

MAN'S IMPACT ON VEGETATION AND LANDSCAPE IN THE KAGHAN VALLEY, PAKISTAN.

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Abstract:

The present study examines the environmental changes in the Kaghan Valley from a historical point of view. Man-induced alterations

of the forests vegetation are reflected by the prevalence of nitrophilous weeds, light-loving elements as well as unpalatable and browsing-

resistant species. A detailed vegetation mapping has revealed that the potential forest areas have decreased by c.50%. The historical transformation processes from forests into farm and rangelands can be differentiated into several periods with varying degrees of intensity. It turns out that the dynamics of landscape change are heavily dependent on the general socio-economic conditions. Until the beginning of the nineteenth century the Kaghan Valley was very thinly populated. Substantial changes in the distribution of forests and agricultural lands occurred in the first two decades of British rule from 1847 to 1867. The protective influence of the Forest Department, founded in 1864, considerably slowed down these transformation processes. Up to the turn of the century the scenery of the present-day cultural landscape has been created in its basic patterns. In the twentieth century the quantitative loss of forest cover is negligible. The last decades are rather marked by negative structural alterations within the forest stands and along the forest margins.

INTRODUCTION

The human impact on the Himalayan Mountain ecosystems, recently discussed among environmentalists under the keyword "Himalayan Dilemma" (Ives & Messerli, 1989), has mostly been analysed in the Central Himalaya up to now. But progressive degradation of vegetation and landscape is increasingly reported from the high mountainous areas of Northern Pakistan as well. According to Haigh (1991) considerable losses of forest cover occurred in the foot hills and lower valleys of Swat and Dir in the past 25 years. Likewise, progressive forest devastation in lower elevations is lamented by Allan (1986) for Swat and Dir as well as by Ellis, Taylor & Masood (1993) for the Murree Hills. As revealed by remote sensing data, the forest cover in the study area of the "Forest Development

Project Siran Valley" has decreased by 45% between 1979 and 1988 (GTZ, 1990; Fischer & Payr, 1993). Additionally Afghan refugees have adverse effects on forest resources of the region (Allan, 1987). Research in the adjoining Karakoram valleys to the north gives evidence for dramatically increased logging in the past 20 years after the connection of these valleys with the lowland by the Karakoram Highway (Schickhoff, 1992, 1993b).

As far as the Kaghan Valley is concerned, detailed information on environmental changes is presented in this paper. The anthropozoogeneous impacts on vegetation and landscape are examined from a historical point of view. The results of this study are based on fieldwork carried out in 1990 within the framework of the CAK (Culture Area Karakoram) - research project of the Deutsche Forschungsgemeinschaft (German Research Council). This joint Pakistan-German research project, integrated into the UNESCO-programme "Man and Biosphere" and closely connected with similar projects of the United Nations University (UNU), the International Center for Integrated Mountain Development (ICIMOD) and the "Commission on Mountain Ecology and Resource Management" of the International Geographical Union (IGU), is working on the relationship between man, environment and culture in the high mountainous areas of Northern Pakistan. Within this interdisciplinary project the sub-project of physical geography is pursuing the objective to assess the natural resource potential and the human impact on the environment emphasizing the spatial differentiation and the historical development in the Karakoram Mountains and selected neighbouring areas.

The studies in Kaghan (Schickhoff, 1993a) aimed at assessing the three-dimensional geoecological differentiation of the valley as well

as investigating the evolution of the cultural landscape. Sampling and mapping of the vegetation followed by an analysis of the plant communities and their environmental relationships formed the fundamental part of the studies. As an important result a vegetation map of Kaghan on a scale of 1:150,000 could be published (Schickhoff, 1994). Moreover, the vegetation studies led to a clear picture of the potential natural vegetation that illustrates the difference between the potential and the actual forest cover. To assess the historical dimension of environmental changes, the fieldwork in Kaghan was complemented by evaluations of early forest documents, aerial photographs and historical sources in the "India Office Library & Records" (London).

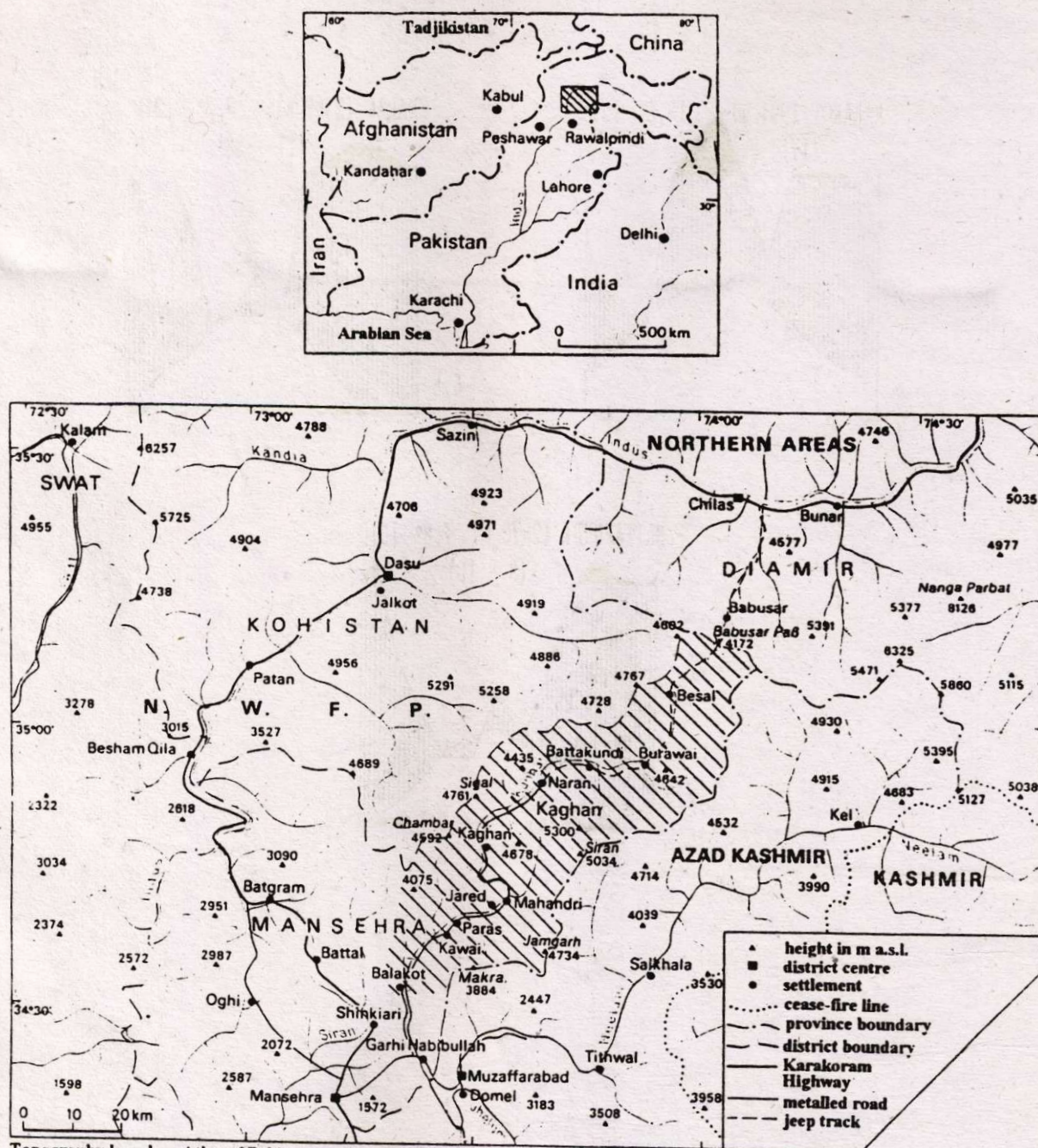
THE STUDY AREA

The Kaghan Valley in the Western Himalaya of Pakistan is located in the Mansehra District (North West Frontier Province) bounded by Azad Kashmir in the east and the Northern Areas in the north (Figure 1). There is hardly any detailed geographical and ecological information on Kaghan so far and the valley remained scientifically nearly unknown, although it already had considerable economic importance in the nineteenth century due to the extensive cedar forests (cf. Clegliorn, 1864). When the British opened the mule track over the Babusar Pass to Chilas and Gilgit in 1898 the valley gained additional importance because this trader route was, besides the Srinagar-Astore-route, only the second north-south-connection to the then Gilgit Agency (cf. Watson, 1908:210; Stein, 1928:6; Grotzbach, 1989:1). After the partition of Kashmir in 1949 the traffic importance temporarily increased, but diminished again with the completion of the Indus Valley Road (1965) and the Karakoram Highway (1978).

The study area on the southern declivity of the West Himalayan range extends over the Kaghan Valley in the narrower sense, i.e. over the section between Balakot (991 m a.s.l.) and Babusar Pass (4172 m a.s.l.), where high mountain relief is predominant. The valley has a length of c.100 km. It forms the upper watershed of the Kunhar River that flows into the Jhelum River south of Muzaffarabad (Figure 1). Like other extensive West Himalayan valleys the Kaghan is marked by a distinct change of climate, soils and vegetation in its longitudinal profile. The general climate and weather conditions result from the position in a transitional area, which is influenced by the extratropical cyclonal precipitation regime as well as by tropical monsoon precipitation during summer. Both regimes show superposition effects in this area (cf. Flohn, 1969; Reimers, 1992).

In the all year round humid Lower Kaghan the climate is clearly influenced by the monsoon regime. 56% of the annual amount of 1545 mm precipitation (Station Balakot, Figure 2) is recorded between June and September. Here the natural vegetation of the lower montane belt mainly consists of *Pinus roxburghii*-forests, that have been heavily depleted due to human impact. As well subtropical-temperate sclerophyllous forest communities (*Acacia modesta*-*Olea cuspidata*/*Quercus baloot*) occur, mostly transformed into degradation stages. Higher up moist temperate coniferous forests of *Picea smithiana* are prevalent interspersed with deciduous trees of the genera *Acer*, *Prunus*, *Juglans*, *Aesculus* and others. On shady slopes in the subalpine belt the natural vegetation gives way to *Betula utilis*-forests and *Salix krummholz*, whereas on sunny slopes the coniferous forests are followed by *Juniperus*-woods. Above the treeline alpine dwarf scrub heaths and meadows occur.

Figure 1. Location of Kaghan Valley in the high mountainous region of Northern Pakistan.

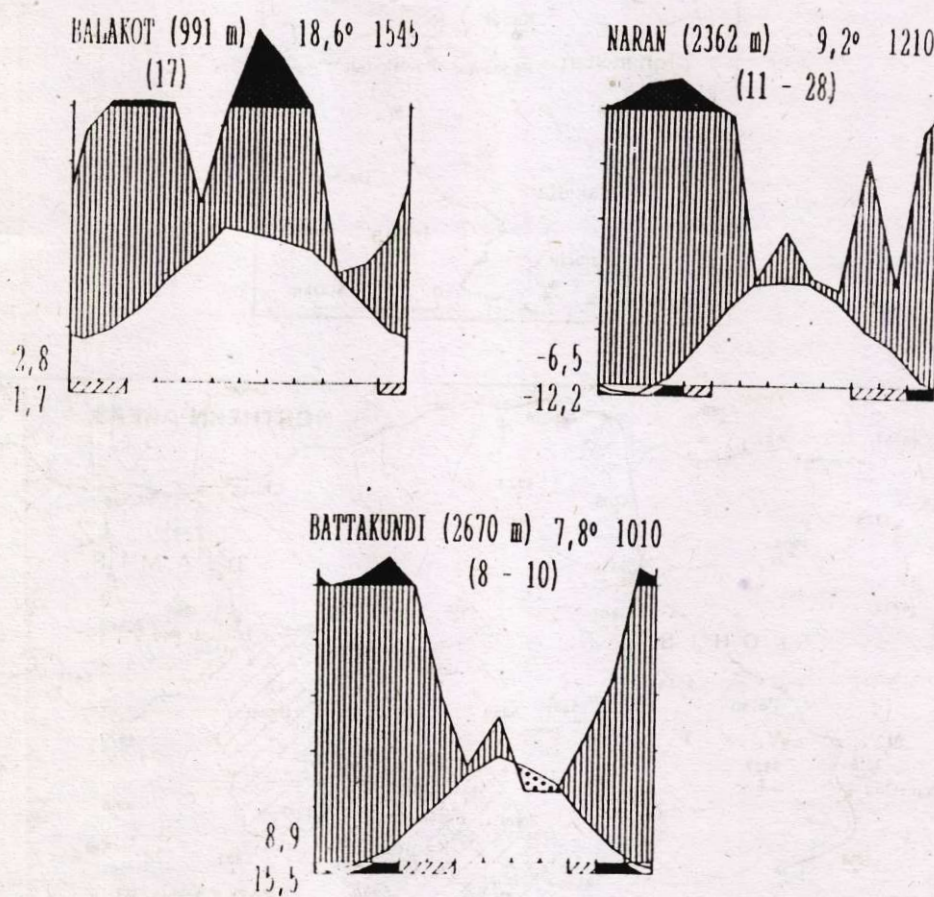


Topography based on Atlas of Pakistan (Survey of Pakistan, 1985)

Design: U. Schickhoff

Cartography: U. Hillebrand / G. Bräuer-Jux

Figure 2 . Climatic diagrams of Balakot, Naran and Battakundi in comparison.
Source: Schickhoff, 1993a.



The monsoonal influence with heavy summer precipitation considerably decreases towards the inner valley, whereas the winter and spring precipitation resulting from western disturbances increases. The sequence of high mountain chains acts as a barrier against the moist monsoonal airmass incursions from southern directions leading to an increasing continentality of the climate in Upper Kaghan. The summer rains share of the annual precipitation in Naran (2362 m a.s.l.; 1210 mm/ha) and in Battakundi (2670 m a.s.l.; 1010 mm/a) only amounts to 15,7% and 13,9% respectively. At Battakundi station two arid months on average are recorded during the summer season (Figure 2). This drought period in Upper Kaghan results in a conspicuous change of the vegetation and landscape character. Southern aspects are now exhaustively covered by *Artemisia maritima*-*Juniperus macropoda*-steppe forests, whereas moist temperate coniferous forests and birch forests are confined to shady slopes. In longitudinal direction the Kaghan Valley can be differentiated into five separate, geocologically homogeneous sections (Figure 3) (cf. Schickhoff, 1993a).

FLORISTIC ALTERATIONS OF THE FOREST COMMUNITIES

Due to the continuous logging and grazing impact floristic alterations can be observed in the forest communities to a large extent. Within the successional developments many weeds, unpalatable and light-loving species are favoured. Many forest stands can be described as secondary regressive successional stages. Alterations of the floristic composition become particularly obvious in the shrub and herb layers. The analysis of the qualitative-quantitative composition of the forest phyto-coenoses (Schickhoff, 1993a) clearly shows the low regeneration rate of deciduous tree species. In the long term and damage to broadleaved tree seedlings by grazing and

browsing implies their elimination in the tree layer. Certainly, compared to the Himalayan regions adjoining to the east, the weak presence of deciduous trees in the coniferous forests of Kaghan must first of all be attributed to the drier, colder and snowier macroclimate, but the really poor regeneration caused by grazing has contributed to their decline in contrast to the less browsed conifers.

Regarding the pervasive anthropozoogeneous impacts on the floristic composition, most of the separate forest communities show similar successional trends:

In the *Pinus roxburghii*-forests other tree species like *Olea cuspidata*, *Morus australis* or *Pistacia khinjuk* only occur as browsed and/or lopped bushes in the shrub layer, which is dominated by thorny and unpalatable species. Periodical fires promote the growth of grasses (*Stipa brandisii*, *Cymbopogon posbischilii*, *Pennisetum orientale* and others) and nitrophilous *Leguminosae* (*Indigofera heterantha*, *Lespedeza* sp. aff. *variegata*). The regeneration of the chir pine is scanty.

The xeric *Acacia modesta*-*Olea cuspidata*- and *Quercus ballot*-forests mostly occur as severely transformed degradation stages. Beneath the sparse canopy sclerophyllous and browsing resistant shrubs (*Isodon rugosus*, *Sageretia thea*, *Daphne mucronata*, *Cotoneaster nummularia*, *Fraxinus xanthoxyloides* and others) are prevalent. Due to thinning several grasses (*Cymbopogon posbischilii*, *Arthraxon* sp. aff. *prionodes*, *Bromus japonicus* and others) and light-loving weeds (*Micromeria biflora*, *Clinopodium vulgare*) are widespread in the herb layer. According to the respective degradation stage the potential natural tree species have already disappeared on many slopes. In the replacement communities the original forest community can

only be recognized by a detailed analysis of the species composition.

At present, moist temperate coniferous forests occupy more than 90% of all forest areas in Kaghan. The phytosociological investigations revealed, that the *Cedrus deodara*-, *Pinus wallichiana* and *Abies pindrow* forests have to be integrated into a community complex (Schickhoff, 1993a). They are not only marked by a similar floristic-sociological structure, but also correspond to a larger extent in their physiognomic-ecological structure as well as in their floristic-chorological spectrum. Even in the Reserved Forests, the shrub and herb layers of these communities are characterized by grazing indicators: *Viburnum grandiflorum*, *Sorbaria tomentosa*, *Indigofera heterantha*, *Berberis lycium*, *Ribes himalense*, *Rubus pungens* in the shrub layer and *Clinopodium vulgare*, *Silene vulgaris*, *Myriactis wallichii*, *Solidago virgaurea* and others in the herb layer. But, compared with *Pinus* and *Abies* forests, the grazing pressure in the *Cedrus deodara* forests is significantly lower. Here, preferentially browsed shrubs like *Lonicera quinquelocularis*, *Euonymus fimbriatus*, *Rhamnus virgatus* and *Rhamnus purpureus* can be seen thriving and the regeneration rate is much higher. Obviously, the economically valuable *Cedrus* forests are subject to a comparatively stricter protection by the Forest Department.

In the *Betula utilis* forests at the treeline, being exposed to additional grazing pressure due to their location near to the alpine meadows, the regeneration of the birch is almost completely absent. The same holds true for the regeneration of *Juniperus macropoda* within the *Artemisia-juniperus* steppe forests. Moreover, cutting and logging of juniper trees contributed to an expansion of the pure *Artemisia* steppe and to a decline of the *Juniperus* stands and their accompanying phytocoenoses.

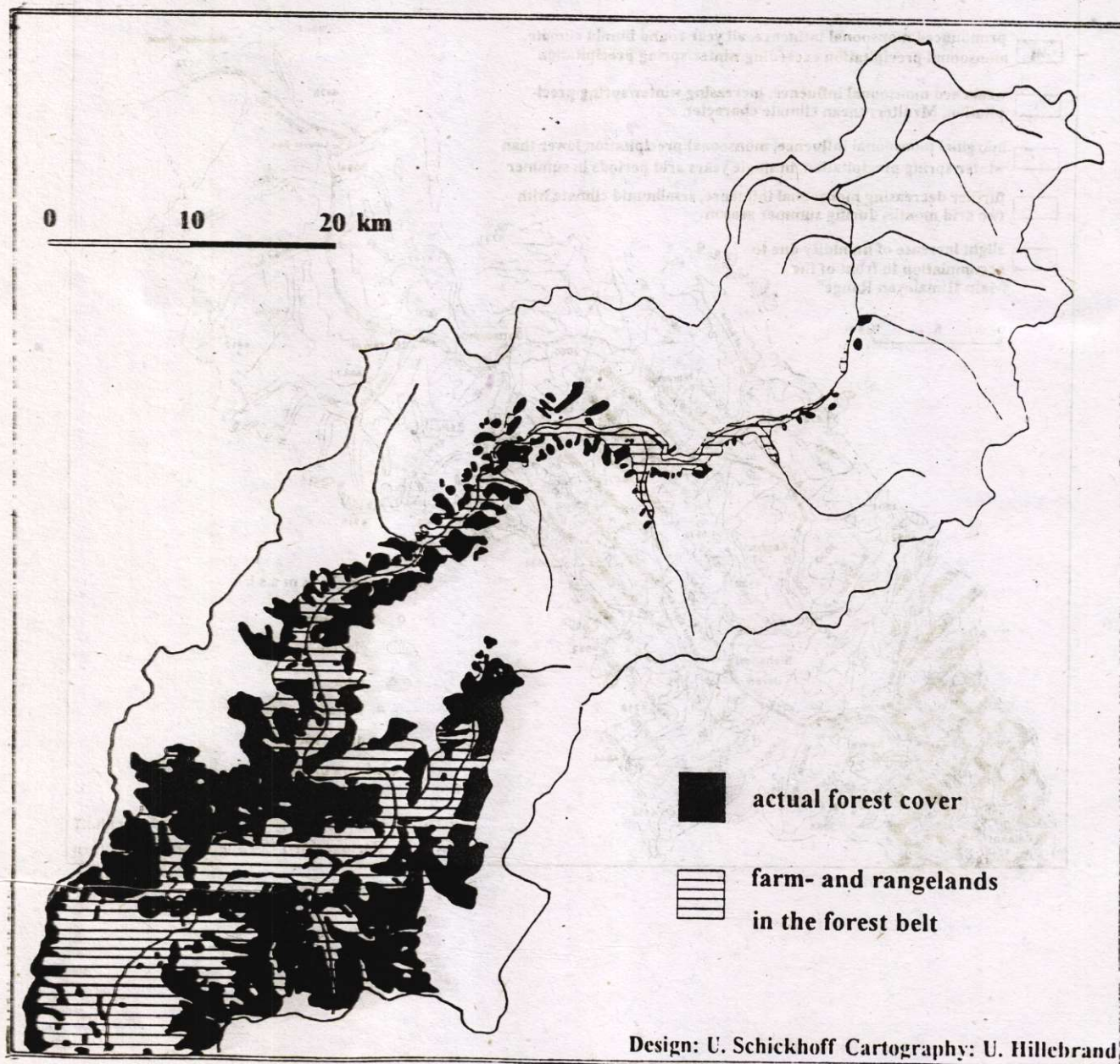
THE DIFFERENCE BETWEEN ACTUAL AND POTENTIAL FOREST COVER

In contrast to the arid-semi arid high mountainous areas in Pakistan following further to the north a lower treeline is not developed on the humid southern declivity of the West Himalayan range. Thus, with the exception of the open *Artemisia-Juniperus*-steppe forests in the Battakundi-Burawai-area the potential natural vegetation of Kaghan consists of closed forests upto the upper treeline. Therefore the quantitative loss of forest areas can be derived from the extension of settlements and farm-and rangelands in the forest belt.

According to the survey of the vegetation map (cf. Schickhoff, 1994) only 16% of the total study area are at present covered with forests. On the other hand, the percentage of settlements, arable and grazing lands in the forest belt amounts to 14.8%. This reduction of the potential forest areas by c. 50% must first of all be attributed to the conversion of forests into agricultural lands in the permanent settlement areas of Lower Kaghan (Figure 4). In the lower portion of the valley subtropical coniferous and scherophyllous forest communities have been reduced to a few small relict stands in the course of expanding agricultural lands (cf. vegetation map in Schickhoff, 1994). Likewise, the *Betula utilis*-belt forming the upper treeline has been largely decimated (see also Chaudhri, 1960:290; Champion, Seth & Khattak, 1965:209) due to the depression of the treeline caused by pastoralism and mountain nomadism.

The moist temperate coniferous forests have been proportionally far less reduced compared to their original extension. On the one hand this is due to the decreasing land-use pressure above the permanent settlement areas (cf. Grotzbach, 1990:22), which particularly applies to

Figure 4 . Difference between actual and potential forest cover of Kaghan (without open *Artemisia-Juniperus* steppe forests). The extension of farm- and rangelands is equivalent to the decrease of forest areas. The map refers to areas upto the actual upper treeline. Based on the vegetation map of Kaghan (Schickhoff, 1993a, 1994).



the shady slopes becoming free of snow much later. These elevations are less characterized by extensive conversion into farm and rangelands, but by the clearing of small grazing grounds on mountain ridges and on plateau like plain areas. On the other hand, the coniferous forests are largely subject to the protective influence of the Forest Department since the designation of the Reserved Forests in 1873.

THE HISTORICAL DIMENSION OF FOREST-COVER CHANGES

What is now the historical dimension of this developmental process from the potential, closed forest cover over forest degradation and depletion up to the present-day structure of the cultural landscape? To answer this question a historical examination of the general socio-economic conditions is necessary (cf. Tucker, 1987; Sharma, Blyth & Macgregor, 1990). These conditions determine directly or indirectly the utilization pressure on the forest stands and thus have steered the genesis of the present-day distribution of forests and agricultural lands. The change of these conditions is manifested in periods of higher or lower dynamics in the development of the cultural landscape. In the following a detailed reconstruction of these periods is elaborated with regard to the Kaghan Valley in the nineteenth and twentieth century.

There is no doubt that the natural environment of the Western Himalaya has already been reshaped by man since the Neolithic revolution. However, the dimensions of these interferences since the Neolithic period seem to have been insignificant. In the seventeenth century and in the first decades of British occupation in the eighteenth century the forests of India and the Himalaya were considered to be more or less untouched and inexhaustible (cf. de Adnrada, 1627, c.t in Ritter, 1833: 442; Stebbing, 1922:37;

Chaturvedi, 1992: 730). Travellers of the early nineteenth century likewise report on extensive, inexhaustible forests in the upper valleys (e.g. Hardwicke, 1809, cit. in Guha, 1989:35; Raper, 1810:544; Royle, 1839/40, I:27; Hugel, 1840, II:164; Moorcroft & Trebeck, 1841, II:96; Vigne 1842, I:34; Hoffmeister, 1847:350-356; Thomson, 1852:71), that have to be assumed for Kaghan as well. There, in previous centuries the population already had to cope with the vicissitudes of history. The invasion of the Swatis in the seventeenth century, the anarchic situations and uncertain conditions during the Durrani rule (1752-1818) and Sikh rule (1818-1847) repeatedly restricted population growth and extension of settlements and agriculture (cf. Punjab Government, 1883/84:184-185). The utilization pressure on the forest stands remained limited. Thus, the development of the rural cultural landscape until the end of Sikh rule could only slowly and gradually progress. The Kaghan Valley was thinly populated by sedentary peasants practicing subsistence agriculture. In the montane/subalpine belt it was still largely covered with forests, mainly above Paras (Stewart, 1867:46). The grazing impact of the very few cattle owned by the inhabitants concentrated upon the immediate vicinity of villages. Seasonal migration of nomadic Gujars and their livestock to the alpine pastures was insignificant during Sikh rule (Henniker-Gotley, 1932:27).

After the British had taken over the administration of the Hazara District in 1847 peace was established and the political situation was stabilized. These conditions resulted in a growing population and a prospering agriculture. On the sunny slopes, preferred for the construction of settlements and cultivation of land, a reinforced forest clearing by destructive fires for the reclamation of arable land was registered. As well a progressive degradation of forest areas close to the settlements by intensive grazing after the

devastation by fire could be observed. In the course of general agricultural expansion also the size of migratory flocks and herds considerably increased (cf. Stebbing, 1923:547; Henniker-Gotley, 1932:12; Tucker, 1986:22). At the same time the pressure on the forest resources rose due to the growing timber demand of the lowland. In 1852 the Deputy Commissioner Hazara, Col. J. Abbott, received the order to arrange for the floating of Kaghan timber down the Kunhar river to Jhelum for the extension and supply of the Indus steamboat flotilla (Cleghorn, 1864:175). As described by Tucker (1982:114-116, 1983:149-156) for other West Himalayan valleys a development can be seen to emerge in Kaghan as well: the expansion of agriculture and trade, fostered by the British, and the gradual integration of the mountainous regions into the market economy of the foreland, also accelerating the commercial timber exploitation by private contractors, already resulted in a considerable reduction of forest cover in the mountains prior to the "railway building era" (see also Atkinson, 1882, I:852).

How was the landscape of Kaghan affected by the socio-economic transformations in the 1840s and 1850s? According to Stewart (1867:43-57) the natural *Pinus roxburghii*-forests and sclerophyllous forest communities between Balakot and Paras had already been converted into arable land or into replacement communities to a great extent. By contrast, between Paras and Jared most of the slopes still were densely forested. The lower sunny slope at Phagal and the valley widening at Kaghan-village were already occupied by settlements, cultivated areas and scrub communities as well. Above Kaghan-village, i.e. above the permanent settlement area, there were hardly any substantial interferences in the forest stands.

After the suppression of the Indian Mutiny 1857/58 the extension of the road and railway network in the Himalayan foreland was forced (cf. Stebbing, 1922:295). In order to provide sufficient timber for the planned construction of the important railway line Lahore-Rawalpindi-Peshawar the forest resources in the upper reaches of the Indus tributaries were inspected (cf. Andrew, 1857:170-174). The inspectors turned their attention above all to *Cedrus deodara*-forests. The hard, durable cedar wood is not only best suitable for boat building, but also for the building of railway sleepers. As a result an overexploitation of the Himalayan forests started to surpass the commercial timber cutting prior to the "railway building era" by far. In Kaghan, where timber had been demonstrably cut for the export to the lowland since 1855 (Henniker-Gotley, 1932:39), according to Cleghorn (1864:173) the easily accessible cedar forests between Paras and Jared were above all subjected to this overexploitation. There was not only the need to meet the timber requirements for railway building, also the improvement of public facilities e.g. in Murree, Abbottabad and Haripur resulted in a rising demand for timber. In the years 1859/60 a particularly high timber consumption was registered due to the extension of Murree as a hill station and the enlargement of the military infrastructure in Abbottabad. The overall increasing timber demand in the Hazara District was primarily covered by logging in the Mochpura Range and in Kaghan (Cleghorn, 1864:186-189).

In the course of prospering economic development the population growth and the intensification of cultivation and animal husbandry continued in the period from 1860 to 1870. In the mountainous regions of the Hazara District the cultivated areas were extended by 25-30 % during this decade, mostly by fire clearings. By 1870 the District Gazetteer ascertained, that "every acre of culturable land is under the plough"

(Punjab Government 1883/84:184-185). Actually, the cultivated area in the Tahsil Mansehra (including Kaghan) only slightly increased by 5.5% from 1873/74 to 1905/06 (cf. Watson, 1908:329). According to official records already by 1870 arable land of nearly the same extent as in 1981 was cultivated in Kaghan Valley (cf. Swati, 1985:151). Thus, the first two decades of British rule in Kaghan represent a phase of particularly high dynamics in the evolution of the cultural landscape, marked by massive deforestation. The radical change of the general socio-economic conditions caused a substantial structural change in the distribution of forests and farm-land/rangelands during this period.

The following decades up to the turn of the century are characterized by the protective influence of the Indian Forest Service, founded in 1864. The establishment of a separate Forest Department under the Government of India in this phase was the consequence of mostly uncontrolled exploitation of the forest stands until then (cf. Brandis, 1884:400; Stebbing, 1923:34; Schweinfurth, 1983:303; Winters, 1975:36; Tucker, 1983:160). However, to gain control over forest fires, logging, forest grazing and extension of arable land as well as to ensure the supply of timber in the long term, the entire forest areas in the Hazara District were already declared the property of the government in 1857 (Khattak, 1976:106).

Later the first Conservator of Forests in Punjab, Dr. J. L. Stewart, immediately realized the necessity to protect the mountain forest in Kaghan (then belonging to Punjab) (Stebbing, 1923:261). From 1867/68 the Forest Department carried out the logging operations in Kaghan (Henniker-Gotley, 1932:39). According to the Hazara Forest Regulation No. II of 1873 the forest areas within the Kaghan Forest Division were then classified into Government Reserved

Forests (20,000 ha) and public wastelands, later called Guzara Forests (37,700 ha) (Khattak, 1976:107). Henceforth the Forest Department took over the management of the Reserved Forests, mainly located on the less populated and less used shady slopes. The previous exploitation of these forest stands was gradually replaced by an extensive silvicultural management system until the turn of the century. Far-reaching forest use restrictions were decreed quite often causing stiff opposition among the local villagers (cf. Stebbing, 1923:533-537). The peasants had the impression that the perpetual timber supply for commercial purposes was given higher priority than the satisfaction of domestic requirements for their subsistence (cf. Saxena, Rao & Purohit, 1993:73).

As the timber demand for the Punjab railways did not culminate until the 1870s and 1880s (cf. Tucker, 1983:160), logging concentrated as ever on the cedar forests. Since it was ascertained that not all of the *Cedrus deodara* forests had been included after the demarcation of the Reserved Forests, each and every cedar in the entire Kaghan range was declared the property of the government (Khan, 1970:40). Later the forest working plan elaborated by Monro (1901) was the first attempt to manage the Government Forests in compliance with strict silvicultural and economic principles. This working plan still almost exclusively referred to the profitable cedar forests.

The Guzara Forests, mostly located close to the villages, remained under the supervision of the government, but were left to the local people to meet the domestic requirements of their subsistence economy. After the division into Reserved Forests and Guzara Forests land-use pressure was increasingly directed towards the latter, resulting in progressive forest degradation. Until the turn of the century this pressure continuously rose due to the extreme population growth. Between 1868 and 1901 the population

increased from just under 16,000 to 37,000 (cf. Punjab Government 1883/84:185; Grotzbach, 1989:5). As the extension of arable land was further limited by legislation, alterations in the cultural landscape now primarily arise from the gradual transformation of forest areas into grazing land. Especially in the densely populated Lower Kaghan the Guzara Forests were further thinned out and depleted. This is expressed in a landscape depiction of 1890, which describes the lower portion of the valley up to above Paras as "steep and uninteresting hill sides nearly bare of trees, very hot and shadeless" (Bruce, 1910:112). For the first time there are also germs (cf. Watson, 1908:214, 331; Glover, 1944:135). The grazing pressure caused a thinning of forest margins and an extension of grazing grounds on clearings inside the forests also in the far away Guzaras and in some Reserved Forests. On these clearings an enormous increase of huts ("dharas") erected by migratory herdsmen was assessed in the 1890s (Henniker-Gotley, 1932:11).

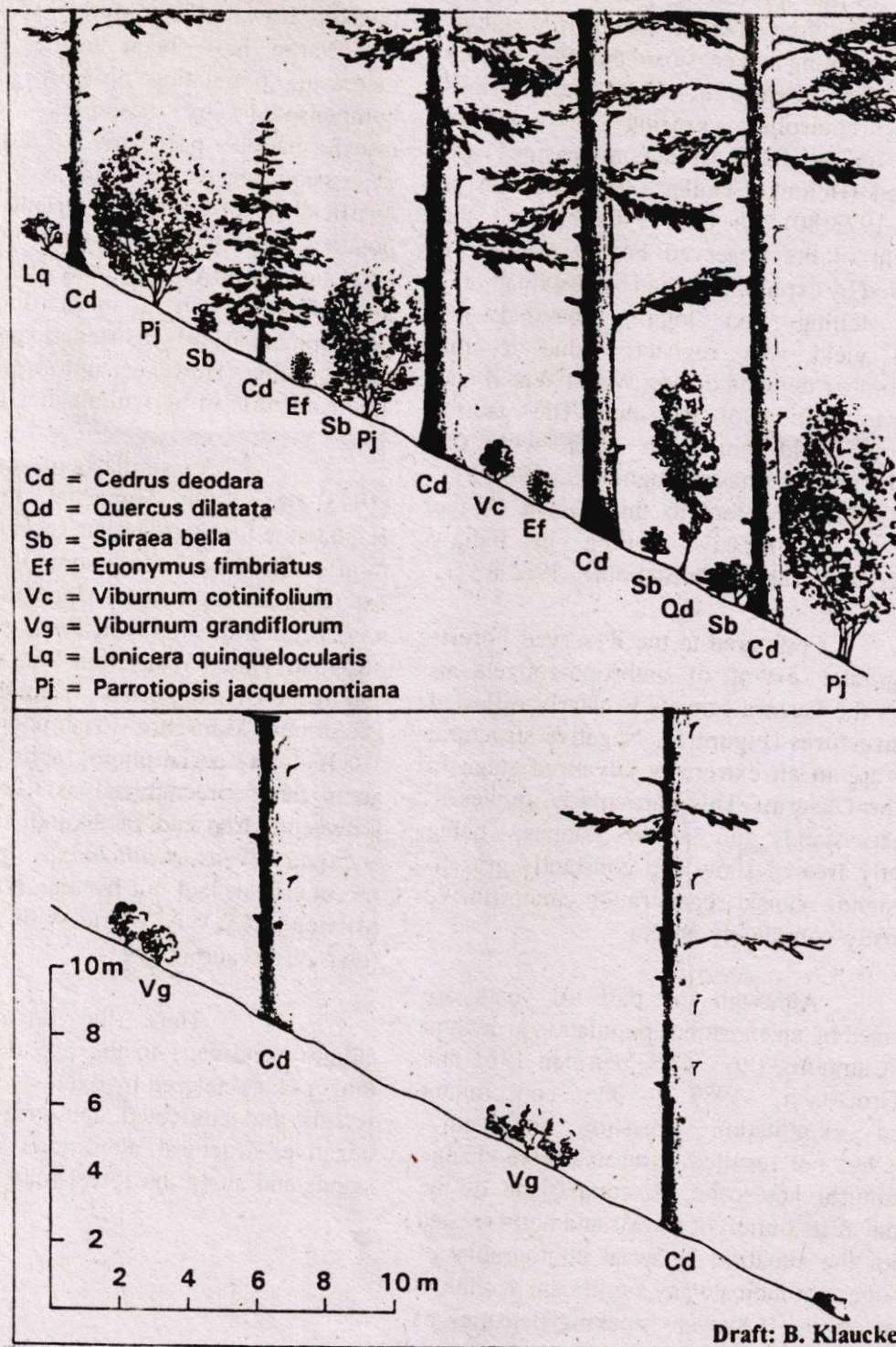
The government could not prevent the Guzara Forests, having been subjected to the silvicultural management of the Forest Department only since 1950, from further deterioration and partial decimation. So the actual forest cover of the Guzaras amounted only to c. 60 % about 100 years after their designation (cf. Masrur & Khan, 1973:68). On the other hand, the forest conservancy measures had their positive effects above all in the Reserved Forests. There the actual forest cover in 1966/67 and in 1985 was around 89 % and 91 % respectively (cf. Masrur & Khan, 1973:65; Swati, 1985:97-105). Hence, it is basically the merit of the Indian Forest Service and it must be attributed to the action taken in the early years regarding forest conservancy and forest management that nowadays c. 16% of Kaghan, i.e. half of the potential forest area is still covered with forests (Schickhoff, 1993a:184).

In contrast to the rapidly occurring changes in the distribution of forests and farm- and rangelands from 1847 to 1867 the protective influence of the developing British-Indian forestry resulted in a distinct retardation of these transformation processes, although the utilization pressure on the forest resources was steadily increasing.

How did the development of the cultural landscape continue? The photographs in Watson (1908) indicate that by the turn of the century the cultural landscape of Kaghan corresponds in its basic patterns to the present-day scenery. Tour notes from the first decades of this century corroborate the then already similar landscape. Above all the deforested slopes in Lower Kaghan were noticed by travellers (Mehra, 1944:362; Gyr, 1949:8). Likewise, tour impressions from Upper Kaghan are approximately in agreement with the present-day situation (cf. Angwin, 1930:51; Tilman, 1949:36-38; Paffen, Pillewizer & Schneider, 1956:29; Khan, 1970:21). Certainly population growth continued and the numbers of livestock further increased. Also a slight extension of cultivated terraces in marginal areas as well as progressive degradation of the Guzara Forests could be observed. But due to the legally established ownership conditions, rapidly occurring extensive forest-cover changes have no longer taken place. Forest development is rather characterized up to the present day by gradual structural alterations as being expressed by the breaking up and receding of forest margins, by the thinning and overageing of forest stands, by regressive successions into browsing-resistant scrub communities, by species displacements in the ground vegetation favouring weeds and light-loving elements as well as by increasing soil erosion.

Serious structural alternations occurred in the Reserved Forests for example, after all the forests in the Hazara District were

Figure 5. Differing stand structures in a Reserved Forest (above) and in a Guzara Forest (below) near Bhunja. The outlined *Cedrus deodara*-stands are located near to each other at 1800 m a.s.l.



released to unrestricted grazing in 1918 as a concession to the protesting peasants (Parnell, 1920: 226). But free grazing caused tremendous browsing, trampling and erosional damages to such an extent that already in 1924 the previous regulation (controlled grazing of separate allotments on the basis of annual leasing) was reintroduced (Henniker-Gotley, 1932:14; Masrur & Khan, 1973:80). In the 1940s as well the management of the Reserved Forests was more characterized by exploitation than by sustainability. Excessive felling and logging beyond the prescribed yield was registered due to the increased timber demand during World War II and after the foundation of Pakistan. The natural regeneration could not keep pace with the exploitation in this phase (Lughmani, 1960:21). Tucker (1988:103) refers to this period as the "second era of massive cutting in India's forests" (see also Table 9 in Stebbing, 1962:137).

Compared to the Reserved Forests the far greater extent of anthropo-zoogeneous impacts on the Guzara Forests is clearly reflected in stand structures (Figure 5). Negative structural alteration are in an extremely advanced stage in most of the Guzaras. This particularly applies to the forest stands on lower slopes, being permanently free of snow and constantly grazed. In these stands natural regeneration cannot thrive and is mostly completely absent.

Although the past 40 years are characterized by an enormous population growth in Kaghan it amounted to c.64% between 1961 and 1981 (Grotzbach, 1989:7)- the concomitant reinforced exploitation pressure on natural resources has not resulted in an extensive change of the cultural landscape. A comparison of the present-day distribution of forests and non-forested areas with the situation in aerial photographs of 1966/67 does not indicate any significant decline in the forest cover. However, stocking densities of

forests close to settlements have decreased and the settlement areas, in particular the bazaars of Balakot, Kawai, Paras, Jared, Mahandri, Kaghan and Naran have been further extended. The increasing population pressure has rather been compensated by complex socio-economic transformation processes. They are finding expression for example in agrarian innovations (artificial fertilizer, market-oriented production of potatoes and other cash crops), in increased non-agrarian gainful employment and spatial mobility and altogether in a more or less advanced development from subsistence agriculture to part-time farming. However, upto now no perceptible extensification of agriculture has taken place.

As similarly described by Kuster (1993) for Kulu (Himachal Pradesh) also in Kaghan the forest cover has recently increased due to afforestation efforts in some valley sections. So extensive areas on sunny slopes in Lower Kaghan have been afforested with *Pinus roxburghii* by the "Kaghan Valley Watershed Management Project" and by the UN-supported "Watershed Management Programme Mansehra" (Mahmood, 1968; Khattak, 1983). In the aerial photographs of 1966/67 these areas can be recognized as treeless rangelands. Between Naran and Battakundi in Upper Kaghan enclosed *Pinus wallichiana*- plantations have recently been laid out by the "Kaghan Friendship Mission" of WWF (World Wide Fund for Nature) (own observations 1993).

Thus, the development of the cultural landscape in the twentieth century is no longer characterized by extensive conversion from forests into cultivated and grazing land, but by negative structural alterations within the forest stands and along the forest margins.

CONCLUSIONS

Degradation of vegetation and landscape turns out to be a long-term, complex process being strongly influenced by changes in the socio-economic environment. Far-reaching changes of these general conditions in the early years of British rule had led to a serious reshaping of the landscape. In the period following, the forest management has largely been able to prevent further depletion of forest areas and progressive degradation, particularly in the Reserved Forests. In the twentieth century the increasing pressure on forest resources has rarely resulted in quantitative losses of forest cover. Instead, gradually occurring, negative stand structural alterations are taking place threatening the protective functions of the mountain forests in the long term. Although the efforts of forestry to forest conservancy in Kaghan have been and still are quite successful, it has to be stated that within the field of conflict between economic constraints and silvicultural-ecological requirements on the one hand as well as domestic needs of the rural population on the other hand forestry has hardly been capable of inducing natural, stable stand structures. Considering the protective functions of mountain forests this should be the priority target of silvicultural management.

As far as the Kaghan Valley is concerned the hypothesis of massive deforestation in the Himalaya in the past decades caused by enormous population growth is definitely disproved. But, due to the specific situation of Kaghan regarding the high mountain relief, the limited accessibility and the history of forest management and of socio-economic developments, the results of this study should not be transferred to other West Himalayan valleys without thorough examination.

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