Estimated Area of Conifer Forests in the Hindu Kush of Afghanistan

Name of Province	*Number of Hectares*	*%*
Kunar	152,640	72%
Laghman	23,320	11%
Paktia	19,080	9%
Nangarhar	16,960	8%

Source: Nedialkof 1975.

It is estimated that the forests in the above-mentioned Afghan provinces contain about 28,560,000 cubic metres of wood. The exploitable timber wood is around 15,000,000 cubic metres. The firewood, mainly from the Quercetum stage (see Table 5.2) approximately represents 13,560,000 cubic metres (MADERA 1992).

During the war against the Russian troops and the internal power struggle that has followed their withdrawal, the conifer forests of eastern Afghanistan have suffered from intensive and indiscriminate logging. In 1993, it was estimated that more than 1500 hectares of conifer forests vanished every year (Braud 1993). The figure is probably much higher now.

Table 5.2 Main Characteristics of the Forests of the Hindu Kush in Eastern Afghanistan

Ecological Stage	Main Species	Climate	Use of Wood	Status of the Forest
Sub-tropicetum Siccum 500–900 m	*Dalbergia sisso* *Ziziphus* *Nummalaria* *Dodonea viscosa*	150–350 mm Dry and hot	Fuel Fodder	Intensively used
Olea reptonetum 900–1300 m	*Olea ferruginea* *Reptonia buxifolia* *Quercus baloot* (seldom)	Around 400mm	Fuel Fodder	Intensively used
Quercutum 1300–1800 m	*Quercus baloot; Juglans regia; Platanus orientalis* and *salix* (near water) *Indigofera* and *Amygdalus* *Cedrus* mixed with *Quercus* at end of stage	400–700 mm	Fuel Fodder for goats Agricultural tools	Highly degraded in some places
Pinetum 1800–2300 m	*Pinus gerardiana* (*Jalghoza*)	600–800 mm	Fuel Fruit Timber	Intensively used locally and for Jalalabad and Kabul markets
Cedretum 2000–2800 m	*Cedrus deodara* (45–50 m high) sometimes together with *Quercus* species (*Q. baloot*, *Q. dalatata*) and *Pinus wallichiana*, *Abies webiana*, *Pieca morinda*, *Juglans regia*, *Amygdalus*, *Pinus gerardiana and Indigofera gerardiana*	700–1000 mm Moderate climate in summer Snow for 4–5 months in winter	Good quality and valuable timber wood for construction and other uses (cedar) Wood resistant to humidity	Degraded in many places due to commercial cutting and overgrazing by animals
Abito Picetum 2800–3300 m	*Abies* and *Pieca* Other species include: *Quercus semecarpifolia*, *Pinus wallichiana*, and *Taxus bacata; Cedrus* trees and *Juniperus* bushes also can be found in this stage	900–1200 mm Humid climate and lots of snow (high range and narrow, lower valleys where sunshine is scarce)	Timber wood for indoor use and other purposes Wood sensitive to humidity	Degraded by exploitation, animal grazing, and natural events such as avalanches

Piceto Quercetum, Secum 3000–3400 m	*Picea* (30–60 m high) and *Quercus semicarpifolia* (15–20 m high)	Precipitation mostly in the form of snow falls (5–10 m high), summer rains sometimes with strong hail Summer pasture	Timber wood for indoor use (*Picea*) Implements, fuel, and fodder (*Quercus*)	Degraded by overgrazing mainly Damage caused by avalanches
Guniperitum	Small trees and bushes laying flat on the ground	Cold weather (short summer and long winter) Rains with strong hail in the summer and snowfall in winter (10 m high or more)	Summer pasture Wood as fuel and shelters of shepherds	Degraded by overgrazing Damage caused by avalanches may be severe
Picetum sub-alpinetum	Seldom *Picea* trees can be seen This stage with rocks is the end of the forest	Very cold with high snowfall in winter and very short summer	Very short time for grazing	Degraded by grazing
Alpinetum	Barren areas with rocks (mountain tops)	Alpine climate Permanent snow		

Ownership and Use of the Natural Forests in Afghanistan

The natural forests in Afghanistan are by law the property of the state. Before the war, the Ministry of Agriculture had a forest and range department with offices at provincial and district levels. In the districts, foresters were responsible for controlling the use of the forests and running nurseries producing forest saplings for planting. Guards were patrolling the forests to check on illegal cuttings.

If the natural forests were the property of the state, the people living in their vicinities de facto owned the right to use them for their own needs. Oak forests from which tree fodder is collected and that serve as grazing ground for domestic animals were traditionally divided among nearby dwellers. Conifer forests where timber and fuel wood were extracted remained part of the common usufruct of the village. However, in some areas, influential and powerful families had appropriated entire forests for themselves.

In the past, village elders and *shura* (village assemblies) could enforce rules regarding the use of the forests. Local penalties were applied in kind or in cash against offenders, for illegal grazing by herds or tree cuttings.

With the war, the control of the state and traditional local authorities (village elders and *shura*) over the forests dwindled and the forests were appropriated and divided among the local people. Timber traders in Afghanistan and Pakistan took advantage of this fact and lured people into earning quick money by selling off their parts of the forest.

Effects of the War on the Conifer Forests in Eastern Afghanistan and the Present Situation

Although it is not yet known how much of the conifer forest disappeared during the seventeen years' war that has torn apart the country, the many scars on the mountain slopes show that deforestation had been taking place on a unprecedented scale. Factors that have contributed to this situation include the following:

- Forest fires caused by bombing
- Increased local demand for timber wood to reconstruct houses and village infrastructure
- Intensification of the illegal trade with Pakistan for timber wood

As indicated above, the latter was fostered by the collapse of formal control over the forests. *Mujahideen* commanders and other unscrupulous but powerful people appropriated forest lands and sold them out to finance their armed struggles, secure their position in the power struggle, or just make money for a rainy day.

Yet, the war and its negative effects on the forest are not solely to be blamed for the alarming deforestation taking place in Afghanistan. Damage is also caused by the inherent misuse of the forests by the local people. Practices such as the following are very destructive:

- Animal grazing inside the woodlands that destroys the young trees and prevents the regeneration of the forest. Natural saplings are sometimes purposely cut off by the shepherd's axe.
- Setting fires to help the regrowth of fresh grass for animal grazing, the sprouting of high-priced mushrooms such as the morels, or just for burning fallen trees that block the passing of herds through the forests. These fires may spread and destroy large areas of forest lands.
- Using archaic and wasteful sylviculture practices such as debarking and drying trees, harvesting small and unmatured trees, wasting wood during cutting operations (partly a result of lack of proper tools), and so forth.

It is understandable that, with the technology that they know and which is available to them, people use the forests in ways that are the most easy for them. They have present needs to satisfy and tend not to anticipate what may happen to them or their children in the future (soil erosion, drying of springs, floods, micro-climatic changes, etc.).

An NGO's Attempt to Fight against Deforestation in Eastern Afghanistan

In the context of its rehabilitation efforts in Afghanistan to help the Pakistan-based Afghan refugees return home, the European non-governmental organization MADERA initiated a social forestry project in 1989. The request for such a project was made by Afghan scholars who were worried about the increasing deforestation at play in the Hindu Kush mountains.

The MADERA's ASFP covers the provinces of Kunar and Laghman, where most of the remaining natural conifer forest lies. The field activities are supported by project infrastructure that includes six forestry centres, one training centre, and eight fruit and forest tree nurseries.

The three main objectives of the ASFP are as follows:

- To make people aware of the need and urgency to protect their forests

- To afforest and/or reforest barren land
- To assess the potential for sustainable exploitation of the forests

To each of these objectives correspond the activities described below:

Awareness Activities

Since 1989, the main emphasis of the ASFP has been to make the Afghan people aware of the need and urgency to protect their forest.

As a non-governmental organization, MADERA has no legal authority to enforce forest protection measures on people. Through discussions, and by means of persuasion, MADERA tries to make the village communities agree not to sell out the village forests to timber traders and to undertake actions to conserve them (e.g., protection of young trees from animal grazing, defining proper routes for the passing of herds through the forests, etc.).

Owing to the vested interests and conflicts that often exist amongst members of different clans and of different political affiliations, such agreements are often difficult to reach and success is not always guaranteed. When agreement is reached, a member of the village is selected to become the local forestry agent for the ASFP. Forestry agents are trained in proper sylviculture techniques and given a set of improved forestry tools. They also receive seed and implements to establish their villages' private fruit and forest tree nurseries.

Forestry agents are the grass-root workers of the ASFP, maintaining the link between the project and their communities. Their tasks include meeting with the members of the local *shura*, the elders, and the herdsmen. Where a school exists, the benefits of the forests and how to protect them are also explained to the students. Forest agents also train other villagers in better tree selection and felling and logging techniques. They are supervised by an ASFP forester and receive a small salary for their work.

Awareness activities are supported by posters, stickers and booklets, that are put on display at the ASFP centres and nurseries, mosques, schools, and other public places (see Appendix I).

Plantation Activities

Plantation activities have mainly taken place in the lower areas of the Kunar province: about a hundred hectares have so far been planted with *Eucalyptus* and *Ailanthus* species. Ten hectares of cedar trees have also been replanted on a mountain slope at a higher elevation.

The plantations are done on private or communal lands with a preference for the latter. Anti-erosion measures including the making of small terraces around the trees and check-dams in the water runoffs are demonstrated to the people during these plantations.

Forest Inventory and Mapping Activities

There is almost no information available on the present status of the conifer forests in Afghanistan and on the extent of the deforestation that has been taking place since the war started. Through inventories and mapping of village forests, the ASFP has been gathering essential data to assess the risks of, and potential for, forest exploitation.

The ASFP is a small project with limited and unreliable funding (less than Rs 5 million in 1994). Despite this, the achievements are not negligible, as shown in Table 5.3.

Table 5.3 Main Achievements of the MADERA Forestry Project 1990–4

Indications of Achievement	Waigal Valley	Pech Valley	Asmar Area	Kamdesh Area	South Kunar
Starting year:	1990	1991	1991	1991	1994
No of villages covered:	8	3	3	11	3
No of forest agents:	8	3	3	11	3
No of people trained:	80	30	30	110	30
Technical cutting of selected trees for village consumption:	1600	30	6	1760	480
No of tool sets distributed:	16	6	6	22	6
No of villages approached by the project:	8	3	3	11	3
No of villages that refused the project:	2	-	1	4	1
No of awareness posters and stickers produced and distributed:	9x1000	9x500	9x500	9x1000	9x500
No of technical booklets published and distributed:	3x400	3x150	3x150	3x500	3x100
No of forest maps produced:	8	3	3	11	3
No of forest inventories:	1	-	-	2	-
No of hectares planted:	2	-	15	1	80

Source: ASFP, MADERA.

Understandably, funding agencies tend to give priority to emergency relief and rehabilitation activities in Afghanistan. However, deforestation in the Hindu Kush is a problem that should not be overlooked. It needs immediate and adequate attention.

Dangers and Challenges for Conserving the Hindu Kush Forests in Afghanistan in the Future

Now that the Afghan people are returning to their villages, the natural resources are likely to suffer from an increasing population pressure on the land. This will be compounded by the fact that many rural dwellers have yet to restore the economic basis of their farming enterprise.

In the elevated areas of the Hindu Kush, livestock rearing, particularly of goats, is a key component of farming systems and represents the main source of income for households. It is highly conceivable that the animal population will follow the same increase trend as the human population. In already over-populated mountain areas, it will be difficult to contain further destruction of the forests by animals and humans alike.

The ASFP faces difficulties in preaching the conservation of the forests when the money is on the side of those whose interest is to destroy them. The main destination of the conifer trees that are cut down in Kunar province and smuggled into Pakistan is Saudi Arabia. From Afghanistan to Saudi Arabia, the value of the same piece of wood is increased by forty times! Although only a fraction of timber wood proceeds goes to the villagers themselves, the pressure imposed on the local communities by the timber traders is considerable. Unfortunately, the latter bring their own people to cut the forest and there is no remunerative employment for the locals. Cleverly, the timber traders keep warning village people that as soon as there is a recognized central government in Afghanistan, the state will take back the forests from them. It is then to their advantage to make use of them now.

As long as there is no control over the Pak-Afghan border, the smuggling of timber wood through the border will continue. In 1993, timber merchants were entitled by the Pakistani government a trading permit from the tribal areas for three months. During this period, 13,000 fully loaded trucks crossed the border from Afghanistan. This approximately amounted to 400,000 cubic metres of timber wood, namely, about 1500 hectares of natural forest cleared in Kunar province.

If awareness activities on forest protection are to continue, a more direct involvement of the ASFP in forest exploitation should be considered. Where a village community seeks to sell forest land to a timber trader, the ASFP should try to intervene on its behalf to ensure that the forest is exploited in a rational way, and that a maximum number of local people are employed in the work. A formal partnership contract could be established with the local community to that end. The practical tasks of the ASFP would then be to train the locally employed loggers in proper forest exploitation techniques, to supply them with appropriate tools, to select the trees to be cut and supervise the harvesting operations, and to assist the villages in making long-term plans for sustainable forest management.

It seems, however, that in the present condition of Afghanistan, particularly in the mountainous areas where poverty is prevalent, the role of the ASFP to act as a technical adviser in forest management will be better accepted by the local population if it is linked to development efforts such as the rehabilitation or construction of village infrastructure including water-supply schemes, schools, and dispensaries.

Concluding Remarks

If it is not too late to save the conifer forests of the Hindu Kush in Afghanistan, it is urgent to take appropriate measures to do it. This includes a continuous effort to educate people about the benefits of the forests and to make them aware of the environmental risks involved if they are not protected.

In a country where the revival of the rural economies is so crucial for the population, a shift of emphasis by the ASFP from a forest protection thrust to a more holistic forest management thrust—that includes a rational and sustainable exploitation of the forests for commercial purposes—is needed. Strategies that empower the local communities both vis-à-vis the timber traders and a future state agency dealing with forestry, and that make them more responsible for the conservation of their own natural resources have yet to be found and experimented. It is this community-based approach that the ASFP will implement in the coming years, giving emphasis to the following:

- Training of local people in proper cutting and logging techniques
- Transfer of adapted technologies for forest exploitation
- Establishment of contracts with village committees and *shura* for technical assistance in forest management

However, the impact of such efforts will be extremely limited without appropriate steps taken by the Pakistani authorities to curtail timber wood smuggling from Afghanistan. Pakistani foresters should assist their Afghan counterparts in conserving the natural heritage of the Hindu Kush by raising their voice against policies that promote rather than prevent deforestation.

The international community, including foreign governments, United Nations agencies, and non-governmental organizations currently working for Afghanistan should make greater effort to save the Hindu Kush forests.

The reason that pushes Afghan farmers to sell out the forest areas around their village is the same as the one that makes them grow poppy in their fields: economic poverty. Substantial efforts are made to eradicate poppy cultivation through supporting the rehabilitation of village infrastructure such as roads, schools, and clinics. Although the deforestation in the Kunar province has no adverse social consequences in the West in the way that poppy cultivation does, Western governments and UN agencies could use a similar approach to reduce the pressure that the rural people are facing to destroy their environment.

Appendix I

Titles of Posters, Stickers, and Leaflets Distributed through the ASFP by 1994

Posters:

1. 'We Have Made a Big Mistake.'
2. 'Forest Is a Gift of God, Protect It.'
3. 'More Gifts of God are Available from the Forest.'
4. 'More Livestock, Poor Forest and Less Yield—Less Livestock, Dense Forest and More Yield.'
5. 'Protect the Wildlife in Your Forest.'
6. 'See, the Forest is Nice, Protect It.'

Stickers:

1. 'If You Cut Down the Forest the Springs Will Dry Up and the Mountains Will Become Bare.'
2. 'If We Protect Our Forest We Will Have More Water and Good Pasture for Grazing.'

Leaflets:

1. 'We Protect Our Forest.'
2. 'Appeal for Protecting the Forest.'

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6

RESOURCE UTILIZATION AND ENVIRONMENTAL DEGRADATION IN SWAT VALLEY, NORTHERN PAKISTAN

*Dr Usman Ali**

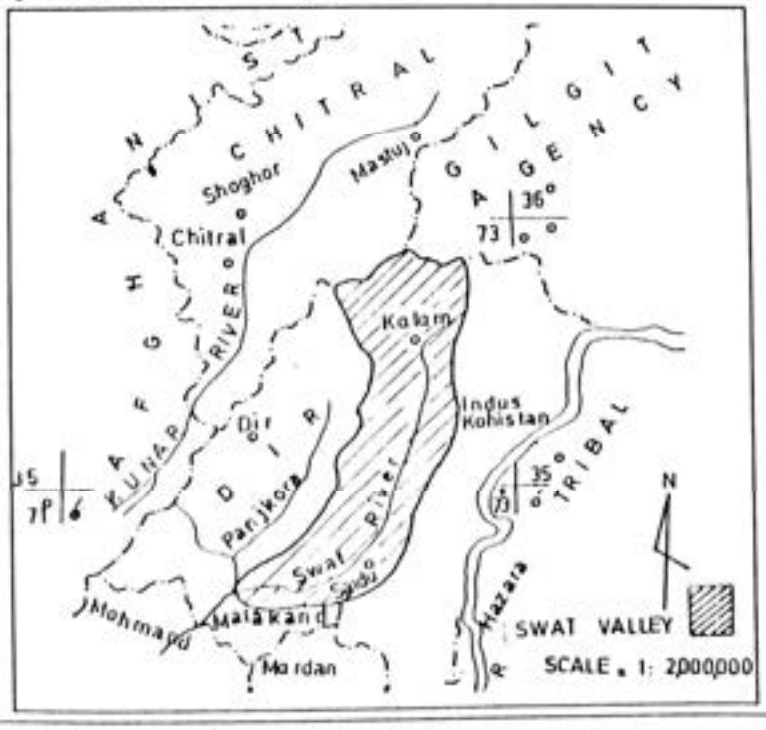
Introduction

The present study is concerned with the understanding, assessment, and evaluation of natural resources, ecology, and environmental conditions of the Swat valley. The study highlights the relationship between human beings, environment, and development in terms of the utilization of resources and their impact on the environmental degradation. The resources selected for analysis include human resources, land resources, and forest resources.

Study Area

The Swat valley is located between 34 degrees, 32 minutes, and 35 degrees, 54 minutes north latitudes and 71 degrees, 45 minutes, and 72 degrees, 45 minutes east longitudes in the Malakand civil division of the North-West Frontier Province of Pakistan (Fig. 6.1). Administratively, the valley includes parts of Swat and Dir districts and Malakand Agency.

Fig. 6.1 Swat Valley and Surroundings



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More than half of the valley (1238.13 out of 2374.7 sq. miles) is hilly and mountainous and has been formed by the erosional work of the river Swat and its tributaries. The river Swat flows through the middle of the valley and almost divides it into two equal halves. The shape of the valley is like a broad 'V.' It has a rugged ground surface and is surrounded on all sides by mountains and hills except one gap to the southwest through which the river Swat flows out. The elevation in relief varies from 1900 feet in the southwest to 20,528 feet above mean sea level in the northeast.

The valley is broadly divided into three physical divisions. They include: Swat Basin, intermontane basins, and hills and mountain slopes.

The Swat Basin is the main drainage basin of the river Swat with a length of 70 miles. It is wider in the lower southern and southwestern parts and gradually narrows down towards the north. The basin is from two to four miles in width, but at its wider portions, it reaches to some fourteen miles.

The intermontane basins comprise the lowlands of the major tributary valleys or glens which have been formed by the various tributaries on the Swat River. These side valleys merge into the main Swat valley at different topographical levels and constitute different ecological niches of the main ecosystem (Swat valley).

The hills and mountain slopes, on the other hand, comprise the uplands located above 4000 feet elevation on the hills and mountains slopes of the valley. These areas are characterized by thin surface soils with steep slopes and highly terraced agriculture.

All the three topographic zones or features are different from each other in terms of gradient, lithology, drainage system and water supply, climate, and availability of agricultural land, as well as tribal pattern (Ali 1985).

The overall climate of the Swat valley is extreme and dry and for the major part is distinctly continental. June is the hottest month with a mean maximum temperature of 96 degrees Fahrenheit at Saidu Sharif, the capital of the valley. January is the coldest month with a mean minimum temperature of 36 degrees Fahrenheit at Saidu Sharif.

Rainfall in the valley is mainly in the winter and spring, that is, between the months of December and April. Monsoon rains occur in July and August.

The economy of the valley, like that of the nation, rests on agriculture, which has been practiced in the area since antiquity.

The demographic structure of the valley shows that in 1981, it contained 0.72 million people with a population density of 307 persons per square mile. The growth, distribution, and density of population varies with changes in the physical features and socio-economic conditions of the population. That is, larger populations are concentrated in compact and nucleated settlements in the southern plains of the Swat valley which have large tracts of flat and fertile lands and developed irrigational and transport networks. On the other hand, in the northern hilly and forested regions with great heights and severe climatic conditions as well as thin surface soils and fewer agricultural lands, population is sparse and the settlement pattern is dispersed and fragmented.

Objective and Database

The present study attempts to evaluate the human factor in resource utilization and the resulting environmental degradation.

This study is explorative, descriptive, and analytical in nature. Owing to lack of sufficient relevant data, the study is mainly based on primary data which has been collected by the

author from personal queries and discussions as well as from various government and semi-government agencies.

The procedures or research techniques used for observing or operationalizing the various units of analysis include both field- and survey-research methods involving intensive field work. The field research was mainly based on the techniques of rapid rural appraisal (RRA) while the survey research was conducted on a worksheet.

Results and Discussion

The natural resources base of a region include land, water, vegetation, soils, and minerals. The availability of natural and human resources and the capability to make their optimal utilization are taken as indicators of socio-economic strength of a society. A society lacking the capacity to harness its resources or over-exploit them remains backward.

The Swat valley is predominantly rural in character. Here, land, water, vegetation, and minerals are the common natural resources. The life-style of the people, their economy and culture, etc., in this rural landscape are influenced by these resources. The evolution of the socio-economic system of the villages in this area is also guided by these natural resources. Any measure towards their future development will be largely dependent on their efficient utilization. Therefore, detailed information on the quality, quantity, and capability of the natural resources is required. The present study has tried to provide some information and understanding of the problem.

The three parameters/resources which are very important for the study of human beings environment interactions and the resulting environmental degradation have been selected for detailed analysis. They include: human resources, land resources, and forest resources. Each of them has been described, interpreted, and analysed in the following account.

Human Resources

The wealth of a country depends upon its human resources. By the proper utilization of these resources, we can achieve the national goals and objectives. Effective manpower planning, which is an important and integral part of socio-economic planning, demands up-to-date and accurate data on these human resources. At present, it is intensely realized that a complex interaction exists between population variation and socio-economic development in terms of resource utilization. The allocation of resources in rural and urban areas cannot be made possible without knowing the population data and its characteristics.

The new approaches to regional planning, physical planning, environmental planning, population planning, family planning programmes, integrated rural and urban development programmes, and other policies, need to meet extra demands for demographic data.

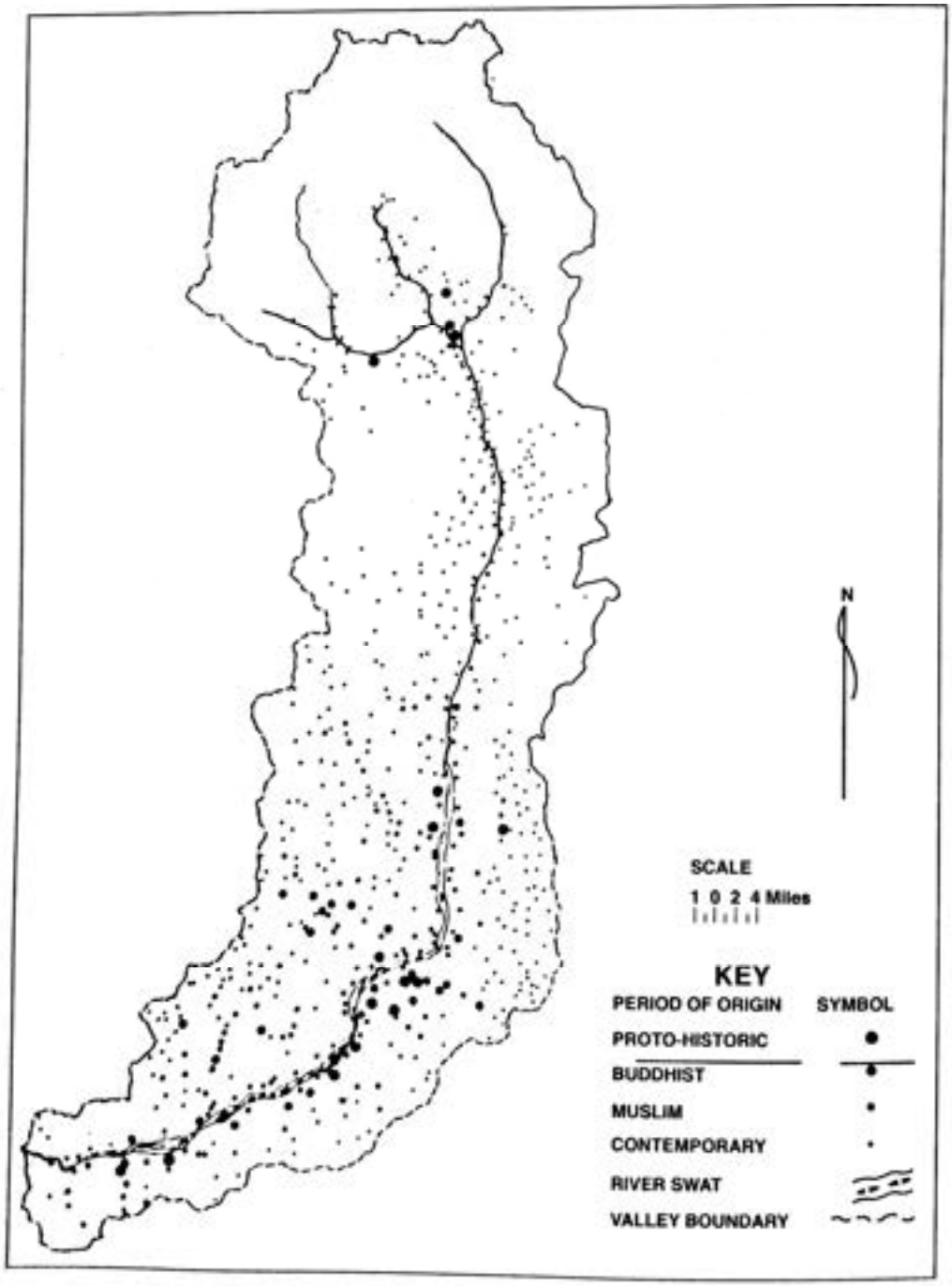
It is, therefore, necessary to understand the extent of population, its mode of living, and the rate of its natural increase or decrease.

During the course of the census periods conducted so far, the total population of the Swat valley was 368,978 in 1951, 453,427 in 1961, 669,586 in 1972, and 719,500 in 1981. This indicates that during the course of the last thirty years, the population has more than doubled. On the basis of 1972–81 figures, the population was increasing at the rate of 3.17 per cent annually. According to unofficial data, the present population of the Swat valley is about 1.2 million (1995). The number of settlements has increased from 145 in 1864 to 1109 in 1985 (Ali 1985), which indicates a tremendous population and settlement growth in the area. In

1981, the population density of the valley was 307 persons per square mile, which increased to about 506 persons per square mile in 1995.

The spatial distribution of population in the Swat valley is influenced by a host of environmental, historical, socio-cultural, economic, and demographic factors like climate, terrain, soils, and natural resources. These factors account for the opportunities of different economic activities in the area and consequently affect the spatial distribution of population. That is, larger concentrations of population with bigger compact and nucleated settlements are confined to the plains along the river Swat and its tributaries for abundant land and water resources. On the other hand, the population is comparatively smaller along the hill slopes and narrow valleys with isolated and dispersed settlement topologies due to scarcity of economic resources in these areas (Fig. 6.2).

Fig. 6.2 Swat Valley: Evolution and Diffusion of Settlements



The present population explosion in the Swat valley exerts tremendous pressure on its meagre resources. Population growth in the valley limits educational opportunities, increases unemployment and underemployment, imposes additional burden on social and administrative services, and increases poverty, ignorance, diseases, crimes, social alienation, malnutrition, resource utilization, and environmental pollution and degradation.

The pressure on land as a result of population growth is one of the major problems of development being faced by the Swat valley. Owing to this pressure, the valley is confronted with a deficit in food supply because of reduction in cultivated lands and low agricultural yields. The mounting population pressure also results in reduction in the size of fields as well as fragmentation and subdivision of holdings. The low agricultural productivity has resulted in the low economic level and nutritional standards of the people.

The areas of the Swat Basin and lower intermontane basins have become an ecologically fragile zone. On the other hand, the population of the northern narrow valleys and hill slopes inhabited by the Kohistani and Gujar tribes is also increasing very rapidly due to the non-intervention of family planning programmes. As such, there are visible signs of population pressure on the resources of these areas. These people need more land for sustainable agriculture, which is obtained by clearing more forests and grazing lands. Consequently, the natural ecosystems are destroyed, leading to severe environmental degradation.

The growth of population also exerts pressure on the fuel wood supply. It has been observed that the clearing of woodlands and forests has been done mainly for getting fuel wood.

Thus, it can be concluded that there is a sort of relationship between economic, social, and ecological problems. Very high pressure is being put on the natural resources by an ever-growing population of the valley. The limited resources of the area are wastefully and recklessly treated. The population growth has severely affected the land-use pattern. That is, the net area sown has increased while the barren wasteland and forests have declined considerably. The unbalanced growth of population on the one hand and the slow growth and development of agriculture on the other have thus put tremendous pressure on the net area sown to produce more food.

Therefore, it can be said that the present and potential future environmental degradation of the Swat valley is the result of human activities and must be protected against human abuses.

Land Resources

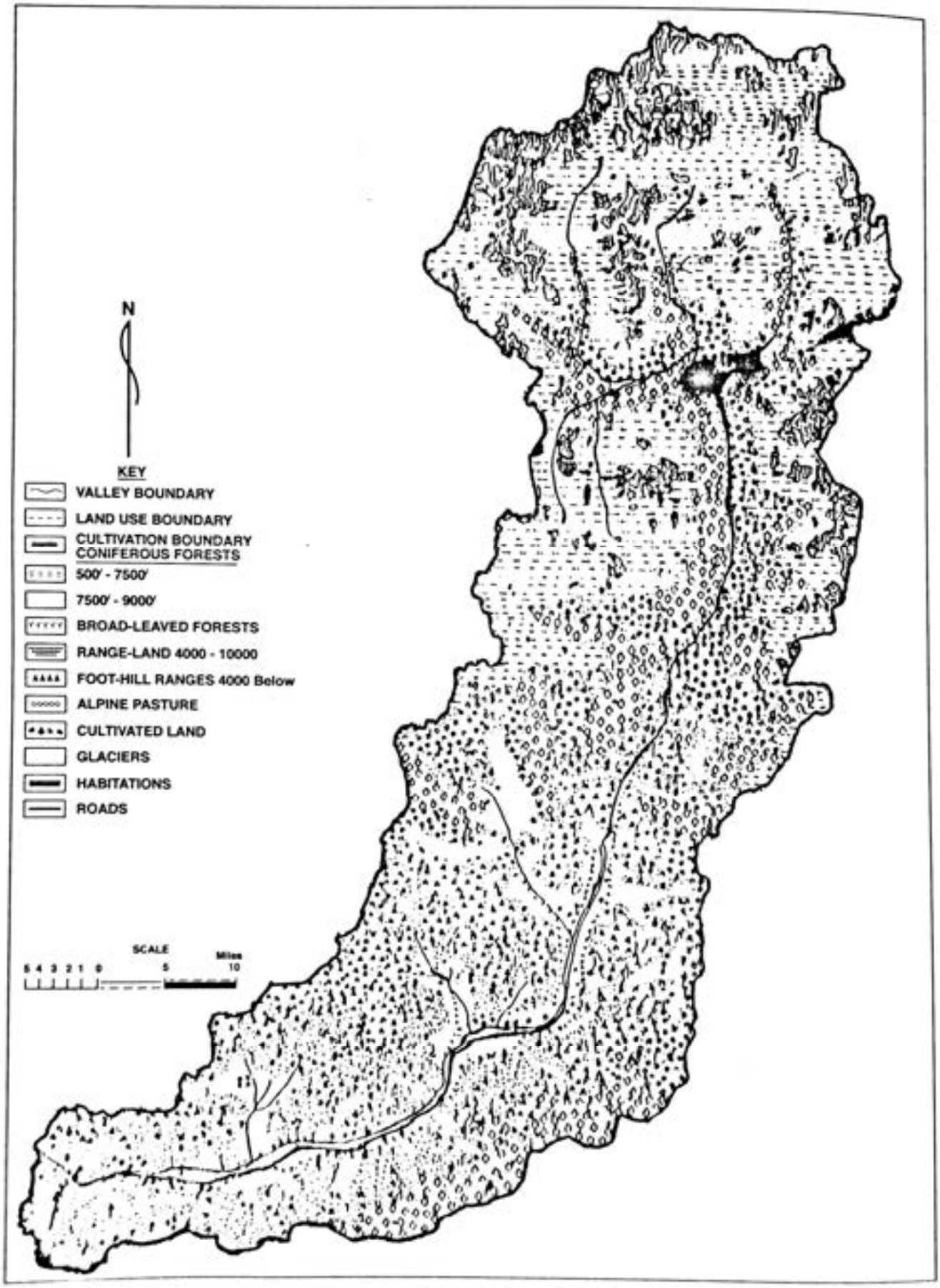
Land is the most important and essential resource base of a region. It is a primary resource in the agricultural economy of the Swat valley and is one of the fundamental components of our environment. The misuse or overuse of this resource results in the varied environmental degradation.

The economy of the Swat valley is primarily based on agriculture. According to 1972 census figures, 67.5 per cent of the population was agrarian. The 1981 figure shows that 73.31 per cent of the population was engaged in agricultural activity. The 1995 field survey has documented that about 80 per cent of the population is directly or indirectly dependent on agriculture. This shows the importance of agriculture as the basic economic activity of the people.

Agriculture in the Swat valley is controlled by the relief and the climatic and social conditions. Variations in relief have resulted in differences in the availability of cultivable lands. On the basis of 1981 figures, out of the total agricultural lands of 372,364 acres, 130,497 acres or 35.4 per cent occur below 4000 feet elevation (Fig. 6.3). These lands have

small slope gradients and are mainly confined to the main Swat Basin. Owing to their deep soil and flat terrain, the farm sizes of these lands are larger and fertile.

Fig. 6.3 Swat Valley: Land Use



The remaining 64.6 per cent of the cultivated lands are confined to the intermontane basins and hill slopes in the ratio of 40.6 and 24 per cent respectively. Amongst them, 24 per cent of the land located along the hill slopes and inhabited by the Gujars has steep slopes with highly terraced fields.

The cultivated lands below 4000 feet elevation have favourable climate for the production of crops while those between 4000 and 8000 feet heights are less favourable. Above 8000 feet elevation, due to severe climatic conditions and extremely steep slopes and thin surface soils, agriculture is absolutely uneconomical and only one crop is grown annually in some parts.

The pressure on cultivated lands as a result of population explosion is continuously mounting. The per capita cultivated land is rapidly declining. For higher populations, we need increase in food production, which can be done in the following two ways:

a. Increasing the area under cultivation
b. Using genetically improved, high-yielding, and disease-resistant varieties of crops

The field survey has documented that the land most suitable for agriculture in the Swat valley is already under cultivation. The rapid expansion of settlements is converting the cultivated lands into residential areas. The construction of roads and other infrastructure also consumes precious agricultural land. Furthermore, putting new land under cultivation is not so easy. It requires massive amounts of energy in the form of fertilizers, human and animal/ mechanical labour, and irrigation. To bring more land under cultivation involves increasing environmental hazards. That is, wherever lands of any region are cleared for cultivation of crops, the natural ecosystem of that region is destroyed. In the Swat valley, only rangelands, grazing lands, and forests are left uncultivated. The present population growth and high demand for food has forced the people to bring these areas under the plough for subsistence agriculture by removing forest and vegetation covers from the slopes. Agriculture in these steep uplands needs much hard work and brings little return. Various forms of terraces have been constructed along the slopes to create more land for agricultural crops. Most of the terraces have been poorly constructed in terms of maintaining site stability and productivity. The people lack knowledge of how to build a terrace which will provide them with adequate growing space and also control erosion. Human intervention in this hilly land ecology through the cultivation of crops poses environmental hazards due to accelerated soil erosion and impaired nutrient flow.

The soils of these slopes are coarsely textured (loamy, sandy, or sandy loam) and are generally shallow to moderately deep. They are slightly acidic in reaction and relatively poor in fertility. Here, the topography is uneven with steep slopes. There is a high rate of soil erosion due to rapid runoff from rainfall. Sheet erosion is a common feature along these slopes which causes heavy annual losses of valuable top soil. Gully erosion is also prominent here, resulting in the conversion of agricultural land into ravine lands. Such erosion intensifies the problem of sedimentation in the river Swat and the associated irrigational networks and channels. It has been calculated that about 6000 tons of silt are carried daily by the river Swat near Chakdara Bridge.

The mountainous region of the Swat Valley thus represents a geocritical region, an extremely fragile environment with accelerated dynamics. The natural susceptibility to lack of balance has been amplified and diversified by a long and reckless human activity.

The major problems of these areas are poor communication and transportation facilities, severe climate, frequent natural disasters, serious soil erosion, degradation of the ecological

environment, insufficiency of food, little potential of expanding cultivated lands, shortage of rural energy and infrastructure, and low quality of the population, among others.

On the other hand, the soil of the lower Swat valley is moderate to fine-textured, with low permeability but relatively high water holding capacity, neutral to slightly alkaline in reaction, and more fertile.

The increasing population in these areas has an over-riding impact on the existing cultivated lands and agricultural productivity. The continuous subdivision of land due to family inheritance laws leads to severe fragmentation and overuse of the land. The cropping pattern here is continuously changing from food grains to the cash crops. It requires heavy doses of inputs such as water, high-yielding varieties of seeds, fertilizers, and human labour. The chemical fertilizers used in farming cause harm to soils as well as plants. As manuring means an external interference with the natural mineral balance, it implies the danger of environmental damage caused by its abuse. That is, heavy use of fertilizers is interfering with the nitrogen cycle. The bacteria in the soil converts atmospheric nitrogen into nitrates. Then, there is the process of denitrification in which nitrogen is returned to the atmosphere in gaseous form by other bacteria and the nitrogen cycle is completed. The denitrification process cannot cope fully with the heavy quantities of nitrogen fixed in the soil through chemical fertilizers. The nitrates are washed into the streams and river, leading to water pollution.

The pesticides, which are used to protect the crops, leave their residues in the troposphere for a long time and applying chlorinated hydrocarbon pesticides has led to the extinction of certain birds and animal species and has caused long-term damage and dangers to human health.

In addition, large quantities of insecticides and herbicides are continuously used to get rid of weeds, insects, pests, and other primary consumers, which adversely affect the normal interaction of organisms in a cropland food web and make the soil poisonous. Repeated use of insecticides eliminates a part of the existing insect population and the survivors become resistant to the insect sprays. Populations of these resistant strains grow and may become even more difficult to eliminate. This has happened with the apple plants of the valley for which people nowadays spray supracide and other dangerous chemicals which have long-term residual effects and prove hazardous to human and animal health. Moreover, it has been observed that most of the plants belonging to the family Cucurbitaceae are being adversely affected by the use of chemical fertilizers. For example, the gourd plant, which was very famous in the area, has now become extinct.

This indicates that the balance of nature is being constantly disturbed and the ecosystem deteriorated to an extent which cannot be easily reversed.

The Swat valley, which had so far been mainly dependent on agrarian resources, is radically changing to industrialization and other means of sustenance because of low land-availability in comparison to population increase. The food grain production is falling short of the requirements of the resident population mainly due to soil depletion.

Thus, to save the precious cultivated lands from disaster and to obtain more food, sustainable agriculture or a system of farming which is not in conflict with the ecological balance should be introduced.

Forest Resources

Forests are the most important biosphere on the planet and one of the key stabilizers of the global climate. Forests regulate the climate, retaining moisture as well as water and preventing erosion.

Forests form an extremely important and popular economic resource of the valley. They provide revenue to government and private people. They are a major source of timber supply for railways, ships, buildings, the furniture industry, the pulp/paper industry, formica, chipboard, firewood, and charcoal, among other things. They conserve the precious fertile soils from being washed away and thus protect the valley from erosion, which causes damage to soils, causes floods, and siltation problems. They also protect the precious wildlife by providing shelter and add to the scenic beauty of the area so that it becomes a source of attraction for tourists and thus encourage the development of a tourist industry.

The main species of forest found in the Swat valley include Chir pine, kail, deodar, fir, and spruce. These trees are utilized as timbers. Besides these, broad-leaved species are also found which are mostly used for firewood. Among the common ones are oak, *Parocea, Dadonea*, and *Olea*. For furniture purposes, the common trees found here are walnut hard, horse chestnut and birds cherry.

Fir, spruce, and kail are comparatively abundant as compared to the rest of the species. Fir and spruce are found on high altitudes up to the tree limit (11,000 ft). The altitudinal zonation mostly varies from 7000 feet to 10,000 feet. However, it may go as high as 11,000 feet and come as far down as 6000 feet above sea level. Kail, deodar, *Parocea*, horse chestnuts and walnuts grow in the middle zone, that is mostly from 6000 to 8000 feet heights.

From 11,000 to 16,000 feet, there are Alpine pastures which are the continuous meadows bearing grasses, forbs, and herbs. These meadows are utilized mostly by the Gujar nomads, who own herds of sheep, goat, and cattle. In addition, there are also grasslands located usually between 4000 and 6000 feet elevations.

In the recent past, the whole of the Swat valley was completely covered with dense and thick vegetation cover. It is believed that during the time of Akbar (sixteenth century), Swat was called 'Swad', meaning black, due to its vegetation cover (Yousufi 1973). In the holy book of the Hindus, Swat has been mentioned as 'Udyana', meaning park or garden, for its abundant vegetation cover (Ali 1985).

Up to the end of the nineteenth century, the vegetation cover of the area was intact and the ecosystem was undisturbed due to little human interaction. The beginning of the twentieth century marked a turning point in the ruthless utilization of forest resources which led to deforestation and severe environmental degradation. It has been estimated that the forest area of the Swat valley has decreased from about 900,000 acres in 1951 to 321,322 acres in 1980 and to about 300,000 acres in 1991 and the process continues on a very large scale.

There are various causes of deforestation in the Swat valley such as population growth, expanding of agricultural areas, firewood and charcoal consumption, lumber-mill activities, forest fire, side effects of socio-economic developments like roads and settlement constructions, etc. But the most serious one is the expanding of agricultural area, especially for the upland crops for commercial export. It has been estimated that the cultivated land of the Swat valley has increased from 150,000 acres in 1951 to 380,498 acres in 1991 and the increase dangerously continues (Ali 1993).

The fertile valley areas are already occupied by cultivation beyond capacity and the pressure for more land for subsistence agriculture forces many people to occupy the hilly area adjacent

to the villages as well as to encroach upon the forested land at higher altitudes. As a result, the ecosystem of the areas is in a highly deteriorated condition. The large-scale removal of forests and fuel wood has created unstable conditions in most of the watersheds. The hydrologic function has been drastically altered as the inflow-storage-outflow equilibrium has been disrupted. Torrents of water and debris are produced in watersheds which in the past were relatively stable. These flows often exceed the natural channel capacity creating severe flooding and siltation problems for the downstream population. The most recent floods in the valley (July 1995), which destroyed thousands of acres of cultivated lands and standing crops as well as more than sixty lives, can be attributed to the large-scale deforestation in the area. The naturally shallow but more productive soil layers are being rapidly eroded away. Thus, the land is becoming less productive and more hydraulically efficient.

The deforestation and removal of vegetation cover as a result of uncontrolled human activities have led to timber wood shortage, fuel wood and charcoal deficiency, outbreak of pests and insects, loss of wildlife, plant species, expansion of saline soils, and other problems.

It has been observed that more than 70 per cent of the population in the Swat valley lives in rural areas and subsists on an economy which is biomass-based. The survey has documented that nearly 80 per cent of all rural energy is met from traditional and indigenous sources like firewood, cow dung, and crop residue, all being biomass-based. The felling of trees in an indiscriminate manner has denuded vast areas in the Swat valley. The wood, which is the common source of energy in the area, has become scarce. The example of Shahdheri village, which has consumed 2809 *kanals* (1 *kanal*=1/8 acres) of oak wood in the past forty years, shows how this scarcity has come about. The situation of fuel wood is alarming. Nowadays, people search for the extraction of roots of the wiped oaks and other trees for fuel purposes. In addition, due to the scarcity of fuel wood, large quantities of animal dung and crop residues, which as a matter of fact could have been utilized in restoring soil fertility and stepping up food production, are burnt as fuel.

In the recent past (about fifty years ago), the Swat valley was very famous for such game as markhor, leopards, pigs, hyaenas, wolves, deer, snow leopards, black bears, snow bears, rabbits, jackals, foxes, porcupines, hedgehogs, monkeys, gorillas, wild goats, and wild sheep and a variety of birds such as falcons, monal pheasants, grey and black partridges, chikors, sisis, ducks, teals, snipes, and quail of various kinds. The eradication of their natural habitats as a result of forest destruction by human intervention has caused most of the wildlife to become extinct.

In the most recent past, the area was very famous for its honey, which was exported in large quantities to various parts of the country and abroad and, consequently, provided an economic activity. Owing to destruction of vegetation cover and pollution of the soil by chemical fertilizers, pesticides, and insecticides, the honeybees have disappeared in most of the places. Similarly, the wild fruit which was an important source of food for various birds and animals has been completely destroyed by human beings.

The rangelands and meadows which were once covered with thick forests have been deforested. The indiscriminate grazing of large numbers of animals has produced a scenario of overgrazed and highly deteriorated conditions in these areas. According to field surveys, 100 per cent of the households in the Gujar and Kohistani tribes own livestock, mainly sheep, goats, and cows. Overgrazing has accelerated soil erosion and soil depletion in these areas.

The deforestation, which is a man-caused disaster, also results in ground water depletion and frequent occurrence of floods. Field surveys have shown that there are certain localities and areas in the valley where water aquifers have completely dried up due to the cutting of forests, overgrazing, and burning of grasslands. Irrigated lands are being converted into

unirrigated lands such as in the villages of Tighak, Aligrama, Sirsinai, and Maloock in the Kabal Tehsil of the Swat valley. Similarly, the position of ancient settlements and their terraced fields near the streams, where no water now exists, suggests that in the past many springs and perennial streams existed which have now completely disappeared.

Thus, it can be stated that the forest resources of the valley are the most threatened. There seem to be alarming disturbances in the ecological equilibrium of these areas. If the situation is not checked immediately, it will lead to an environmental catastrophe.

Conclusion and Recommendations

The Swat valley today is faced with the crisis of environment. Here, human beings utilizes their natural resources for economic development and social progress without proper planning and keeping in view the resultant environmental degradation.

The unprecedented population growth has placed extreme pressure on every aspect of the natural and social environment of the valley. The existing resources are over-exploited beyond their capacity, which has given birth to the varied environmental hazards. Thus, there appears no way to solve the problem of environmental degradation in the Swat valley but control the human population and bring it to the level of available resources.

Land is a basic resource in the agricultural economy of the Swat valley. The tremendous pressure on land as a result of population growth is one of the serious problems of development being faced by the Swat valley. The great land fragmentation results in environmental hazards and low agricultural productivity. Heavy doses of chemical fertilizers, insecticides, pesticides, and herbicides lead to poisoning and depletion of the soils. The newly formed steep, terraced, cultivated lands along the hill and mountain slopes are the greatest source of erosion, soil losses, and sedimentation.

Thus, it is essential to develop a sustainable agriculture in the region. Its aim should be to develop a farming system that is productive and profitable, will conserve the natural resource base, and, at the same time, protect the environment over the long term.

The deforestation is a very serious environmental problem which has created unstable conditions in most of the valley. The recent population and economic pressures on forest resources are immense. As a result, the forested lands are continuously decreasing, which creates an ecological imbalance. The existing natural species of forests are most ecologically suitable. Once this natural vegetation is destroyed by human activity, there is bound to be alarming disturbances in the ecological equilibrium leading to complete disappearance of the forest cover and consequent environmental catastrophe.

It may be concluded that human activities have adversely affected the landscape and the entire ecosystem of the Swat valley. The environment of the valley is being affected by human intervention in various ways (such as population explosion, the increasing intensity in land uses, over-ploughing, over-manuring, over-fallowing, over-lopping, overgrazing, ruthless cutting of the forests, etc.). These activities have accelerated soil erosion, slope and soil changes, soil creeping, soil depletion, landsliding, gullying, flooding, siltation, water depletion and pollution, atmospheric pollution, river capturing, extinction of plant and animal species, and other adverse effects. These tendencies indicate that a state of disequilibrium is being created.

Therefore, it is an immediate need of the hour to search for ways and means to accelerate the natural process of returning the ecosystem to a state of dynamic equilibrium.

The message from the findings of this study for the policy/decision makers is clear. It is:

i. that the Swat valley requires technical assistance and resource mobilization for the immediate improvement of its environment;
ii. that the communities in the area need a new form of organization to protect their natural and human environment, in view of the realities of their changed social, economic, cultural, and political conditions.

In order to meet these requirements, it is recommended that an environmental protection board be established for the Swat valley. The main functions of this board should include the following:

a. Review of the existing resource utilization pattern in the valley on modern scientific lines
b. Development, coordination, and implementation of policies for the conservation of land, water, and forest resource base of the valley
c. Provision technical assistance for the rehabilitation, physical improvement, and resource mobilization of the deteriorated and disturbed ecosystem of the area
d. Development, coordination, and utilization of local expertise in the organization, rehabilitation, maintenance, and management of the available resources on modern scientific lines

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7

SOLAR WATER HEATER (AB JOSH)*

*Habib-ur-Rehman Mian***

Today due to technological progress, population growth, and rising living standards, the need for energy resources is increasing at an accelerating speed day by day. The existing resources of timber, coal, natural gas, and petroleum, among others, are getting exhausted because of too much use and it is estimated that the world's petroleum supply will be depleted within the next hundred years. This alarming situation has urged scientists to investigate the potential for new resources, one of which is solar energy. This power is derived from the sun to produce heat and light. Its chief advantage is that it is inexhaustible.

In various parts of the world several methods of solar energy use have been developed but, unfortunately, Pakistanis, despite the fact that they are blessed with ample quantity of sunshine throughout the year, have not yet given attention to this important gift of nature. With this in view, this author has invented a 'solar heater' named AB Josh. It is a very simple instrument that uses materials easily available within the country. Its construction is also not complicated and it can be easily made in any village by a local craftsman.

Description

The AB Josh consists of three parts:
1. Solar energy collector
2. Hot water tank
3. Cold water tank

Solar Energy Collector

This is made of a corrugated galvanized (GI) iron sheet and a plain GI sheet of twenty-two to twenty-four gauges. The two sheets are joined as shown in Fig. 7.1.

Hot Water Tank

The size of the tank can be according to the consumption needs of the house. However, a 50 gallon mobile oil drum is recommended because it is easily available and not too expensive. If more water is required, then two drums can be used. These days fiberglass tanks, which can also serve the purpose, are also available in the market.

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The tank is to be insolated with the help of styrofoam. Styrofoam is generally used for packing television sets, refrigerators, and other fragile materials and is available in sheets of different thicknesses. One can use a 1 inch thick sheet according to the size and number of the drums. The sheets are to be glued around the bottom and top of the drum in such a way that no part is left uncovered, because otherwise the water will lose heat. The colder areas should use double coats of styrofoam sheets. The hot water tank and solar energy collector should be fitted together as shown in Fig. 7.2.

Fig. 7.1 Construction of Solar Energy Collector

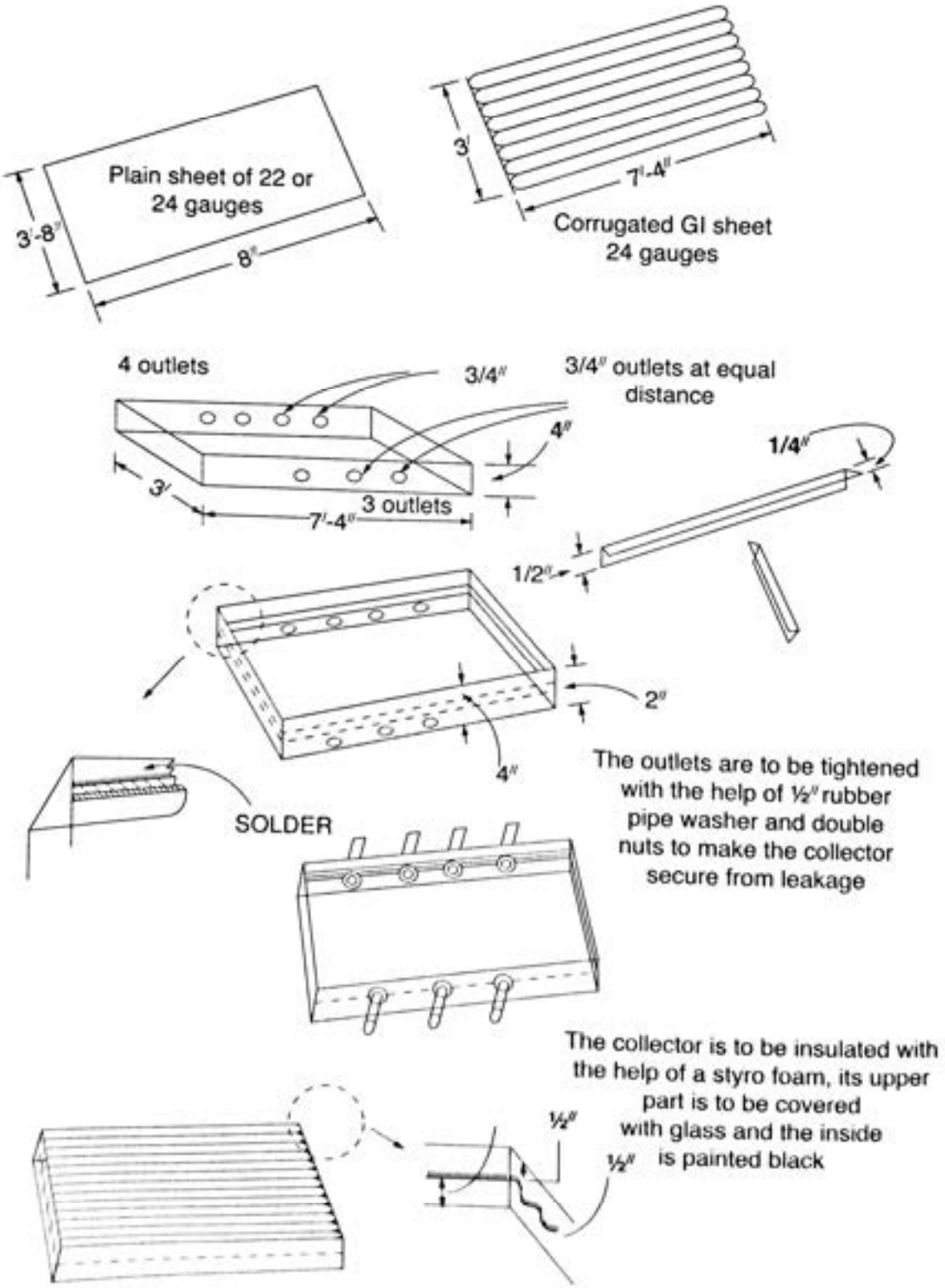
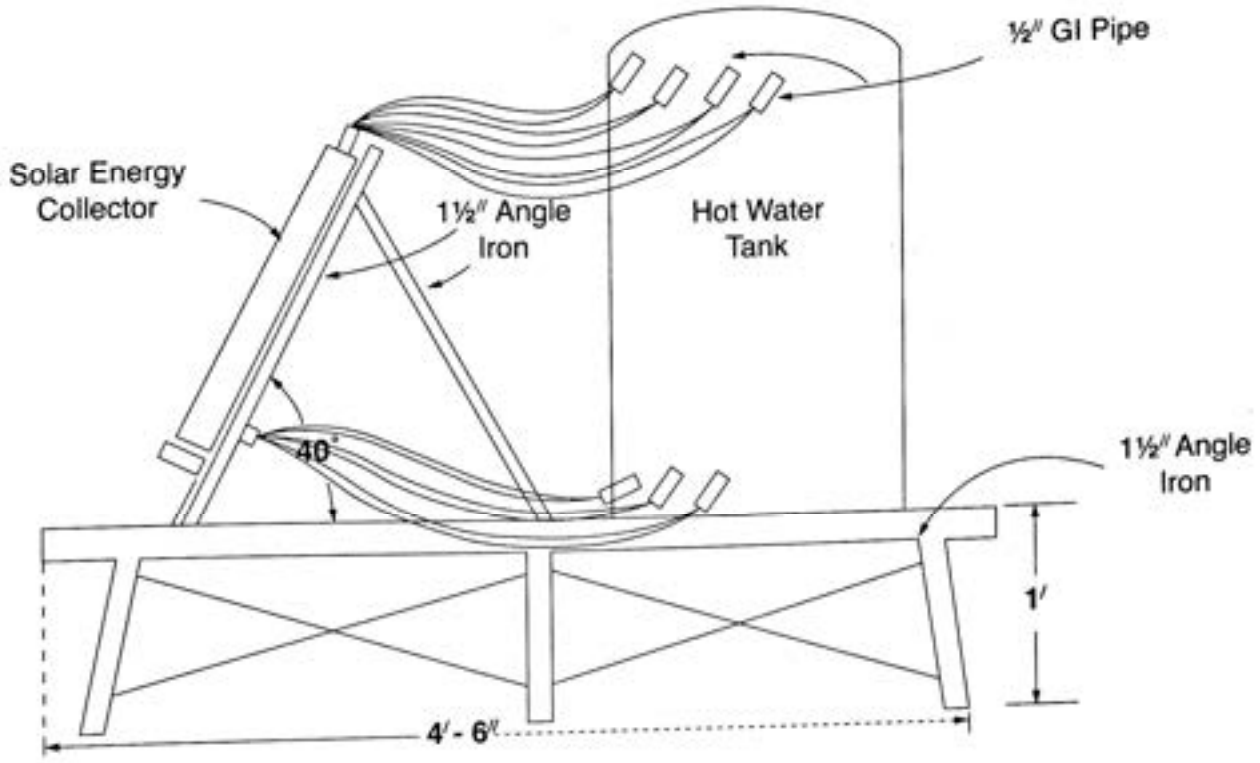


Fig. 7.2 Hot Water Tank and Solar Energy Collector When Joined Together



Cold Water Tank

This tank can also be made from mobile oil drums. If there is already a water tank on the roof then that can be used. This tank is to be connected to the hot water tank with the help of tubes and at the outlet of the tubes a level clock has to be fixed, which will help to balance the level of the water in the two tanks. The whole instrument is assembled as shown in Fig. 7.3.

Fig. 7.3 Assembly of Solar Energy Heater