CONTRIBUTIONS TO NEPALESE STUDIES
CNAS, TRIBHUVAN UNIVERSITY

Vol. 13, No. 3
August 1985

Resource Management in the Arid Himalaya: Problems and Prospective Solutions

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MUSTANG

Geographical Description

The administrative district of Mustang is located in northern Nepal between 83°28'3" and 84°8'11" east longitude and 28°33'36" and 29°19' north latitude. It is bordered by the Tibetan Autonomous Region of China to the north, the Myagdi district to the south, Manang district to the east and Dolpo district to the west (Fig. 1). The district covers an area of some 3,176 square kilometers and is drained by numerous tributaries in the north which merge to form the Mustang River (Chu, T.). Additional tributaries flowing into the Mustang River form the Kali Gandaki, with its strikingly broad alluvial plain between the villages of Lete and Chhelegaon, has been a traditional trade route between Tibet and India for hundreds of years.

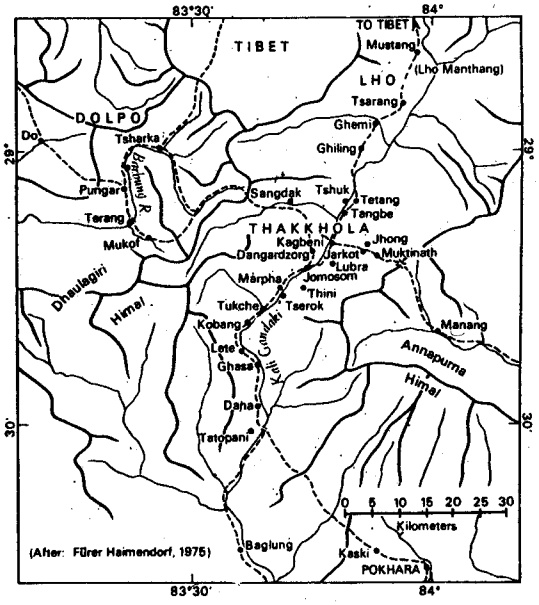

Figure 1. Eastern Dolpo and Mustang Districts, West Nepal

Mustang is located in the Trans-Himalayan arid zone, an expanse of barren country screened from the summer monsoon rains by the Dhaulagiri and Annapurna massifs at the south. These mountains "form the boundary between the Indian subcontinent and the high plateaus of central Asia," and have been described as "one of the most rigid climatic barriers in the world" (Nelson et al., 1980:10). Rainfall varies from 3,470 mm/yr on the southern slopes (Pokhara) to less than 300 mm/yr north of the chain. The district may be further divided into two fundamental physiographic regions--an extension of the Tibetan plateau to the north (Upper Mustang), and an exceptionally deep Inner Valley region, which separates the Annapurna and Dhaulagiri massifs, in the south (Lower Mustang) (see: Nelson et al., 1980).

Upper Mustang, also called Lho Manthang or Mustangbhot, is generally referred to as the region between Kagbeni and the district's northernmost border with Tibet. It is synoptically a large, open valley drained by the Kali Gandaki and enclosed by high mountains, with the average elevation above 3,000 m and highest peaks in excess of 7,500 m. Upper Mustang is an "almost treeless country which in climate and vegetation is Tibetan in character" (Stainton, 1972:49). Rainfall is less than 300 mm/yr. Sod grasses and steppe shrubs predominate (Sophora-Oxytropis as a stream-side community; Caragana-Artemisia on the lower slopes; and Caragana-Lonicera on the upper slopes) except for occasional enclaves of pine, birch, cedar/cypress or juniper on the north-facing slopes of certain tributaries (Dobremez and Jest, 1970). Three distinct physiographic units have been defined for the region. They are the rounded hills, dissected plateaus and lowland complexes of the "Upper Mustang Valley Land System"; the higher grasslands, smooth ridgelands and alluvial fill terraces of the "Western Mustang Valley Land System"; and the upper hills, benchlands, flood plains and terraces of the "Lower Mustang Valley Land System" (Nelson et al., 1980).

Because of its proximity to Tibet, Lho is "culturally, linguistically and ethnically...purely Tibetan" (Fürer Haimendorf, 1975:137), and "one of the last strongholds of Tibetan culture in Nepal" (Nelson et al., 1980:19). The region is sparsely settled by the Lopa, a Tibetan-like people engaged in trade (salt and wool for the cereal grains of the south), agriculture (barley, wheat, buckwheat and potatoes), and animal husbandry (yaks, yak hybrids and goats). Villages lie between 3,050 and 3,660 m and are usually located along the Kali Gandaki or its major tributaries. Houses are built of rammed earth, with the flat, mud-covered roofs supported by poles from the coppiced poplar or willow trees which grow along the irrigation canals. Likewise, agriculture is limited to those areas which can be irrigated, and villages appear as oases in an otherwise barren and eroded landscape.

This region has one of the lowest population densities in Nepal (less than 8 per km) but a high density per cropland area (approximately 16/ha). The major population concentration is at the walled city of Mustang (Lho Manthang). The ruins of old forts and villages throughout Lho suggest that population densities were much higher in the past. The

decline of the Kali Gandaki as a major trade route, the short growing season, harsh climate and lack of natural resources makes Lho an extremely difficult place in which to live (Bista, 1980).

Until the Gorkha conquest of Nepal in the 18th century, Lho was a relatively powerful mountain kingdom, one of the many "scattered over the more fertile parts of this higher Himalayan region" (Snellgrove, 1979:75). Until 1951 it remained a "separate principality, ruled by the Raja of Mustang" (Fürer Haimendorf, 1975:137). This hereditary title is still recognized in an honourary sense by His Majesty's Government, henceforth referred to as HMG, and the present Raja continues to exert considerable political and social influence over the region's inhabitants (see: Vinding, 1978; Jackson, 1977, 1978; Fürer Haimendorf, 1975, 1981; and Snellgrove, 1979, for discussions of Lho's early history).

Lower Mustang, also known as Thak Khola, generally refers to the region between Jomsom and Ghasa (the Baragaon region, a cultural and ecological "transition zone" between Kagbeni and Jomsom, will be discussed shortly). The major physiographic units defined for this region are the Alpine Highlands and the Inner Valley Land Systems (Nelson et al., 1980). It is within this region that the Kali Gandaki River separates the Annapurna and Dhaulagiri massifs, forming a very deep gap between the two 8,000 m+ peaks. At the bottom of the gorge is the broad alluvial plain of the Kali Gandaki, ranging in width from 2,500 m to 3,500 m between Lete and Chhelegaon. Daily winds funnel northward with velocities often averaging 50 kph.[1] The winds have a severe drying effect on the valley floor and permit only the growth of a Sophora-Oxytropis steppe formation. In contrast to Upper Mustang, however, the slopes on either side of the valley floor are well forested to an area just south and east of Jomsom, as most regions receive between 1,300 to 2,500 mm of precipitation per year. Precipitation values generally decrease as the head of this inner valley is approached. Climate and vegetation change dramatically and range from the subtropical monsoon flora below Ghasa, through the temperate forests of pine (Pinus excelsa), fir (Abies spectabilis), and cedar (Cupressus torulosa) through Tuckche to the windblasted shrubs (Sophora moorcroftiana, Lonicera hypoleuca, Caragana spp.) and barren hills of Jomsom (Stainton, 1972). With increasing altitude above from the valley floor a fir-birch (Abies spectabilis/Betula utilis) and rhododendron (Rhododendron campanulatum) formation is usually encountered, followed by the alpine meadows and snow-covered summits of the High Himals.

"Thak Khola" refers to the "river valley inhabited or dominated by the Thak (Thakali) people" (Jackson, 1978:191) and is made up of the Baragaon, Paanchgaon and Thaksatsae regions. The Thakali people, "though at one time drawn into the Tibetan cultural orbit," are not of Tibetan origin, but more likely part of an ethnic group which included such tribes as Tamangs, Gurungs and Magars (Fürer-Haimendorf, 1975:134)

As in Lho, the ruins of numerous old forts throughout Thak Khola point to a time when it was a separate kingdom or group of smaller principalities (see: Fürer-Haimendorf, 1981). The year 1869 marks the

beginning of the Subba period, when leading families were granted a lucrative trade monopoly on all incoming grain and salt (Messerschmidt and Gurung, 1974). This lasted until 1928, although the Thakalis have since continued to be leaders in the business/trade sectors. Frequent travel and a desire to gain acceptance into Hindu society also led to their "gradual abandonment of many of the customs and habits which they had shared with Bhote (Tibetan) populations" (Fürer-Haimendorf, 1978: 145). While no doubt affected by the trade restrictions imposed by China in the 1950's, they have since supplemented their business and agriculture incomes by developing the tourism and horticulture industries. While architecture, animal husbandry, agriculture practices and life-styles are similar to those found in Lho, Thak is a much wealthier and more sophisticated region with a comparative abundance of natural resources. Thak Khola has also been a center for recent developmental activities, including the many land-use components of HMG's Resource Conservation and Utilization Project (RCUP), a 260 kw mini-hydro plant near Tukche, and the Agricultural Farm near Marpha.

Baragaon and the Muktinath Valley

The Baragon region is located in the central part of Mustang District at approximately 28°6' east longitude. It spans four political units known as panchayats[2] (Muktinath, Jhong, Kagbeni, Chhusang) and lies within the "Lower Mustang Valley Land System" previously mentioned. Landforms consist primarily of rounded, barren hills which enclose the benchlands, terraces and rubbly plains of the Kali Gandaki. The 19 villages of Baragaon[3] are inhabited by a people normally referred to as the "Baragaonle," a Tibetan-like people more similar to the Lopa of Upper Mustang than to the Thakali (Schuler, 1981). Markedly influenced by the Thakali, however, the Baragaonle and Baragaon region may be said to represent a "transition zone" between Upper and Lower Mustang.

On the extreme eastern edge of the Baragaon region, at approximately 29°11' north longitude and 83°53' east latitude, lies a high basin within the hills known as the Muktinath Valley. It is aligned east-west and is drained by the Jhong (Dzong) Khola, a tributary of the Kali Gandaki. Six villages (Khingar, Jarkot, Purang, Chongkhor, Jhong and Putra) are located in the central and eastern part of the valley and range in elevation from 3,050 to 3,810 m. The Jhong Khola is the dividing line for the valley's two panchayats, Muktinath and Jhong. A seventh village, Lubra, is located in the Punda Khola valley (Muktinath panchayat) which lies adjacent to and south of the Jhong. Lupra is included in this particular study group because of its proximity to and use of local forest reserves. Kagbeni, at the junction of the Kali Gandaki and Jhong Khola, has been excluded because of its access to different forest regions further up the Kali Gandaki.

A six-hour walk or three-hour horse ride from the administrative center of Jomsom is required to reach this central part of the valley. The walk takes one along the twisted, wind-swept plain of the Kali Gandaki and begins to gain in elevation near the village of Kagbeni.

During this approach there is little to distinguish the mouth and adjacent regions of the Muktinath valley from the surrounding countryside. Both the north- and south-facing slopes exhibit a Caragana-Artemisia steppe formation spread unevenly over the hills of black, slaty soils. The south-facing slopes, however, appear steeper and more heavily eroded, with yellowish pillars of cave-pitted sediments rising hundreds of feet from the banks of the Jhong Khola. One deserted village near this area is passed, which shows evidence of heavy landslide activity forcing the inhabitants to leave at some time in the near past.

The six villages of the Muktinath and Jhong panchayats, soon in full view from a hill two hours east from Kagbeni, quite drastically change the character of the land wherever they happen to be located. Each appears as an oasis of terraced, irrigated fields surrounding the clustered groups of flat-roofed, white-washed adobe houses (Plate 1). Barley, wheat

Plate 1: Alluvial plain of the Ponda Khola, en-route to Lubra.

and buckwheat are the principal crops and can be grown only on irrigated land. Poplar (Populus ciliata) and willow (Salix spp.) trees grow in and about the villages, along the irrigation canals, and around the Muktinath temple (mandir, N.) and monastery (gomba, T.). The valley receives 369 mm of rainfall per year, which is slightly more than the nearby Jomsom, and can be attributed to the valley's higher elevation and greater distance from the drying winds of the Kali Gandaki. Although this upper part of the valley is characterized by a Caragana brevispina-Lonicera spinosa steppe formation (Dobremez and Jest, 1976), it should be noted that the north-facing slopes are moister and exhibit a more continuous cover of vegetation than do the drier, heavily eroded south-facing slopes.

The population of the valley (including Lupra, with a population of 87) is approximately 1,404 (APROSC, 1983). The Baragaonle speak a dialect of Tibetan and are followers of Tibetan Buddhism and Bon religion. There are 12 monasteries in the valley as well as the Hindu shrine complex and pilgrimage site of Muktinath for which the valley is famous. The Baragaonle are agro-pastoralists and graze their herds of yak, dzo (yak/cattle hybrid) and goats on the valley slopes and in the higher alpine meadows of the Punda Khola. Because of the short growing season in this high valley, the people depend on various other sources of income which include trade, employment outside of the region, the production of handicrafts and tourism (Schuler, 1981).

As do most Himalayan peoples, the inhabitants of Muktinath utilize wood for heating, cooking and constructional purposes. Kindling is often found neatly stacked on the outer edges of roof-tops or in sheltered areas and is conservatively burned in the cooking stoves (chulo, N.). Vertical and horizontal beams of de-barked or hand-squared lumber support barns and houses. Access to a continual supply of wood products is critical to survival, as there are no feasible sources of alternative energy at present. With minor exceptions, however, the species most frequently utilized for the above purposes are nowhere to be seen in the valley. This prospect led to an examination of (1) the species used, (2) the timber and fuelwood requirements, (3) forest locations, and (4) present management practices.

WOOD

Fuelwood

Within the study area, birch (Betula utilis) is the most common species used for cooking and heating. It is considered superior to other species as it burns more cleanly, more slowly and with a higher heat output than pine or juniper. The branches of scrub juniper (Juniperus indica) are used for kindling. During the winter, dung cakes supplement wood stores, and dried thorn bushes mixed with dung are also burned at this time.

The average household is said to burn a yearly average of seven ser (approximately 8 kg) of wood a day, a figure which cannot be verified at this time. It is, however, a fairly low estimate when compared to those given for other regions of Nepal (Donovan, 1980) and probably reflects the relative scarcity of fuelwood in Baragaon and the conservative burning methods employed. It does not include the additional amounts required by tourist groups, tourist hotels and pilgrim populations, which will be discussed shortly. Likewise, it is not known exactly how much dung is burned each year, except to say that its usage in Baragaon, Mustang and Dolpo is much heavier than in the rest of Nepal for the same wood scarcity reasons.

Fuelwood is burned in the cooking stoves which are constructed of rock and mud and usually contain two cooking holes. Thak Khola is unusual in that it is one of the only places in Nepal where chimneys and form-fitting pot-holes (sheet metal cut-outs) are used. The resultant "smokeless chulo" (see: Saubolle, 1979; RECAST, 1980), which has received considerable attention from international donor agencies in Nepal due to its health and alleged fuel conservation benefits, is said to have been introduced by the Khamba, Tibetan militants based in Mustang who fought the Chinese during the 1960's. The Khamba, who will be discussed in greater detail shortly, are also reported to have introduced the sheet metal stoves and pipes used for heating purposes during the winter. Both types of stoves are now found throughout Thak Khola.

Families often group together to form wood-cutting expeditions in the summer and early fall. There has reportedly been an increasing usage of pack animals (mules and dzo, or yak-cattle cross breeds) within the past 25 years for the transportation of wood. This is thought by some to be an indicator of the growing distances from the villages to the harvesting regions (Sidney Schuler and Krishna Lal Thakali, 1978, personal communication).

The closest source of fuelwood is the Muktinath forest (Jangal, N.), a three to four hour walk from the village of Jarkot. The forest consists primarily of two species--Blue Pine (Pinus excelsa) and Himalayan White Birch (Betula utilis)--which together comprise an area of nearly 400 ha (APROSC, 1983). It is located on the north-facing slopes of the Panda Khola, parallel to and due south of the Jhong Khola valley, with a lower elevation limit of approximately 3,050 m and upper limit of approximately 4,115 m. The local name for this forested region is Liidii.

Although the forest comes under the jurisdiction of the HMG Forest Office in Jomsom it is managed by the Muktinath panchayat in a fairly informal manner. The panchayat determines which species may be cut, how much wood may be harvested, taxes timber and fines offenders. There appeared to be little or no interaction with the Jomsom office, which suggests that the forest has remained under an indigenous management system in spite of the nationalization of forest lands in the 1950's through the return of responsibility, under the Forestry Act of 1979, to the panchayat.

For reasons which are not entirely clear, the villagers of Jhong, Chongkar and Putra depend more on the forest regions of the upper Jhong Khola for fuelwood than on Liidii. This is probably related to old forest boundaries between the two groups of villages which are still more or less adhered to. With the exception of a small sacred birch forest, the predominant wood species found in this region is scrub juniper, which is hacked up live or burned in situ and allowed to dry before its transportation back to the households. In contrast to the three villages of the Muktinath panchayat, villagers in Jhong indicated that they had an exceptionally difficult time procuring fuelwood. It is also of interest to note that these three villages reportedly burn much greater amounts of juniper and dung than do Jarkot, Khinghar and Purang. As with Liidii, the management of this remote region is determined by the Jhong panchayat.

Figure 2 shows the Muktinath and Punda Khola valleys and includes the local names for the various communal pastures and forest regions. In 1982 the people of Muktinath utilized the regions east of, and Lubra villagers the region west of, the indicated stream.

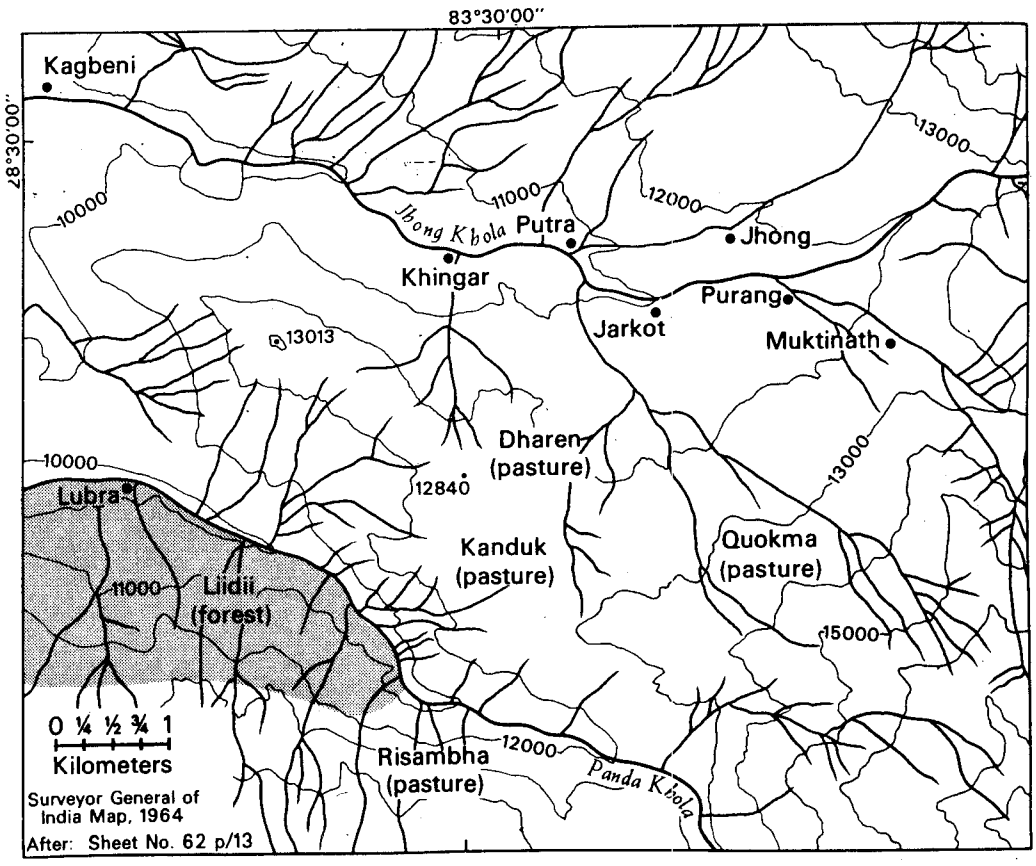

Figure 2. Muktinath Panchayat. Liidii forest region is indicated by the shaded zone.

According to the Muktinath Village Assembly Chairman (Pradhan Panch), the panchayat has set no limit to the amount of fuelwood which a household may harvest for its own use. However, only the wood from dead trees may be cut, and offenders of this rule are subject to fines. There did not appear to be much internal control over this regulation and no system of regular protection (e.g., forest guards) was observed.

Larger lumber (i.e., birch poles and pine logs) for construction purposes is taxed by the panchayat. Individuals must petition the panchayat for permission to cut the larger trees, and taxes are arbitrarily defined depending on the amount requested and the ultimate use. It was reported, however, that most of the larger timber comes from the forests in the vicinity of Thini and Marpha further south, as the truly large trees had been harvested years ago.

The panchayat's ban on the cutting of pine in 1982 indicates the general concern felt for the future of the Liidii forest area (Plate 2). Only birch could be cut, as it was obvious that the more accessible pine was rapidly being depleted. However, it should be noted that most villagers blame the decrease of pine reserves on the Khamba, Tibetan refugees and guerillas who had been involved in periodic skirmishes with China's People's Liberation Army (PLA) since the PLA's advance into Chamdo (east Tibet) in October of 1950. Beginning in 1956 the Khamba allegedly received covert training and aid from several international intelligence agencies (Piessel, 1967; Mullin, 1975; Allman, 1974; Long, 1981), and in 1961 moved to the Mustang District in order to have better access to supplies. The move was also engineered to take advantage of Nepal's neutrality while enjoying a close proximity to Tibet. By the summer of 1962 there were some 6,000 Khampa soldiers in Mustang, Dolpa and Manang, living "...near isolated monasteries, hidden valleys and forest regions" (Piessel, 1967:219). Of note is that the village of Kagbeni was one of three principal supply centers along the vital supply line of the Kali Gandaki, and that the Khampa presence throughout Baragaon and Paanchgaon was high.

Plate 2. Villager of Baragaon packing out shrub Juniperus sp. from the upper Jhong Khola region.

In 1973, under pressure from China, the Nepalese Army forced the Khampa to surrender their arms and to re-settle in numerous refugee camps in either India or Nepal (Asian Recorder, 1974; Singh, 1975; Long, 1981). However, the Khampa had not been without their economic, social and ecological effects upon the peoples and landscape of Baragaon and other parts of Mustang. For example, villagers in many parts of Thak Khola and Lho are said to have been pressured into selling their yak herds; independent trade with China was violently prohibited; the native wildlife, particularly the musk deer and blue sheep populations, were shot to near extinction; native medicinal herb sources were depleted; and forests were heavily cut to provide fuel and timber for the Khamba soldiers. The ruins of one such Khamba fort are located in the Liidii forest east of the village of Lubra and the presence of the approximately 40 soldiers who lived there over a 12 year period is said to have greatly contributed to the region's deforested appearance. Given the natural resentment felt by local peoples for an "occupying army", it is not entirely clear how much of this environmental degradation was indeed an effect of the Khamba presence and how much can be attributed to retrospective feelings of hostility.

As was mentioned, there did not appear to be any regular system of forest protection and offenders of regulations are fined on a "catch as catch can" basis. A typical fine for the cutting of live wood was given at Rs. 100/-, and one unfortunate young man, who was accused of being responsible for the burning of approximately 1.2 ha of pine forest in 1981, was fined Rs. 700/-.

Overall, Liidii appeared to be in fair to poor condition. It is a high altitude forest with a slow regenerative capacity, grazed heavily by livestock. The many stumps observed point to a time when the forest was much thicker, and indeed the villagers of Lubra say that the "mountain could not be seen" (because of forest coverage) within living memory.

Building Materials

In the construction of houses, wood is used in the making of window frames, shutters, doors, horizontal roof beams and supportive vertical beams. Walls, as previously mentioned, are either constructed of stone and covered with mud, or made of earth which is compacted between wooden forms. Pine (Pinus excelsa), both in the old and newly constructed houses, is sometimes transported by man-power from the forests of the lower Kali Gandaki near Marpha and Thini (a supply source of many years) and used for boards and heavy vertical beams. The beams are roughly hand-hewn in the forests, planed and worked in Muktinath. Boards are either roughed out by adze or cut by planksaw from the larger beams.

The forests regions of the Marpha-Thini region consist of cedar-cypress (Cedrus deodara-Cupressus torulosa), pine (Pinus excelsa), pine-cedar, and juniper (Juniperus indica) formations. They cover many of the east- and west-facing slopes of the Kali Gandaki river, beginning

at about 760 m above the valley floor and terminating at altitudes of approximately 3,965 m. In contrast to the barren country north of Jomsom, this region has been frequently no ted for its abundance of timber. In fact, over-mature stands of trees, abundant dead-fall within the forests and several burned-over regions have been observed. Its apparent lack of use for fuelwood/timber indicates the relative abundance of trees, and supports the impression that fuelwood/timber supply is not an area of particular concern to the Thakali inhabitants.

All users of the Marpha-Thini forest regions, however, are subject to the rules, regulations and taxes enforced by the HMG Forest Office in Jomsom. For example, structural timber may be obtained only by formally petitioning the Forest Office, which grants or denies the requests based on the actual construction plans and needs . Permits are granted for the harvesting of up to 5.6 m^3/Yr with a tax of between Rs. 105/- to Rs. 125/m^3, depending on the species required (pine or cypress). Governmental controls over the Marpha-Thini forests appeared to be well enforced and observed by the local people. More efficient forest management practices, however, are required if the full fuelwood/timber production potential is to be maximized.

Normally, the Baragaonle will utilize the Marpha-Thini forests only if the required size or volume cannot be found in Liidii forest. Usage appears to have increased during the past five years due to the building of tourist hotels and new houses; the renovation of monasteries and pilgrimage buildings; and the general deterioration of Liidii forest.

The previously mentioned poplar trees (Populus ciliatus) of the Muktinath valley play an important role in house construction. As cutting (approximately 25 cm long) from the older trees, they are frequently planted in groups of three which can result in a larger, thicker trunk. Coppicing is practiced as soon as the branches attain a desired length (usually 3-6 m). These poles are used primarily as horizontal roof beams, with the space between each pole filled wi th either split birch or pine prior to being covered with mud or clay. The trees are either individually or village owned. If family owned, the poplar is divided evenly among brothers according to the fraternal polyandry system of estate division. If village owned, the tree may be either used for village needs or sold to an individual, with the price of an average specimen (height: 7.5 m) given at Rs. 4000/-.

Summary

In summary, the demand for wood and wood products in Muktinath currently exceeds the convenient supply. At one time, perhaps as little as 50 years ago, both fuelwood and timber were easily obtained from the Liidii forest. Fuelwood gathering from Liidii now involves greater factors of distance and time, while the main source of heavy timber has shifted to the Marpha-Thini regions. The situation appears to be a phenomenon of the past 30 years,[5] where additional pressures from the

Khamba and Tibetan refugee populations contributed to a more rapid rate of deforestation.

There appeared to be a general awareness of and concern for the problem in Muktinath. This impression is based on interviews, the indigenous management system and the receptiveness of the Baragaonle toward recent HMG and donor agency projects concerned with afforestation. In general, future energy sources and wood supply take on a much higher priority in Baragaon and Lho than in the better forested regions of the lower Kali Gandaki and the Middle Hills. The current situation, however, will probably be complicated by such factors as population growth, an increase in pilgrim populations and the introduction of tourism, all of which are creating added demands on a forest with an unusually slow regenerative capacity. These are examined briefly below.

INTERNAL AND EXTERNAL FACTORS

Population

Schuler (1980) found the gross reproduction rate (GRR) of four villages in Baragaon to be 1.31 or 1.22, "based on the births during 1977-78 and 1978-79 respectively" (p. 143). The figures are "very low" on the reproduction scale developed by Nag (1976:15), which Schuler references in her study. They most likely reflect the constraints on childbirth resulting from the fraternal polyandrous system of marriage, and the high incidence of stillbirths and infant mortality due to improper hygiene (Charles Ramble, 1982, personal communication).

This trend, however, appears to be shifting in the other direction. Younger people are uniting more and more in monogamous marriages, and health conditions are improving to the point that birth control measures have been advocated (Schuler, 1980). In addition, out-migration from the harsher regions of northern Mustang and Dolpa is reportedly on the increase (Fürer-Haimendorf, 1975; Nelson et al., 1980; Krishna Lal Thakali, 1982, personal communication) and is thought by some to be the main contribution to population increase at present.

Pilgrims

Muktinath has been a pilgrimage site for Hindus and Buddhists for several thousand years. Messerschmidt (1981) writes that Muktinath's ancient name of Salagrama (after the ammonite fossils--sāligrām--found in the region) is mentioned in the Mahabharata (4th century B.C.) and the Purana (4th to 11th centuries A.D.). He also mentions that Muktinath is "listed as one of the destinations on the 'Grand Pilgrimage of India' (Bhardwaj, 1973)". Other accounts by western visitors which

mention the holiness of the place and great numbers of pilgrims include those of Kirkpatrick (1811), Oldfield (1880), Hedin (1916-1922) and Landon (1928).

For over 2,000 years, then, it can be safely stated that pilgrims have placed added demands on the resources (primarily food and fuelwood) of the Muktinath valley. Although records are not kept for pilgrims by the Police Checkpost in Muktinath, their numbers are reportedly increasing due in part to improved networks of transportation in India and Nepal. "High priced bundles of firewood" (Schuler, 1981) are sold to the pilgrims by the Baragaonle on a regular basis. There is no reason to believe, at present, that the situation will change.

Tourists

The Muktinath valley was opened to relatively large-scale, commercial tourism in 1976. Only a handful of westerners (e.g., expeditions, scholars, Peace Corps Volunteers) had visited the region prior to this time (primarily in the 1950's and early 1960's), and the District experienced several periods of complete official closure during the 1960's and early 1970's depending upon concurrent levels of Khampa guerilla activity (Asian Recorder, 1974). Well over half of the Mustang District (from Kagbeni to the Tibetan border) currently remains off-limits to westerners for political, administrative and ecological reasons. The Police Checkpost in Muktinath recorded 3,500 tourists for the 1976-78 period; this had jumped to over 5,000 for the single year of 1981, which is not surprising considering that Jomsom recorded 10,019 tourists, or 36.5% of Nepal's trekking population, for the same year (Shrestha, 1983).

In 1978 there was one tourist lodge in Jarkot, with another being built in Rani Powa fairground region. In 1980 there were a total of four lodges in both places. More fuelwood is now required for cooking, for the sheet-metal wood-burning stoves in several of the lodges, and for the trekking parties which camp in the Rani Powa region. Tourism has already achieved a solid standing in the valley's economy, providing additional income for the Baragaonle through the sale of blankets and souvenirs, wood, food and lodging. Tourists, like pilgrims, appear here to stay.

CURRENT DEVELOPMENT PROJECTS IN LOWER MUSTANG--PROGRAMS, PROBLEMS AND PROSPECTS

In an earlier work, the author made a number of "Suggestions Toward Conservation" for the Muktinath Valley (Byers, 1979). Briefly, these were (1) the establishment of programs which would increase the level of awareness regarding more sound land-use practices, (2) actual reforestation and management programs for the Liidii forest area, and (3) the investigation of the feasibility of alternative energy forms (solar, wind) appropriate to the Baragaon region. The paper also suggested that

regulations concerning tourist and, to a lesser extent, pilgrim populations be investigated in order to minimize their respective ecological impacts.

It is remarkable that, most coincidentally, many of these items were directly addressed by various HMG and donor agencies in the interim period. For example, the Resource Conservation and Utilization Project (RCUP), mentioned in the 1979 paper, began its land-use activities in Lower Mustang (Jomsom, Marpha, Lete) as of June, 1982 (a nursery at Jarkot was also established at this time). The Remote Area Development Board, under the Ministry of Panchayat and Local Development, was active in drinking water schemes, bridge building and monastery renovation, with plans to construct a 12.5 hectare fuelwood/fodder tree plantation in Jhong panchayat in 1983. The Department of Tourism built an enclosed camping space for trekkers at the Rani Powa fairground, and the fruit tree sapling and vegetable seed distribution programs of the HMG Marpha Agricultural Farm had expanded considerably into Baragaon and regions further north. The construction of a 260 kw micro-hydel plant near Tuckche was nearing completion in June 1982, which was to provide electricity for Tuckche, Marpha, Syang and Jomsom. Its implications for Baragaon will be discussed shortly. In brief, perhaps only the Sagarmatha (Everest) region received more national and international attention than Lower Mustang in the period 1978-1983. Several of these projects, and the implications of their activities for the Muktinath valley in particular and the Mustang District in general, are briefly discussed below.

Resource Conservation and Utilization Project (RCUP)

By far the largest donor project in Mustang is the Resource Conservation and Utilization Project (RCUP), a "multi-faceted and integrated project that will attempt to halt the rapid degradation of Nepal's environment" (AID Project Paper, RCUP, 1980:35). It is jointly financed by the United States Agency for International Development (AID) and HMG, with contributions of $27,498,200 and $5,660,500 respectively over a five year period. Technical assistance is provided by the contractor, the South East Consortium for International Development (SECID), based in Chapel Hill, North Carolina. SECID works in a collegial relationship, with HMG's Ministry of Forests, Department of Soil and Water Conservation, the primary HMG implementing agency. The RCUP has 11 components (Inventory and Monitoring, Watershed Management, Forest Management, Energy, Irrigation, Drinking Water, Community Livestock/Range-Pasture, Agronomy/Extension/Research, Horticulture, Fisheries Development, and Training), including an overarching, integrating Social Science component responsible for effective and appropriate implementation strategies. Each is implemented by the particular HMG line agency most concerned with the respective activities. The project effectively began in July, 1980, working in the Kali Gandaki and Daurandi Khola (Gorkha District) catchment regions.

Theoretically, activities are implemented using a "bottom-up" approach, with Panchayat Conservation Committees (headed by a "recognized panchayat leader" and consisting of 9 additional ward representatives) submitting their recommendations concerning needed land-use projects to the District's Catchment Conservation Committee (chaired by the District Panchayat Chairman, with members from the various governmental line agencies) which in turn forwards these recommendations to the Project's Central Office in Kathmandu. This approach is novel to established project implementation procedures within HMG, as is the RCUP's emphasis on "villager participation" (see: Messerschmidt et al., 1983) for all field projects.

Project implementation in developing countries always seems to proceed more slowly than originally planned, and the RCUP was no exception. In Mustang, the RCUP encountered a number of delays and implementation problems during the first year (1980-81), most of which were related to the project's great size, complesity, the relative remoteness of Mustang and other inherent difficulties of project start-up. By 1981-82, however, the project was well underway and nearly all of the planned activities were completed. Most of the "targeted" activities (i.e., pre-established work items to be completed within a given fiscal year) were implemented between Lete and Kagbeni, which contained the first year's "priority panchayats". A partial list of activities and sites includes grass trials (Lete), nurseries (Marpha, Jomsom, Jarkot) (Plate 3), fuelwood/fodder tree plantations (Marpha, Jomsom, Kagbeni), alternative energy tests (solar heaters and improved stoves in Jomsom and Jarkot; one windmill test in Jomsom; solar dryers in Marpha), watershed protection sites (Thini) and community water source protection (Jomsom).

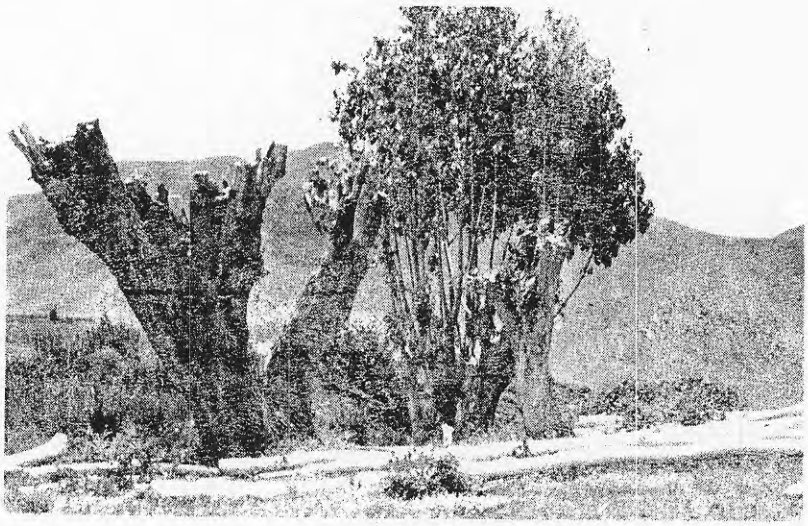

Plate 3. Coppicing of Populus ciliatus in the Muktinath Valley. Poles in the foreground will be used as structural beams for houses.

Plate 4. Testing an "improved stove" in the village of Jarkot.

Certain social aspects of the RCUP (e.g., establishment of the Panchayat Conservation Committees) lagged somewhat behind the physical target implementation as a result of the project start-up difficulties previously mentioned. Activity site-selection was thus largely determined by the Catchment Conservation Committee in Jomsom during the years 1980-82. Panchayat Conservation Committee formation was planned for April, 1983, so it is not possible at this time to assess the Committee's actual performance.

Structurally, the RCUP contains the strategies, funds and components which can directly address the priority problems--irrigation, range/pasture, forestry, energy development-of the people of Mustang. Local traditions of voluntary labor would also appear to be most compatible with the implementation policies of the RCUP, and the high levels of local interest in land-use problems will probably facilitate intervention maintenance and, if demonstrated to be feasible, eventual dissemination. In short, there is probably no area with a greater need for a RCUP than Mustang, and given enough time the chances for land management improvements would appear to be excellent. Most of the implementation problems encountered to date--inappropriate site-selection (e.g., nurseries in a heavily forested, low-priority region), inadequate construction and maintenance of completed "targets"-- can be linked to the problems of project start-up and a corresponding lack of local involvement. Many of these, however,

will probably be corrected once the infrastructure of the RCUP has had a chance to become firmly established. In particular, it will be of interest to follow the progress of the recently formed, decentralized "Gaun Sallah" (village dialogue) approach to panchayat resource inventory and planning (Messerschmidt et al., 1983; APROSC, 1983). In brief, this method involves extensive discussions between RCUP assessment teams, village leaders and villagers prior to the recommendation (and eventual implementation) of future development inputs. The success of other agencies (e.g., HMG's Remote Area Development Board, discussed below), which have used similar though less formalized methods of resource inventory and planning (Krishna Lal Thakali, 1982, personal communication) would tend to show promise for the effectiveness of the Gaun Sallah procedure.

Remote Area Development Board

The Remote Area Development Board (RADB), under HMG's Ministry of Panchayat and Local Development (MPLD), is responsible for the implementation of developmental projects in Nepal's 13 "remote" districts (there being a total of 54 districts in the kingdom). RADB personnel are usually young men from the particular district, who are responsible for (1) the assessment of regionally appropriate projects, (2) the submission of budgets to cover project costs, (3) supervision of construction, and (4) monitoring of the final intervention.

In Mustang, priority in the last two years has been given to drinking water schemes, school construction, monastery maintenance and renovation, and the construction of suspension bridges. In Muktinath, the RADB funded monastery and pilgrim resthouse renovation (Rani Powa) during 1980-82, and assisted with the joint UNICEF/MPLD drinking water schemes in Jarkot and Khingar. Plans for 1982-83 included (1) an irrigation scheme in Khingar and Lubra, (2) a 12.5 hectare fuelwood/fodder tree plantation in Jhong, (3) drinking water development in Chhongar, and (4) renovation of a Buddhist monastery near the Muktinath temple.

Excluding certain cases of faulty construction (e.g., a now-defunct bridge at Marpha) and renovation (e.g., a leaking roof at Rani Powa), the assessment/implementation methodology of the RADB could probably serve as a superb model for other agencies. For example, the RADB representative in Mustang in 1980-83 was a young, local Thakali man with a deep interest in the history and development of the Mustang District. He traveled frequently and widely in the lower and upper Mustang regions and appeared to be known and respected by all ethnic groups encountered. As RADB activities are based entirely on felt-needs, it was up to the local panchayat and villagers to determine which interventions would be implemented. A very high degree of actual participation by the villagers (e.g., carrying cement bags and plastic pipe from Jomsom to Muktinath, digging canals, etc.) was required, due in part to RADB implementation philosophy and also to its comparative shortage of available funds. In short, the employment of local representatives, the villager/panchayat decision-making procedures and the emphasis on

villager involvement usually resulted in fairly successful projects, and removed the RADB from the list of several so-called "give-away" projects in Mustang.

It is of interest to note that the villages of Jhong panchayat specifically requested a large fuelwood/fodder tree plantation. As was mentioned, fuelwood is in shorter supply here than in Muktinath or Jomsom, and energy is a high priority item. Villagers insist, however, that they will plant the area using the traditional method of large cuttings and poles, as the trees "will grow faster and bigger" than the small cutting or seedlings advocated by other agencies. Although the large-scale feasibility of such a practice is not known, this input at least demonstrates the importance of considering traditional practices and priorities before the implementation of activities.

Relative supply of fuelwood, however, is not necessaritly the main factor that determines the sense of need or priority. For example, in the village of Tiri, about one half hours walk north of Kagbeni, wood is also in short supply. The RCUP (at the request of the Catchment Conservation Committee, prior to the formation of the Panchayat Conservation Committees) constructed a nursery, but the village reaction was that "they told us to build one, so we did", when in fact they would have preferred apple and fruit trees from Marpha. It thus appears that in some cases the prospects of short-term economic gain still preclude a sense of resource management and long-term land-use.

The emphasis of RADB projects in the coming years will probably focus on the regions north of Jomsom, where it is felt that the need is greatest. Based on the travels and interviews with local people by RADB representatives, these are some of the particular activities contemplated (Krishna Lal Thakali, 1982, personal communication):

1. Construction of bridges and horse paths.
2. Renovation of monasteries.
3. Irrigation schemes in response to the apparently growing shortage of water in Mustang; methods to lift water from the Kali Gandaki (e.g., via windmills or upriver-downriver gravity flow) will be investigated.
4. Range pasture improvements to counter (a) degradation caused by the influx of yak and sheep herds from Tibet during the late 1950's, and (b) the possibility of Tibet closing its borders and winter pastures to Nepal herds.
5. An assessment of the depletion of jinbu (an herb used to flavor dal) in the upper Mustang and Baragaon regions. Reportedly, a high percentage of people in Mustang have traditionally been engaged in the sale of this herb to southern traders. Its growing scarcity, combined with a decrease in demand from the Middle Hills, is another factor causing economic hardship in the area.

6. Establishment of small cottage industries which focus on wool products (sweaters, blankets, scarves) in order to encourage the sale of Nepalese in place of Indian wool.

7. Development of alternative energies, especially solar and wind, because of the chronic wood shortages.

8. Development ofcottage industries in Muktinath which could capitalize on the tourist growth, now that traditional winter migrations to Assam for the sale ofsweaters (Schuler, 1978) have been prohibited by the Indian government.

9. An assessment of methods to (a) transport and (b) process the projected over-production of apples (65-75 metric tons/year at present) in Mustang. One idea currently being considered is the construction of a ropeway between Jomsom and Pokhara.

10. Agricultural improvements, especially with the production of vegetables.

11. Better use of forests in the Marpha/Thini region, where the abundant deadfall is currently left to decay.

While the RADB could not possibly fund even a fraction of these, the recommendations offer certain insights regarding the current areas of concern to the inhabitants of Baragaon and upper Mustang. Cooperation among agencies such as RCUP, RADB, and UNICEF is a potential method of solvingthe funding problem, and should continue tobe encouraged in spite ofpast coordination problems.

Small Hydel Development Board (SHDB)

HMG's Small Hydel Development Board, with funding from OPEC, was completing construction ofa 260-kw mini-hydro plant on the Chokapani River near Tuckche in 1982. The plant was scheduled to supply electricity for four villages (Tuckche, Syang, Marpha and Jomsom), and poles and high tension wires between the plant and various villages had already been erected.

The project was greeted with great ent.usiasm by the Thakali people, who generally saw its benefits in terms of lighting (with less reliance on expensive, imported kerosene) and the availability of electric cooking stoves. Unfortunately, the poles and high tension wires were erected above ground which, for many tourists at least, detracted from the quality of the visual landscape. Viewing Dhaulagiri through wires and around poles does not, probably, contain the same measure of enjoyment as does the more natural prospect. Future hydro projects in the region, in spite of the many and obvious benefits of electrical power, might consider under- va. above ground wires in response to the growing importance of tourism in the region, and model their efforts after the recently completed plant in Sagarmatha National Park (Brot Coburn, 1984, personal communication).

In 1982 the RCUP employed a Kathmandu-based consulting firm to conduct a feasibility study concerning the establishment of a mini-hydro unit in Mustang (one of three such units "targeted" under the energy component). The site selected was on the Jhong Khola near Kagbeni. Preliminary reports indicated that the seasonal water flow was sufficient for electricity generation, and other considerations of the study (cottage industry potential, mechanical power, affordability, benefits/costs) were being investigated at this writing.

The benefits of such a project would seem intuitively obvious, and the Baragaonle themselves place a very high priority on the electrification of their valley. A decrease in the need for fuelwood and kerosene was often stated as the primary benefit of a mini-hydro plant.

Marpha Agricultural Farm

Perhaps the project with the most far-reaching effects in Mustang to date has been HMG's Department of Agriculture Horticulture Farm in Marpha. As has been mentioned, the farm has experienced a very high degree of success in the growth of apple, apricot and peach trees in the arid climate found here, and is also active in the production of vegetable seeds. Marpha apples, brandy and wine are already famous throughout Nepal, and many new orchards can be seen in the Paanchgaon region.

The interest in orchard establishment among the Baragaonle and Lopa peoples has also become quite high, and villagers may often be seen bying the subsidized seedlings at the Marpha Farm. This, however, contributes to the present concerns of over-production of apples in Mustang due to the lack of transportation networks. Solar drying has been advocated and tested by some agencies, and the availability of electricity may also provide certain processing possibilities. A ropeway, as was previously mentioned, is being considered, which would appear to provide an excellent transportation alternative. The eventual construction of a motorable road from Beni (in the south) to Jomsom is another item under informal discussion.

Department of Tourism

In 1982, HMG's Department of Tourism built an enclosed camping space for trekkers in the Rani Powa Fairground region. It was surrounded by a stone wall and did not contain toilet facilities, which were planned for the next fiscal year (1982-83).

The permanence of the structure negated the possibility of camping-site rotation, which may be preferable in the long-run due to the delicate alpine plant life found in the area. However, there appeared to be little alternative because of land ownership conflicts, which necessitated the purchase of the land by the Department of Tourism.

Nevertheless, if the volumes of group-trekking parties continues to grow, the requirement that they camp within this space may help to prevent the general degradation of the Rani Powa region.

SUMMARY: FUELWOOD

Muktinath's proximity to the administrative center of Jomsom, among other things, has placed it in a unique position as recipient of numerous development projects. Most of this has occurred in the past 5 years, and will probably continue in the future.

The RCUP in particular, and the RADP in general, have taken steps to introduce solutions to the fuelwood shortage in the form of nurseries and fuelwood/fodder tree plantations. These measures are not often particularly well received in various Middle Hill regions, due to the relative abundance of wood supply and, perhaps, project implementation methodologies. However, the Baragaonle appear to have embraced the concept of a medium- to large-scale reforestation of their valley, and the nurseries and plantations are generally seen as "wise moves" (Sherab Gurung, Muktinath Pradhan Panch, personal communication). They are, in fact, extensions of a pre-existing emphasis on valley reforestation in the form of planting trees (poplar, willow) along irrigation canals (Byers, 1979). Although this is mostly done in the belief that the trees will help staunch the seepage of water through the porous soils, a greater abundance of fuelwood/building supplies is another benefit anticipated. Photographs taken in 1978 and 1982 show a marked increase in the number of newly planted trees. With the addition and propagation of fuelwood plantations, the change in the next five years could be even more striking.

On the other hand, serious consideration of the Liidii forest management prospects, other than informal inventories (APROSC, 1983), have yet to occur. The birch, pine and juniper from Liidii still constitute the primary wood-types used for fuel, and they are being cut with a minimum of supervision and regulation. The panchayat regulates the forest's use in a rather informal manner which, judging from the physical state of Liidii and the various external factors mentioned, is and will be insufficient for a future sustained yield of fuelwood.

The RCUP has planned, for the fiscal years 1982-83 and 1983-84, to promote the objectives of HMG's Forestry Act of 1979 by assisting the panchayat in the designation of Panchayat Forests, Panchayat Protected Forests, Leased Forests and Private Forests. Liidii will undoubtedly fall under a Panchayat Forest category, which alone will do nothing to alter the current indigenous management system. The difference, however, may lie in the designation of various protected forest regions within Liidii, the assignment of forest guards and the availability of high-altitude regeneration and management expertise (see: Brown, 1982).

The latter point contains important implications for Baragaon and other similar arid regions. As was mentioned, reforestation efforts to date have centered on the propagation of valley species such as willow

and poplar. Little has been done regarding the high-altitude forests which lie on the north-facing slopes of many tributary valleys of the Kali Gandaki. Research and trial revegetation programmes using indigenous tree species are clearly indicated for Liidii and the Muktinath using indigenous tree species are clearly indicated for Liidii and the Muktinath valley (see: Brown, 1982), and the knowledge gained could be directly applied to the other areas mentioned. Liidii's relative closeness to Jomsom is another factor in its favour as a potential test site, as supplies and expertise are more easily obtainable.

It should be mentioned that this area of study does not necessarily correspond to the Middle Hills "model" of deforestation causing increased runoff, erosion, siltation of water courses, etc. (see: Rieger, 1977). Rather, it addresses the regenerative capacity of arid-zone forests where a sustained yield, environmental quality and an apparently increasing desertification process are the main priorities. The latter point obviously crosses many land-use boundaries--irrigation practices and range/pasture use in particular--and more research in the prevention of further desertification in Mustang is certainly indicated.

Alternative Energy

The introduction of electricity could provide considerable savings of fuelwood for many valley inhabitants. The RCUP feasibility study concerned with this had not been completed at this writing, so that the actual prospects of mini-hydro installation are not known. However, even with the majority of the population switching to electric stoves for cooking purposes (a prospect difficult to imagine within the next 10 years) wood would still play an important role in construction and for space heating purposes during the winter months and cool evenings.

The development of other alternative energy sources could also considerably reduce the dependence on fuelwood, in some cases. High levels of solar insolation make certain solar technologies, such as solar water heaters and dryers, particularly applicable. A 60 litre solar water heater manufactured at Balaju Yantra Shala in Kathmandu is priced at approximately $300.00 (including all attachments, but not transportation) and their applications in tourist lodges have already been demonstrated. They would not, necessarily, be a high priority or even affordable item among most of Muktinath's inhabitants, who do not normally use hot water. Nevertheless, the trekker's affinity for hot water, his/her willingness to pay for it (Rs. 5/- per shower) and the savings in fuelwood are points to consider. The remoteness of the region is, however, a major inhibition to the dissemination of solar and other technologies, as even the limited warranties provided by the manufacturers are worthless when one must transport a heater to Kathmandu for maintenance.

Other solar technologies tested to date include solar fruit/vegetable dryers and solar stoves. The Marpha Farm has had good results with one solar dryer developed by the Research Centre for Applied Science and

Technology (RECAST) at Tribhuvan University, for the drying of apricots. The glass, wire screening, rubber channeling, drawer handles, etc. must, however, be imported from Kathmandu. If shown to be feasible they would still probably be affordable for many Thakali entrepreneurs, but not to most Baragaonle, Lopa and other ethnic groups.

Solar stoves ("Haybox Cookers", reflector cookers) have been tested to a limited extent by the Marpha Farm, UNICEF, and independent researchers. While the devices appear to work fairly well they still involve certain cultural inconceniences which could make dissemination difficult.

Obviously, the main constraints to the dissemination of alternative technologies has been cost and lack of maintenance facilities. Poor performance has been another factor, as the devices have often been unproven and their installation in Mustang a test in itself (e.g., a shattered RCUP-funded windmill in Jomsom, a frigid UNICEF-funded "solar heated" hotel in Jarkot). Nearly all have been developed by foreign and Nepali engineers or researchers in Kathmandu, and this support of in-country energy entities should certainly be continued. However, the tendency is often one of "re-inventing the wheel", when somewhat more proven devices (e.g., Dempster windmills, solar space heating technology) are available from international sources. Importing one model whose specifications match the conditions found in Mustang, testing it and then promoting in-country manufacturing of a similar device would appear to save considerable hardship, time and money.

Much has been written concerning applications of alternative technologies to the land-locked, fossil-fuel dependent situation found in Nepal. To date the progress has been less than satisfactory. Above all, the cultural and ecological diversity of Nepal point to the need for site-specific tests and applications, prior to the making of generalizations. Technologies designed to exploit the solar, wind and water resources of Mustang should thus continue to be tested. Data and experiences from Ladakh and Tibet, with their similar environments but somewhat more advanced information network, should also be explored.

Tourists

An informal survey of lodges in the Jomsom/Muktinath region showed that the average tourist lodge requires 373 kg of wood per month, as opposed to approximately 231 kg for a family of five. Some, with sheet-metal space-heating stoves and "hot shower" (a bucket of hot water) facilities use considerably more; others without these items use somewhat less. As was mentioned, wood will continue to provide the energy for space-heating stoves in the forseeable future, and demand will grow along with tourist, pilgrim and local populations. Above all the situation fortifies the need for a sounder management of the local forest regions. Modifications in the stoves themselves, with chimneys often 6 m in height and no damper controls, would also be worthwhile considering.

Pressure cookers have become very popular in many households, and their use should continue to be promoted. "Improved stoves" will require an extended performance and evaluation prior to attempts at widespread dissemination.

Solar heaters are fairly widely used in Jomsom lodges, and one has been installed at a lodge in Rani Powa. This was unfortunately not in use due to a leak which the owner was unable to fix, even with the help of local blacksmiths (kaamii, N.) or the application of pitch. In this case, remote area maintenance solutions are clearly indicated, which the manufacturers should be encouraged to investigate. The income generated from solar heaters for tourists, and the savings in wood, at least demonstrates the feasibility of solar water heaters along trekking routes.

As was mentioned, a "solar heater hotel" in Jarkot was built in 1976 with funds from UNICEF. This was unfortunately not functioning as designed, and in one sense demonstrated the lack of follow-through, and loss of credibility among local peoples, which some projects experience. Solar space heating, however, remains an area with a very high potential in Mustang and should continue to be tested.

Camping spaces such as those built at Rani Powa will lighten the effects of tourist groups on the fragile alpine environments. It remains to be seen whether or not the single area designated for tourists will be sufficient to handle most of the traffic, or even if it will be a desireable place to camp. Rotation of camp sites would also appear to be an area of future consideration.

Any regulation of tourist traffic would probably be most unpopular among the Baragaonle and is not a probable solution. Lessoning the demands of tourists by internal means such as those outlined above will probably continue to form the main strategy.

Pilgrims

Compared to tourists, pilgrims exert fewer demands on the valley's resources for financial, travel-style and length of stay reasons. While wood is sold to pilgrims, they were often observed carrying their own bundles of sticks gathered along the way; food is also carried up on occasion. Pilgrims almost never stay in tourist lodges and do not use hot water. Again, dealing with the demands they do place on the valley probably relates more to the forestry management considerations previously discussed, as the regulation of their numbers is not a feasible alternative.

CONCLUSION

Five years ago, the Muktinath valley represented a somewhat typical, arid-zone region in Nepal. Its environmental problems reflected those of the "arid-zone model" discussed previously, where the threat of desertification through land mis-use is more immediate than the prospects

of soil erosion, landslides and silted watercourses characteristic of many Middle Hill regions.

Muktinath today, however, differs from all other arid-zone regions primarily because of the development attention it has received in the interim period. Already, however, the importance of understanding certain elements prior to project implementation has been demonstrated. These include the respective environmental/social processes at work (e.g., reasons for deforestation, historical factors, amount of wood required, local social or environmental constraints to afforestation), corresponding site-specific alternatives, and the role of these alternatives in the context of a populations needs, priorities and available resources. Other factors which can contribute to more successful project implementation include the hiring of local people as project coordinators, and the coordination of different development agency activities to avoid duplication. It will be of great interest to follow the progress of the various development projects in Mustang as many of these items are addressed in the near future.

Nevertheless, practically every innovation in Mustang to date represents a beginning which has increased our knowledge of arid-zone development and land management in Nepal. Obviously, much work remains, and it is still too early to predict what effects the various projects will have on the perceptions and actual forest management practices of the Baragaonle. Intuitively, enough attention is being focussed on these areas that the prospects for improvement would appear to be good, and that noticeable differences will occur within the next 5-10 years.

Few other arid-zone regions, however, can hope to receive comparable amounts of aid and assistance within the same time frame. It is thus of critical importance that all forest-related activities in Baragaon be thoroughly monitored, so that any transfer of technology to these more remote and inaccessible regions may have the best chance of success.

Similarly, Baragaon can represent a "proving" ground for other priority projects (irrigation, energy, range/pasture); the role of the panchayat in determining activity site-selection and, perhaps most importantly, project success; and the cultural/economic/environmental considerations associated with tourism. Hardware and technical assistance is more easily available to Baragaon than to other regions, a situation which will probably not change significantly within the next 5-10 years. Interactions with panchayats and insights regarding the effectiveness of the PCC's would also be more convenient and available. Baragaon's experiences with tourism would also appear to be valuable for other remote and arid regions, some of which will most likely be opened to tourists within the near future (e.g., Dolpa).

Although this paper specifically addressed the fuelwood and energy situation in Muktinath, it is obvious that they are only parts of the overall developmental picture and cannot be viewed as separate entities.

For example, forest regeneration may be related to livestock control, which may be linked to improving pasture conditions. Local acceptance of nurseries, plantations or forest regulations may be influenced by the initial provision of higher priority items such as irrigation, pasture improvements, monastery renovation or agricultural schemes. The complexities of project management and corresponding political factors can often prevent the implementation of strategies which are sensitive to these elements, even though they appear to be contained in the project documents.

In all fairness, however, very little time h as passed since a general awareness of land-use problems in the Himalaya was established, and projects intended to counter the adverse processes were designed and implemented. The response of donor and national agencies, particularly in Nepal, has been remarkable. Much remains to be learned, however, in what is essentially a new field of mountain resource management and development in third world countries.

NOTES

1. This figure is based upon data collected in Jomsom between March and July, 1982, using an anemometer supplied by the Engineering Division of Balaju Yantra Shala, Kathmandu, Nepal.

2. The panchayat ("Council of Five") is the village-level body of decision makers in Nepal's party-less system of democracy. The term also refers to those villages and land under the council's jurisdiction, separated into nine "wards" and usually containing between 2,000 and 4,000 people.

3. "Baragaon" means "twelve villages" in the Nepali language, but the fact that 19 villages exist in the region today is probably the result of administrative boundary changes more than an indication of population growth (Schuler, 1981).

4. Lupra has historically been a center for the study of the Bon religion. See: Fürer-Haimendorf, C. von, 1981, p. 194; and Messerschmidt, D., 1974. Social status, conflict and change in a Gurung community of Nepal (Ph.D. dissertation, University of Oregon), for references to Gurung travel to Lupra.

5. As is mentioned, the forests of Thini and Marpha today supply the large structural timber for most of Upper Mustang. Piessel (1967: 236) was under the impression that Mustang was more heavily forested in the past, and that climatic change in the form of a drying trend was largely responsible for the loss of much of Mustang's forest land. His "scientific facts" are unfortunately not referenced. However, it is of interest to note that Mustang as a "pure and green" land is a common theme in local folklore; that numerous abandoned villages exist throughout the district; and that there

are unverified reports of ancient Buddhist lama biographies describing Mustang as green and well-watered. An interesting work on a similar topic may be seen in: Patti, C., 1983. Climatic change in the Himalayan region. Unpublished manuscript, Department of Geography, University of Colorado, Boulder, Colorado.

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