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ALTERNATIVE ENERGY SOURCES FOR SAGARMATHA NATIONAL PARK

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ALTERNATIVE ENERGY SOURCES FOR SAGARMATHA NATIONAL PARK IN KHUMBU REGION

This dissertation is presented in partial Fulfilment of the Diploma in Parks and Recreation Management, Ranger Option, at Lincoln College

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By

Ang Rita Sherpa

October 1986

"The strategy for conserving forests and grasslands in the park was still evolving but it would include restriction on trekkers and mountaineers in the use of firewood and the promotion among the local people of alternative energy sources - for example, small hydro electric schemes, charcoal, gas, etc."

Peter Gorman,
Volunteer Service Abroad
to work within the Sagarmatha
National Park, 1979.

ACKNOWLEDGEMENTS

It is my pleasure to acknowledge the assistance and encouragement that I have received from many people during this study.

Dr P.J. Devlin, senior lecturer in Parks and Recreation Management course at Lincoln College is sincerely thanked for his continued supervision of the course and for this paper.

Mr R.H. Murray for his continued interest and enthusiasm and for his discussion, critical assessment and advice throughout all stages of this project as well as being very patient in correcting my bad English.

I am grateful to Mr Mingma Norbu Sherpa (ex-Lincoln College student) for his help in designing the topic for this project, as well as his encouragement for me to take this course; also to Nima Wangchu Sherpa and Mr Lhakpa Norbu Sherpa.

Many people made this task easier by generously providing me with useful information. I wish to thank especially Surya Bhadur Pandey, Gorden Nicholls, Norman Hardie, Dave Bamford, Paul McGahan, Martin Heine, Dave Wakelin and Marilyn Somerville.

I gratefully acknowledge the Ministry of Foreign Affairs of New Zealand for continued financial support during this course, and Kathy Brown for typing this paper carefully.

Last, but not least, I would not leave this country without thanking my very good friends Leonie Hooghart and Tomyu Hu for their friendship from start to end.

Finally, special thanks are extended to everyone who has made my stay in New Zealand enjoyable, especially the Himalayan Trust Family.

Errata:

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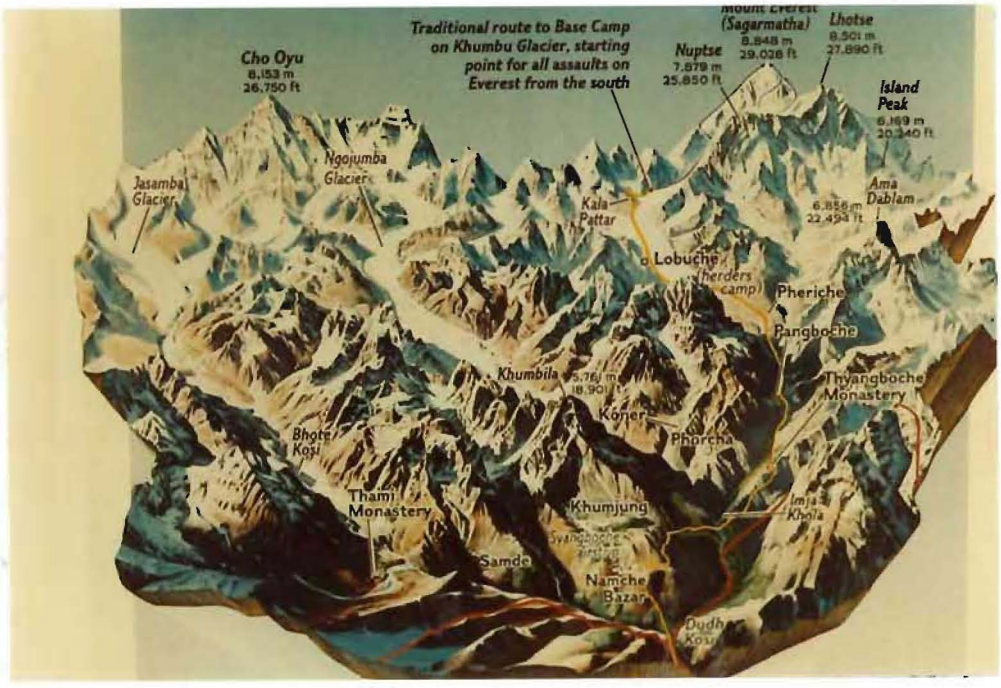

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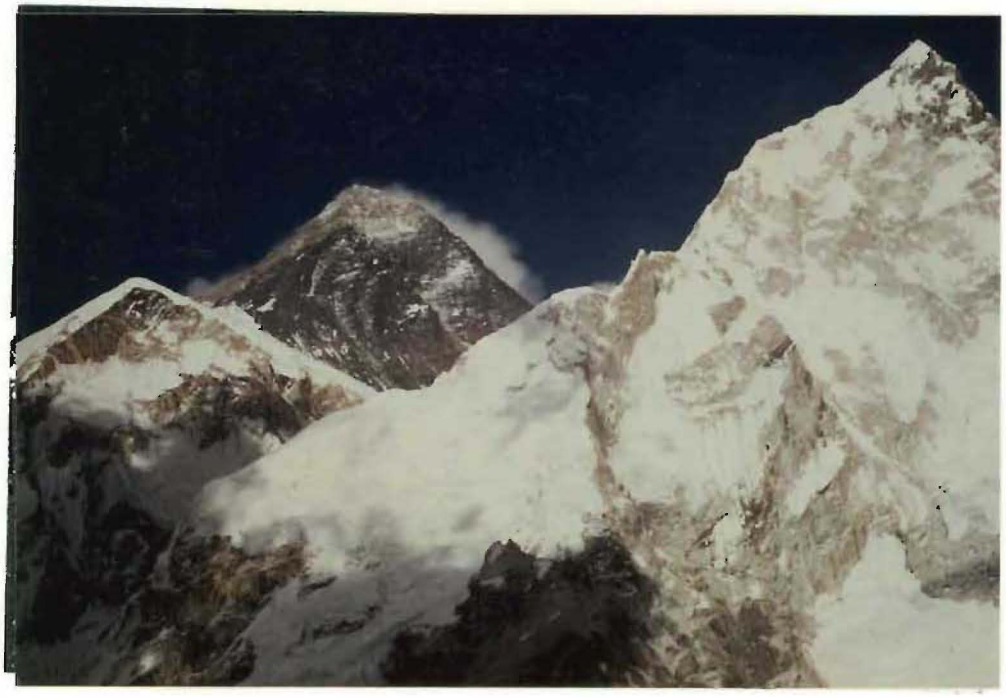

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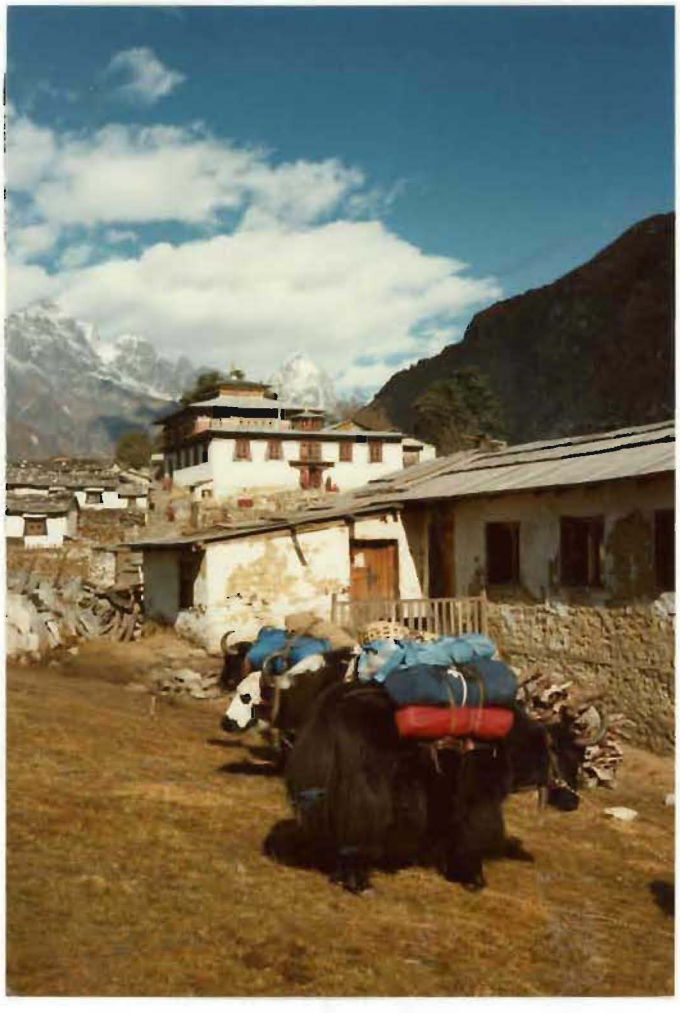

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INTRODUCTION

"When I first visited Mount Everest in 1951, what a beautiful place it was. I can remember crossing the pass above Chounrikarka and looking for the first time in to the upper reaches of Dhudkosi River and seeing the sacred peak of Khumbiyula towering up in the heartland of the Sherpas. We climbed through dense pine forest up the long steep hill to Namche Bazar. The whole region was dense with greenery, below the villages, giant conifers soared, framing the snow and ice peaks that lined the other side of the valley. We climbed to Thyangboche Monastry at 13,000 ft; it was clothed in forest and surrounded by a ring of superb mountains."[1]

The Everest region or Solu Khumbu is one of the most celebrated areas of the world. It is here that the highest mountain in the world, Mount Everest, or as the Nepalese call her, Sagarmatha "Mother of Universe" is situated. The high mountains and valleys of the Solu Khumbu is not only the home of Mt Everest but also that of a hardy ethnic group called "Sherpa" who migrated to the area from Eastern Tibet in the early 16th century. This remote part of the world holds some of the most awe inspiring peaks to be found anywhere, framing a backdrop to the fascinating old Bhuddist Monasteries and amiable Sherpa villages.

These people have not only adapted to this marginal environment overcoming its problems and poor soil, but

have also established a rich cultural heritage.

Up until 1950, the forests of Khumbu region had served as a multi-purpose resource for the Sherpas; firewood, building materials, leaf litter for compost and grazing animals.

The influx of tourism since the fifties increased demand for this resource. Large areas of forest have been burnt to ash by mountaineering and trekking groups who have used the wood for cooking, heating and hot showers, particularly on the route to Mt Everest and wherever there are lodges, tea shops and hotels.

This dissertation is concerned with the problems already outlined, along with proposals for introducing alternative energy sources. In an area where income is limited, the success of alternative energy sources will depend largely on the cost to the local inhabitants.

CHAPTER 1

SAGARMATHA NATIONAL PARK: PROBLEMS OF RESOURCE MANAGEMENT AND THE PHYSICAL SETTING

1.1 BACKGROUND OF SAGARMATHA NATIONAL PARK

> *"Since it was first discovered in 1852, Mt Everest.....has been attributed special status as the highest mountain in the world. We sincerely believe that this region and its surroundings in the grandeur of the valley are of major significance not only to us, but to the whole world as an ecological, cultural and geographical treasure which we hope should provide peace and tranquility and be a significant contribution to a better world heritage."*[1]

Sagarmatha (Mother of Universe) is its Nepali name. In 1852 the height of Mt Everest was established and it was accorded special status as the highest mountain on earth, 8848 m. George Everest, an English mathematician and surveyor-general of India, surveyed the peak of Everest from Calcutta and he consequently named Everest after himself.

Prior to 1950, the southern side of the Everest region in Khumbu valley remained a mystery. All the expeditions were made only through southern Tibet before 1950. In 1947, the Dalai Lama banned the issue of travel permits to Tibet. With the 1950 Chinese takeover, Tibet was firmly closed off. By this time, however, Nepal

had opened its doors, and climbers from several nations vied for the summit on that side. Three years later, Sagarmatha was finally scaled by a New Zealander, Sir Edmund Hillary and by a Nepalese, the late Sherpa Tenzing Norgay on May 29th, 1953.

Since then, descriptions and photographs about the British expedition began to circulate, and many people were fascinated by the thought of walking to the base of the world's highest mountain. By now thousands of mountaineers, trekking parties and explorers have discovered for themselves the steamy, many hilled trek to Khumbu, where the valleys are inhabited by the Sherpa people. With attention suddenly focussed on this region, Nepal became known.

1.2 THE ESTABLISHMENT OF SAGARMATHA NATIONAL PARK

The creation of a national park in the Khumbu region was proposed by the Food and Agricultural Organisation (F.A.O.) Wildlife Conservation Advisor in March, 1971. A conservation committee was formed in May 1973 under the chairmanship of H.R.H. Prince Gyanendra. In the first meeting held, Mr Mishra was appointed by the chairman of the committee to make an investigation fixed on the study of the possibilities of establishing a national park around the Mt Everest region in the Solu Khumbu District.

H.R. Mishra's objectives for this region are as follows:

(1) Selection of the park boundary to ensure optimum protection of the flora and fauna of the region and enclosing Mt Everest inside the park.

(2) To investigate the tourist utility of the park.

(3) To suggest necessary development regarding a nature conservation programme.

(4) To study the feasibility of involving local people in conservation work.

(5) To estimate the cost required for staff and for development.[2]

1.3 REASONS FOR ESTABLISHING NATIONAL PARKS

In 1972, Blower, the F.A.O. Wildlife Management Advisor stressed that the conservation of this natural environment was all the more crucial since its destruction would result in disastrous erosion leading to an enormous economic and aesthetic loss to the country. Hence, to ensure conservation and to increase the country's revenue from tourists, he suggested a national park should be established in the Khumbu region. The reasons he gave for the establishment of Sagarmatha National Park were as follows:

(1) As the highest point of the earth's surface, Mt Everest and its surroundings are of major significance not only to Nepal but to the whole world, and its status as a national park would bring international prestige and support to the country.

(2) Khumbu region is already an important tourist area and its importance does not show any sign of decline. The scenic and wilderness values which are its major attractions must be protected from further exploitation and ill-judged commercial development based on sound conservation principles.

(3) The depleting forests of Khumbu are not only of aesthetic value but are vital to the local people as a source of fuel and as building material. They also play an important role in the conservation of soil and water and harbour much wildlife.

(4) As an ecological unit in the highest region of the world, the Dhudkosi drainage is of much scientific value and offers unique research fields to scientists throughout the world.

(5) The area is of major religious and cultural significance in Nepal since it abounds in holy places like the Thyangbochie Monastry, and also is the homeland of Sherpas whose way of life is unique compared to the high altitude dwellers.[3]

In 1973, H.R.H. Prince Gyanendra attended the World Wildlife Conference in Bonn and made the special announcement to create Sagarmatha National Park. As a result, the park was formally gazetted on the 19th of July, 1976.

1.4 DEFINITION OF WORLD-WIDE NATIONAL PARK

More than a hundred years have passed since the United States established Yellowstone National Park in 1872, the world's first national park. The idea of preserving natural areas as national parks has since spread to most of the world's countries.

Although differences exist from one country to another in both the method and the reason for the establishment of national parks, most countries have adopted the definition put forth by the International Union for Conservation of Nature and Natural Resources (IUCN) which introduce the following criteria for national parks in 1969.

> *"A national park is a relatively large area.....*
>
> 1. *Where one or several ecosystems are not materially altered by human exploitation and occupation, where plant and animals especially, geomorphological sites and habitats are of specific scientific, educative and recreative interest or which contain natural landscape of great beauty; and*
> 2. *Where the highest competent authority of the country has taken steps to prevent and to eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphological or aesthetic features which have led to its establishment; and*
> 3. *Where visitors are allowed to enter, under special conditions, for inspirational, educative, cultural and recreative purposes."*[4]

1.5 NEPAL NATIONAL PARK POLICY

According to the National Parks and Wildlife Conservation Act 1929, the general policy of national parks in Nepal is such that:

National Parks are special areas of land set aside by His Majesty's Government for the conservation of animals and plants in their natural surroundings;

National Parks may also be areas specially selected for their natural beauty of scenic value as is the case with the mountain national parks of Nepal; and

National Parks are given special protection to ensure they will always be scenic and natural places. The national parks, where possible, are free from the influence of man. Therefore, people may not normally:

.....enter without permission,

.....build any houses,

.....cultivate the soil,

.....introduce domestic animals,

.....hunt or trap any animals,

.....destroy any vegetation.

1.6 PHYSICAL FEATURES OF SAGARMATHA NATIONAL PARK

Location:

Sagarmatha National Park lies in the lap of the Himalayas. It is situated in the north eastern region of Solu Khumbu district of the Sagarmatha Zone of Nepal.

Topography:

It is clear that the Sagarmatha National Park is in mountainous areas containing the highest mountain on earth. This park is determined by the great Himalayan ranges, its glaciers and river valleys. The major mountain peaks in the area are Sagarmatha and several other notable peaks over 6,000 m such as Lhotse, Lhoste shar, Cho Oyu, Gychungkang, Pumori, Amadablam, Temserku, Kangtaiga and Kwangde which forms a roughly triangular geographicl unit.

Broken by deep gorges and glacial valleys, there are glaciers of various sizes in this region, they are Khumbu Glacier, Lhoste Glacier, Nozumba Glacier and Nangpala Glacier.

There are a number of glacial lakes which drain from mountain peaks into the Khumbu Valley which contain three main rivers, Dhudkosi, Botekosi and Imja kola.

Size:

Sagarmatha National Park encompasses a fan-shaped area of about 1,243 sq.km in the upper catchment of Dudhkosi River.

Boundary:

The park boundary extends from various sites. The eastern boundary runs from the base of Mt Lhoste, Mt Chopalic and Mingbola Pass which includes the Mt Amadablam. The northern boundary extends from the border of Nepal and The Peoples Republic of China which includes the mountains of Cho Oyu, Gychungkang, Pumori and Lhoste shar. The

southern boundary extends from the confluence of Dhudkosi and Bote kosi rivers. The western boundary extends northward along Tashi lapcha pass and the ridges of Langmoche.

Climate:

The Khumbu region is located at 27°-00 North latitude, and 80° East longitude. The altitude ranges from 2800 m at Monjo to 8848 m at the top of Sagarmatha (Mt Everest). The climate of Khumbu may be classified as cold and humid with maximum rainfall in summer due to the monsoon period. The mean temperature of the coldest month, January, is -4 - 0°C and the mean temperature of the hottest month, July, is 20°C.

Population:

A total population of almost 3,000 residents live within the 1,243 square kilometres of Sagarmatha National Park. The residents of this region consist of mainly native inhabitants, Sherpas, followed by a few Tibetan refugees and various people from other parts of Nepal, i.e. the Government administrators as well as army patrollers.

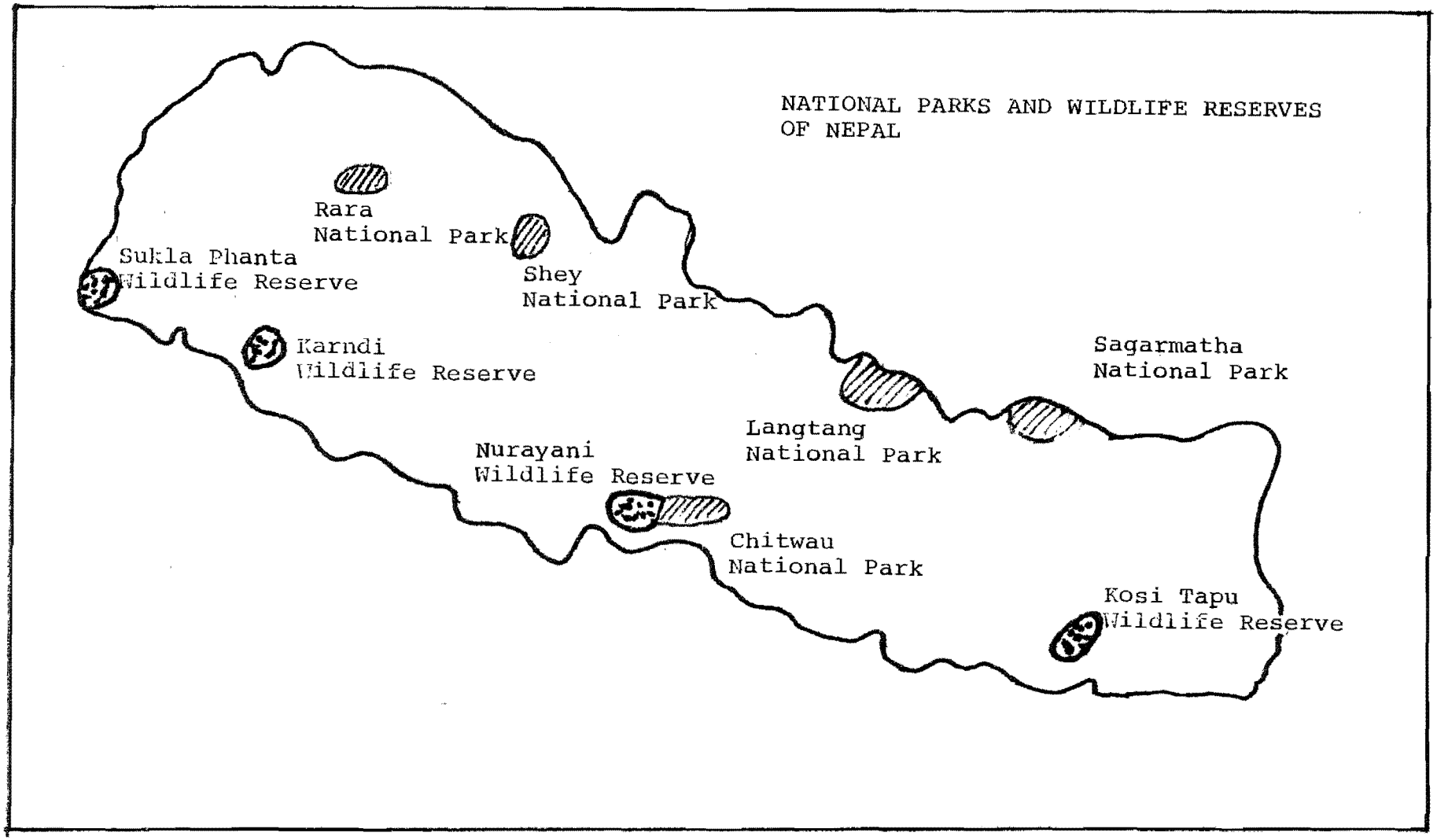
Access:

The two most common ways of getting to the park are either by plane to Lukla (the first air strip in this region) then two days walk or by at least ten days walk from Kathmandu.

Mammals:

The mammalian population in the Khumbu was found to be very low. However, there are some large animals and birds to be found in the Khumbu as follows: snow leopard, wolf, weasel, marten, Himalayan thar, blue sheep, goral, serow and musk deer.

Khumbu is relatively rich in bird population, among them blood pheasants, impeyan pheasants, snowcocks, Dhanfe pheasants and snow partridges are common in this region.


NATIONAL PARKS AND WILDLIFE RESERVES
OF NEPAL
Rara
National Park
Shey
National Park
Sukla Phanta
Wildlife Reserve
Karndi
Wildlife Reserve
Sagarmatha
National Park
Langtang
National Park
Nurayani
Wildlife Reserve
Chitwau
National Park
Kosi Tapu
Wildlife Reserve

CHAPTER 2

GROWTH OF TOURISM AND ITS IMPACT IN THE KHUMBU REGION

Nepal is one of the more spectacular countries for trekking and mountaineering. There is a wide range of landscapes from jungle to high icy mountains containing the world's highest peak. Nepal offers a unique experience to the visitors in appreciating a living culture which is virtually unmodified by western technology.

After two centuries of isolation where no outsiders were allowed entry, from 1951, with the downfall of the Rana Prime Minister's regime, Nepal was no longer a closed country, and permission was given to the scientific and mountaineering expeditions to visit the Nepalese Himalayas.

From 1965, annual tourists increased rapidly to more than 168,000 in 1979. Today tourism has become a major source of income for the whole of Nepal.

Like the rest of Nepal, the Khumbu region has experienced a growth in tourism. Until the last few years almost the only people to visit Khumbu have been members of climbing expeditions with a few botanists and geographers. Since 1965, with the construction of a small airstrip at Lukla built by Sir Edmund Hillary, it has been possible for visitors to avoid the tedious two weeks journey on foot from Kathmandu.

In 1973, H. Mishra stated that the number of tourists visiting Khumbu in 1964 was 20 and in 1979 this number had gone up to 4,000.[1] The main reason for the increase was that people came to climb the mountains including the highest mountain on earth, as well as to see the stupendous scenery in one of the world's finest and unspoiled natural areas.

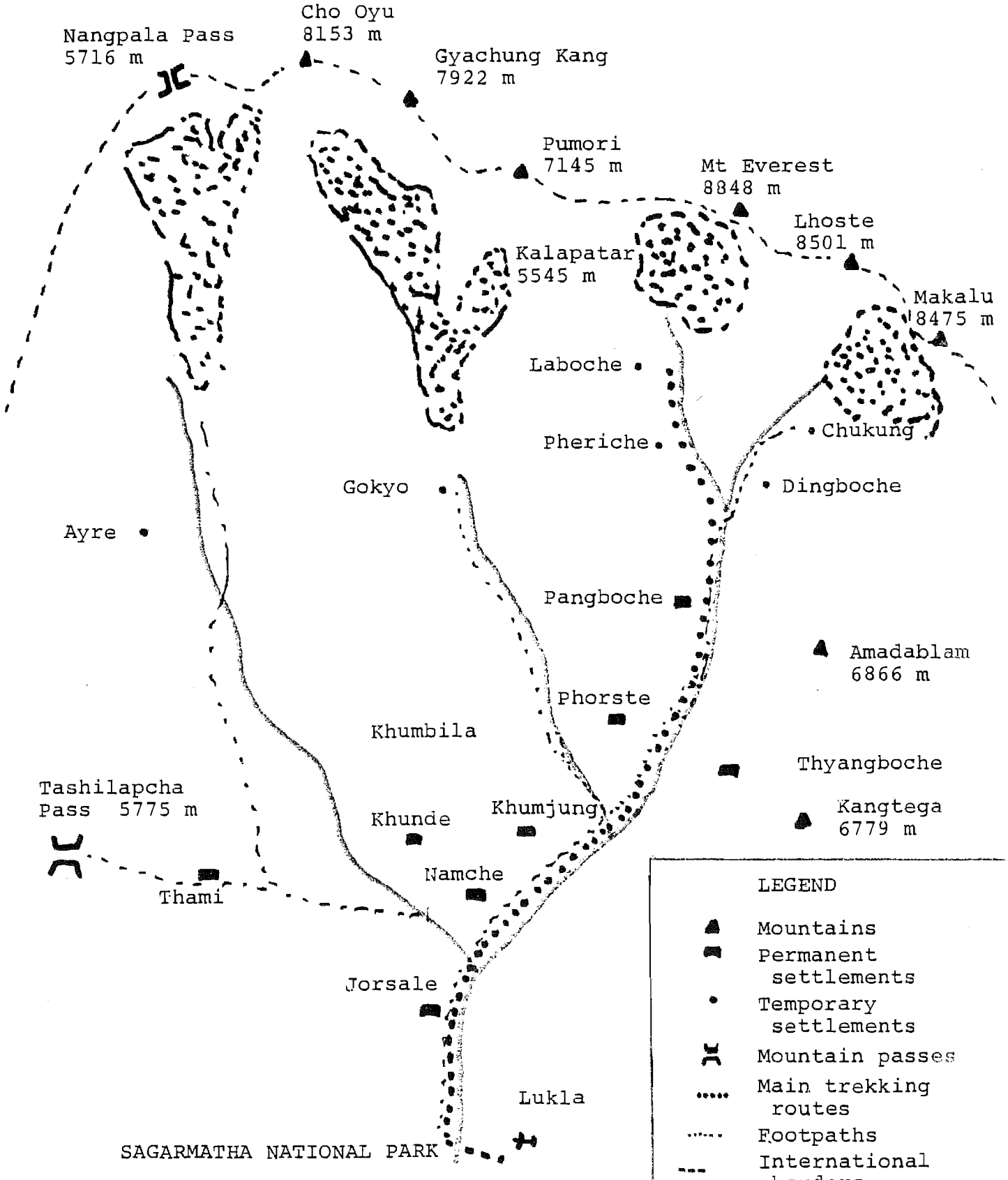
2.1 TOURISM AND ITS IMPACT

The growth of tourism and mountaineering has threatened the natural and cultural resources directly and indirectly. These are discussed below.

2.1.1 Direct Impact

Trekkers and mountaineering expeditions involve the extensive use of local timber for fuel. Large amounts of wood are being used during their stay in the park which can last up to three months, especially the mountaineers. They have used the forests of this region not only for fuel purposes but also for equipment, e.g, using large amounts of timbers for ladders in the Khumbu icefall.

This placed heavy demands on the limited wood resources in the region. The other direct impact is that uncontrolled and unorganised tourism has used the Khumbu region like a rubbish bin. Trekkers and mountaineers have left their tin cans, leftover equipment and other litter such as toilet paper at campsites as well as tea shops and lodges. The route to Mt Everest base camp is well marked by litter, especially concentrated around the



MAP OF KHUMBU REGION SHOWING PRINCIPAL TOPOGRAPHY FEATURES, HUMAN SETTLEMENTS AND TOURIST ACCESS ROUTES

campsites.

> *"You cleaned the mountains today, but they will be dirty again tomorrow."*[2]

> *"Thirty years ago conservation had not really been heard of. On our 1953 Everest expedition we just threw our empty tins and any trash into a heap on the rubble-covered ice at base camp. We cut huge quantities of the beautiful juniper shrub for our fire; and on the South Col at 26,000 feet we left a scattered pile of empty oxygen bottles, torn tents and the remants of food containers. The expeditions of today are not much better in this respect with only a few exceptions. Mount Everest is littered with junk from the bottom to the top."*[3]

Plate 7: Lukla airstrip built by Sir Edmund Hillary in 1964.

2.1.2 Indirect Impacts

Many local people have increased wealth due to tourism. This has influenced the Sherpas to have better living standards. Increased income has been used to build larger houses, hotels and tea shops along the route to Everest base camp, and this has led to the demand for timber increasing rapidly. Now there are more than 100 tea shops and lodges within this region to serve tourists.

Plate 8: One of the lodges built on the way to Everest to base camp which caters for a variety of food and hot showers.

- Cutting and selling of the forest resource for tourists by locals became essential to the villagers to finance the purchase of high cost food. The lifestyle of many villagers has changed as they became increasingly dependent upon tourism. This also caused the breakdown of the forest guard system ("shingi naua") of Khumbu region.

- Constructing hotels and lodges in mountainous areas without regard to their architectural suitability in one of the world's finest and unspoiled natural areas.

- Hotels built in mountainous areas are high-energy consumers because the outside weather is cold. Energy must be fed in, often by over-use of the forest for firewood which led to deforestation in the region and electrical development as an alternative to firewood may have a significant impact on the landscape. There is architectural pollution in this region by building large, dominating hotels owned both locally or internationally. Architectural pollution is the inevitable result of the juxtaposition of buildings with widely different architectural styles.

- Tourist activities have led to competition for labour. The majority of the people in this region have engaged in tourism activities, such as trekking and mountaineering to secure higher income. This has created labour shortages for traditional activities like farming and is particularly noticeable during peak periods.

- The deliberate chopping of trees for tent poles and firewood as well as construction of campsites involves the

removal of vegetation.

- There is conflict between tourists and the culture where tourists carry out washing and cleaning activities around the well which is the main source of water for the region.

Plate 9: Firewood supply to Everest base camp by local people.

Plate 10: Mt Everest base camp at 5,538m.

2.2 AIMS AND OBJECTIVES OF SAGARMATHA NATIONAL PARK

In K.J. Garratt's 1979 Management Plant for Sagarmatha National Park, he established the following objectives:

1. Nature Conservation: To ensure the permanent conservation of viable examples of all the natural communities of flora and fauna occurring in the park, with particular attention to endangered species and their habitats.
2. Water and Soil Conservation: To ensure provision of sufficient forest and other vegetative cover on watersheds and catchment areas, to effectively control unnatural erosion and excessive water runoff.

3. Indigenous Population: To enable the local population to determine their own lifestyle and progress, and to achieve desirable social and economic development.

4. Religious and Historic Value: To ensure the permanent protection and preservation of buildings and structures of religious and historic significance, and to preserve the cultural and religious heritage of the Sherpas.

5. Tourism: To promote tourist and visitor use suitable to the environment and conditions of the park, to an extent compatible with the other objectives and in a manner which will provide economic benefit to the local population and to Nepal.

6. Mountaineering: To permit continued use of the park's high mountains by competent mountaineering expeditions, to an extent compatible with the earlier objectives and in a manner that minimises adverse environmental impact while benefitting the local and national economy and prestige.

7. Energy: To ensure that the energy requirements of residents and visitors are provided in a manner that will not deplete or be otherwise detrimental to the natural resources of the park.

2.3 THE SHERPA PEOPLE OF NEPAL

The world hears the word "Sherpa" only in connection with mountains and expeditions and many people think it is a word meaning "porter" or "guide", but this is not true. The Sherpas are a tribe and the meaning of the word is

"Easterners". These are a Mongolian race who claim to have migrated from an area in eastern Tibet called Salmogang. They left their original homeland and crossed the Nangpa la Pass into Khumbu to escape from political pressures 400 years ago.

Since then, these Sherpa people occupied an uninhabited remote and inaccessible mountain region which is their homeland. Traditionally the Sherpas spent their summer in Tibet and winter in Nepal. The region is harsh and stoney; the weather is bitter; but still the Sherpa people of this region have developed agriculture and permanent pastures. Potatoes are the biggest crop, followed by barley and buckwheat. Rice is hardly eaten in this area because it is hard to import from other areas.

The Sherpas, as Easterners, could not afford to engage in trade, so migrated to Darjeeling in Northern India. Since Nepal opened its doors to foreigners, the Sherpas have found employment in mountaineering expeditions.

Adapted to a hard life at high altitudes, the Sherpas offered their services as porters for the climbing expeditions and soon proved their exceptional stamina and cheerfulness under the most exacting conditions. Today they are employed not only within their own region but also for climbing and trekking expeditions in Western Nepal. Trekkers and mountaineers have been heavily dependent on the Sherpas.

Major changes have occurred in the lives of the Sherpas. Service type occupations for foreign visitors has brought a new element into the economic patterns of the Sherpas.

Namche Bazaar, being the first Sherpa village, has greatly changed since foreigners arrived and ever since 1970 has become a halting place for most of the tourists entering the region. The houses within the Khumbu are built of stone, usually with wooden shingles for roofing and wood for doors and window frames. These days there are many new houses and they are of a different type from the traditional houses. Iron has replaced wooden shingles and glass has replaced wooden window structuers. Old houses have been reconstructed to serve as hotels for tourists. The influence of tourism in the Khumbu region has done much to change the Sherpa way of life.

The other important factor in the change of social life is education in the region. Once in Khumbu the only people who could read and write were some of the Lamas. It was not until 1960 that an education system was formed.

When the local Sherpas required the establishment of schools in their region, it led to an education scheme established by Sir Edmund Hillary in 1961. Since then the Sherpa children began to receive education. People of this region are no longer "blind" and have become more independent and the education received from Sir Edmund Hillary's school has enabled them to cope with modern change.

Once they received a little education and managed to communicate with foreigners, they were no longer students

and ignored the advice from their own teachers because they experienced little difficulty in making money without the need to acquire additional qualifications.

Seventy per cent of households contain at least one of its number engaged with tourism or mountaineering, and youngsters who have left school can spend as much as eight to nine months away from their villages actively involved with tourism. Sherpas who are benefitting from tourism have built houses in cities, while still contemplating an ultimate return to Khumbu where they hope to spend their old age. There are many differences within the Sherpa culture of today.

CHAPTER 3

DEVELOPMENT OF ALTERNATIVE ENERGY SOURCES

3.1 THE NATURE OF THE PROBLEM

The most severe and critical problem in the park today is the depletion of the forest. The increase in population both locally and internationally is pressing hard on the environment. There is a major problem between supply and demand which is unbalanced. Fire-wood collection for cooking and heating purposes created this man-made deforestation. In the Khumbu region today there is no end in sight to the use of wood as the main source of fuel. The trees are being cut down faster than they can grow.

> *"The most visible sign of these impacts on this fragile alpine environment is the lack of trees within a one to three kilometre radius of each village; but many traditional pasture lands are deteriorating as well, where there are increasing problems of erosion and de-stabilised slopes.*[1]

3.2 REASONS FOR DEVELOPING ALTERNATIVE ENERGY SOURCES

In this study, "alternative" means choosing among different possible sources of energy. The problems which have developed in the Khumbu area have led to the need to examine alternatives to traditional sources.

In the case of the Khumbu region it means to prevent the depletion of forest resources which comes about by the demands of trekkers and mountaineers as well as the local inhabitants.

The Khumbu Valley is completely surrounded by mountains. Because of the region's high altitude, local inhabitants have had to adapt to the harsh conditions. Sherpa houses are generally built of earth, and are often large two-storied units. The interior of the houses are built around a central fireplace which services the cooking, living and sleeping areas.

In such a situation, the local people are dependent upon the forest for their daily needs. Therefore, the problems noted bring the need to develop alternative energy strategies. These include hydro-electric development, the use of charcoal, solar water heating, gas, wind energy and kerosene as well as firewood. These sources of energy are examined below in more detail.

3.2.1 Hydro Electricity

The development of hydro electricity is one source of alternative energy. In 1971, Bodman had carried out preliminary studies on establishing a hydro electric micro plant in Khumbu and found it to be feasible. Later in the year the Austrian Government agreed to develop a hydro electric scheme for the region especially for Namche, Khunde, Khumjung and Hotel Everest View. The scheme has been under construction in Thamo Valley.

According to a report on Sagarmatha National Park by New Zealander P. Lucas (1974) on Nepal ~~on~~ aid work, it was believed that the completion of this scheme would lead to a 40% drop in the use of firewood by the Sherpas.

In 1980, UNESCO designated Sagarmatha National Park a world heritage site, with further intentions of protecting the unique environmental and cultural features of the park.

In October 1981, the World Heritage approved $31,000 for the construction of a prototype, 25 kilo watt micro electric facility for Namche Bazer.

3.2.2 Difficulties with Development

These hydro electric units appear to have much merit in this cold climate if they are developed according to the size of the river and the needs of individual villages. As mentioned in a previous chapter, the minimum temperature which occurs during mid-winter is about $-7^{o}C$. This is why the small streams are frozen, as well as the lakes around Gyoko, Chola and a recently built lake in Pangboche.

It is also important to note that the three major rivers that flow in this are fed by melting glaciers and have their origin entirely within Khumbu region. Because of their glacial origin, in winter normal flows of the river are determined by the glacial origin. In summer normal flow occurs due to the bursting of the glacial lakes in the upper catchment which has occurred several times in the past.

The rivers have enormous flows during the monsoon floods and low flows in winter. Much of the area is old glacial moraine which makes it difficult to establish the foundations of hydro dams. It is also a remote area and leads to difficulties with the transportation of equipment, e.g. building supplies and tools for construction. Shortage of labour for construction is a problem due to the large numbers of local people engaged in trekking and mountaineering expeditions. Additionally, the region is too far from electrical suppliers and experienced persons for the particular tasks associated with the supply of electric energy.

3.2.3 Selection of the Areas for Power Needs

Mr Norman Hardie, a member of a New Zealand mission to Sagarmatha National Park in early 1974, suggested that three schemes should be considered in this region. They are as follows:

1. Power to Thyangboche, Phorste, Devoche and Pangboche.
2. Power to Khumjung and Khunde.
3. Power to Namche Bazer.

The introduction of hydro electric development in any area of the world brings with it advantages in the form of energy. It also brings with it environmental and social impacts. These aspects of hydro electric development in the Khumbu region are examined below.

3.2.4 Advantages

1. Ecologically, developing hydro electricity will help to solve the depletion of forests. This will provide an opportunity to save the local forest resources and the forests will have a greater chance to recover.
2. There would be a chance to control the erosion in which previously the soil had been washed out to the Indian ocean.
3. Socially it will give more time to the people of this region, as it will reduce the time needed for collecting firewood.
4. Sherpas will have better health due to a cleaner and more convenient way of life.
5. Sherpas who owned the lodges and hotels will have better facilities, not only for themselves but for the tourists as well, and thus would encourage tourists to stay.
6. There would be less demand for kerosene and charcoal. The reduced demand will make these fuels easily available to Sherpas who are not served by electricity. A lower demand will possibly lead to a lower price for both commodities, and encourage people who cannot afford to buy power lines to use keroseen or charcoal as an alternative to firewood.

3.2.5 Disadvantages

1. It would destroy the natural and cultural characteristics of Khumbu region by developing an artificial

dam and seriously affecting the flow rates of the rivers. The development of an artificial lake would be in conflict with established cultural and religious practices of the whole region.

2. It will seriously modify the local habitats of plants and animals. This is especially important as this region is not rich in plant and animal habitats.

3. Power lines and transmission lines will affect the scenery and the aesthetic qualities of this region.

4. It would be difficult to train Sherpas as electricians, especially since the majority are now involved in trekking and mountaineering.

5. It will change the Sherpas' lifestyle because of changes in the environment and more modernisation.

6. Flow on affects? purchase of electrical fittings / equipment. would these create a demand -- financial crises - servicing? - repair

3.2.6 Limiting the Impact of Hydro Electric Development

According to Gut and Mishra's (1977) report, installation of hydro electric units must be developed in this region without harming the environment and the solutions that were recommended are:

1. Electricity should be generated by means of decentralised small turbines.

2. A power station should be located in a well hidden and inconspicuous place.

3. The simplest possible technology associated with minimal breakdowns should be used.

4. The installations should run as self-regulating as possible, requiring minimal staff.

5. All cables should be laid underground wherever technically and economically possible.

3.2.7 Solar Water Heater

In this region, the demand for firewood has increased dramatically because tourists not only want light, heat and cooked food, but also hot showers. Much of the firewood has been used for showers wherever the lodges are. The alternative to this is to develop solar water heating. The most popular application of solar energy today is the solar water heater. Many consumers could save a forest in the long-term by installing solar water heaters. Limitations of this installation depends on the availability of sunlight, material and an experienced installer.

Since 1966, Khunde Hospital has been using a solar heating system. In 1980, UNESCO developed several inexpensive 60 litre flat tank (non-circulating) solar water heaters in the region. These are manufactured in Balaju in Kathmandu and have been installed in several locations within the park through UNESCO volunteers.

3.2.8 Charcoal

Although local people can cook and heat their homes with hydro electricity and heat water by solar water heaters, the local His Majestys Government administrators as well as tourists cannot tolerate the cold without the additional warmth provided by charcoal. This is the major problem in this region, especially in winter.

So far the number of households using charcoal as an alternative fuel is very low because of the high cost of importation. Local people cannot afford to use charcoal as fuel, even though they have a serious firewood shortage. Those who can afford to use charcoal are people who have benefitted from tourism. Much of the charcoal has been used in winter by the owners of lodges and tea shops.

3.2.9 Kerosene

Kerosene is the only lighting fuel available in most of Nepal, especially so in the mountainous areas. Nima's firewood survey in 1979 indicated that a number of households use a bottle of kerosene per week.

Within the region, most people use small wick lamps which contain only a half bottle of kerosene. Those who can afford them, use lanterns and metal lamps. In poor countries like Nepal, kerosene for lighting is one of the largest users of oil, and an important item in the household budget of poor families.

Within this region, there is a great variation in the amount of kerosene burnt. In villages like Thami and Phorste, people use very small amounts compared with Namche, Khumjung and Khunde. The majority of people in Namche, Khumjung and Khunde are either engaged with trekking and mountaineering or running hotels and lodges. Thus they have higher incomes than people from Thami and Phorste.

Kerosene in this region has to be brought up from near the Indian border, and by the time it reaches Namche

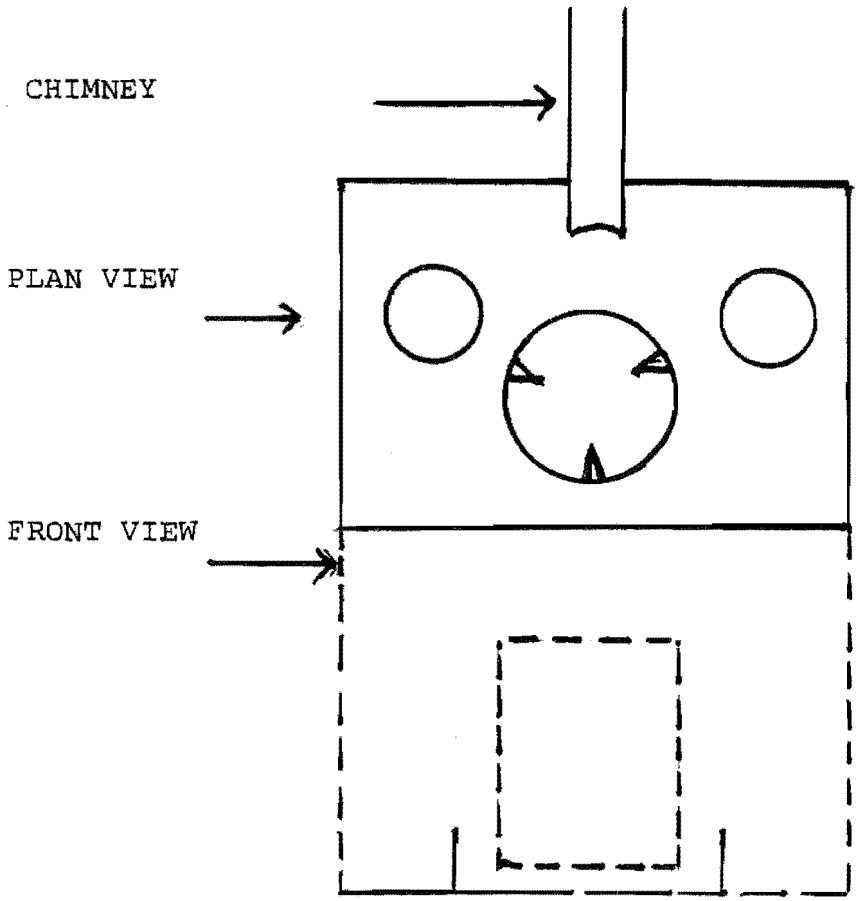
Bazer it has become very expensive. Minimum cost per bottle would be at least 10 or 12 rupees, and this is very expensive for those who do not benefit from tourism. ? $. N.Z. 1986

3.3 TECHNOLOGICAL CHANGE AND FUEL STOVE EFFICIENCY

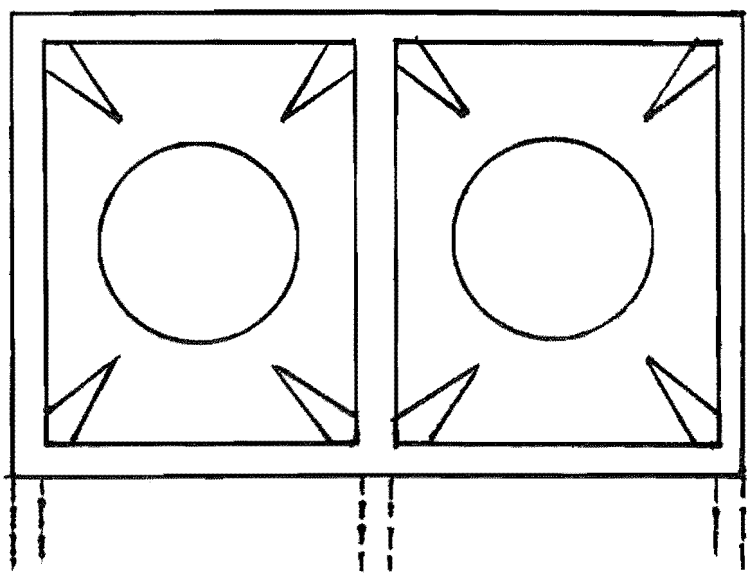
The increased shortage of wood has led to many alternatives in this region, among them is the need for wood burners that have been designed to be more efficient in the amount of fuel burnt and its energy output. The majority of the households have their traditional fireplaces, because the fireplace and hearth is of improtance to the Sherpa's Bhuddist religion.

Traditional fireplaces consume large amounts of wood and are not efficient in providing heat to a house. In the last few years, the Sherpas have converted their own traditional open floor pit fireplaces to stand-up hearth fireplaces. The reasons are for greater convenience, smoke control, as well as saving large amounts of firewood. A majority of the people in this region preferred the open fire pits rather than hearth fireplaces because they provided some light in dark kitchens.

With the encouragement of Sir Edmund Hillary, local people are now accepting the use of efficient burning stoves. The Sherpas are now building their own stoves from local material and the skills of local blacksmiths, thus making the cost of such stoves cheaper.



FIREPLACE



OPEN FLOOR-LEVEL FIRE PIT

Figure 10: Differences between fireplace and open-floor-level fire pit.

3.4 SUPPLY OF ALTERNATIVE FUELS AND ENERGY SOURCES

The National Parks Department has recognised the severity of the deforestation problem and is attempting to prevent further deterioration of the country's forested land by accepting foreign technical and financial support. The use of alternative sources of energy is being encouraged by the Government. The National Parks Department has begun to enforce the regulations that all visitors entering the park must bring their own portable cooking stoves. They must carry sufficient fuel while they are in the park. It is now illegal for tourists to burn wood in open camp fires within Khumbu's Sagarmatha National Park.

In spite of the ban on tourists using firewood, many trekkers and mountaineering expeditions continue to cook on wood fires. This is because of the difficulties involved in obtaining and the costs of local kerosene. To overcome this problem, a kerosene depot has been established at Jorsalley at the entrance to the national park to assure a supply of cooking fuel at a reasonable price to the visitors of the park. The idea of a kerosene supply depot was made by a special committee formed by different agencies, such as the National Parks Department, trekking agencies, the German Alpine Club and the Nepal Oil Corporation.

Some tourist groups are taking the additional step of achieving energy self-sufficiency while visiting the park. They are insisting that all their group members use kero-

sene for cooking and they also patronise hotels and tea shops around the region to use quickly renewable energy sources such as solar energy and bio gas.

There needs to be more visitors with a similar attitude in the future to save the natural resources of the region by encouraging and developing the use of alternative energy sources.

CHAPTER 4

FOREST MANAGEMENT PROPOSALS

4.1 BACKGROUND

> *"The early visitors to the Khumbu Valley found majestic mountains rising from well-forested valleys rich in wildlife and abounding in colourful plant communities."*[1]

For 400 years the Sherpas were able to burn as much wood as they wanted. Namche in the Sherpa language means "dense forest". Many of the hill slopes surrounding Namche once covered in forest, are now bare. Sherpas have a strong sense of community life in Khumbu, and that was reflected in the system of control over the cutting of trees in the forests which was evolved by the Sherpas themselves, without imposition of control by any Government agency. Certain members of the community were designated (shigi naua) forest guard, their function was to report any person who cut trees without permission having been obtained from the village council. Fines were imposed for wrongdoing and were paid in the form of beer (chang). This self-imposed system of control helped to protect the forests of Khumbu from haphazard and destructive cutting.

> *"Compared with the forests of lower and climatically more favoured regions where peasants of Chetri, Brahman and Newar stock have in recent generations wrought enormous devastation, the*

forests of Khumbu are on the whole in good condition. This is mainly due to an efficient system of checks and controls developed and administered by a society which combines strong civic sense with a system of investing individuals with authority without enabling them to tyrannise their fellow villagers."[2]

Later the forests have gradually degraded under the pressure of increasing human and animal population. The sudden influx of Tibetan refugees and their animals, and increased numbers of tourists using firewood as fuel has caused serious problems in the region by causing deforestation.

4.2 MANAGEMENT PROPOSALS

Many people have been involved with the forest management proposals either nationally or internationally due to the seriousness of the deforestation. The aim of these management proposals are to control the remaining forest grazing animals, litter collection and collection of firewood for fuel purposes.

Management seems very necessary in Khumbu as it is likely that within a few years the forest resources will become very seriously depleted. People will be forced to use liquid fuel. As this has to come from India, the cost will be very high by the time it reaches Khumbu and will make living circumstances in Khumbu more difficult.

According to Naylor (1970), the management of forests would have been controlled better if they were managed according to specific areas. He suggested that a forest area of 60 acres with 60 years of rotation would give additional acres of new forest yield per year. The control by area could well be done by setting up a fire wood production zone. For example, the people in Phorste have set up production zones by their forest guard system for centuries. These production zones could supply the dry wood as at present as well as the litter collection from all forests. He predicts that it will take at least 20 years for seedlings and saplings to be physically strong to resist cattle, therefore it is necessary to control grazing animals in the region by developing a locally and inexpensive available fence, i.e. stone walls and strict policing by the park guard.

4.3 NEED FOR CONSERVATION EDUCATION IN KHUMBU REGION

The Khumbu people must realise that forests around their village have been over-used as fuel. They must not forget their traditional conservation practices through strong social and religious taboos in the past years. The firewood problems around the Khumbu region have been rapidly getting worse because more and more people are using it for fuel. The fragile environment around Khumbu has become well used by foreign trekkers and mountaineers. This in turn is causing deterioration of the age-old conservation traditions. There is conflict between older

and younger generations. The older, of course, try to preserve the traditional way of life, but the younger generation would rather seek a future in tourism and do not worry about losing their own resources. They tend not to think about how to preserve their resources, cultural heritage, and how to make it better, but are concerned with making money, by working for the trekking and mountaineering groups and build their homes in the cities rather than living in their original homeland.

For a situation like this, there is an urgent need for conservation education in this region to make them understand the situation of this region.

The overall aim of conservation education should be to change people's ideas with respect to nature and to teach them how to treat the natural resources properly, so that they are not depleted in future. To help us with this, the following things can be organised as a future plan.

1. The national park must keep a deep relationship with school teachers and trips should be arranged for students and teachers to various sites within the park in order to feel, touch and learn to protect and preserve their unique natural heritages as well as to create more interest in nature conservation and wildlife.
2. Regular films and slides shown in and around the villages if it is possible, otherwise once a week at the park headquarters about nature conservation.

3. Regular lectures should be given to the public by the park warden about the history of their own homeland and the degrading of the natural and cultural resources of the area due to influences by Westerners. These should be organised from time to time so that active participation by school students is possible on a large scale.
4. Regular contact with local Panchyats through various media and encouraging them to support the park to preserve the natural resources of the region.
5. Providing conservation leaflets to the various trekking agencies in Kathmandu as well as in the Department of Immigration where the tourists get their trekking permits.
6. Lectures in local villages in and around the park should discuss why parks are established and how the parks can achieve their objectives. Discussion should take place with local people to find out whether they are recognising the problems which face them from day to day and if so, what they can do to solve the problem.
7. Weekly radio programmes could be broadcast by the Forest Ministry of H.M.G. of Nepal. The programmes should be about broad aspects of nature conservation such as national parks and wildlife reserves, forest protection, forest management, plantation programmes, nursery techniques, seed

collection techniques, soil conservation programmes and the like. This material should be well written by the forestry staff and broadcast in Nepali languages. The radio programmes would be effective because people who live in remote villages like Khumbu region could listen to it.

4.4 ESTABLISHMENT OF REFORESTATION AND ITS OBJECTIVE IN KHUMBU REGION

4.1.1 Reforestation

> *"Certain parts of the area were well forested in the last few years but now are completely devoid of trees (e.g., Shyangboche area and Namche area). Forests in these areas need to be restored by planting indigenous species to fill future human requirements and to ensure soil conservation."*[3]

In 1978/79, two qualified forest scientists from New Zealand co-operated in Nepal through Volunteer Service Abroad. Peter and Penny Gorman set up production nurseries in this park. They established two nurseries, one at Namche and the other at Tashinga. Conservation and replanting programmes were also initiated by the Gormans; later Lawrie and Kay Halkett took over their jobs.

The Gormans believed that the project would help preserve the "natural character of at least one part of the high Himalayas in the face of increasing population pressure and environment degradation."

4.4.2 The Objectives of Reforestation and the Choice of Tree Species

When selecting a tree species for a planting project, the park must in the first place always consider the species which grows best under the given ecological limitations. Secondly, which of the possible species serves best our purposes and gives the maximum benefit. The purpose of tree planting will be analysed here in more detail. Objectives of planting trees can be one or several of the following:

1. Production of fuel wood.
2. Production of sawn wood.
3. Erosion control.

1. Production of fuel wood - In Khumbu region fuel wood is very important for both higher and lower income groups. Fire for cooking and heating are the largest consumers of wood. According to B.A. Coburn (1980), each Sherpa hearth burns over 5,000 kilograms of wood each year. Additional wood is required for ceremonies and cremations. Wood as a fuel has the great advantage over all other sources of energy. It is a renewable source as well as being much cheaper than fossil fuels and is also locally available.

When selecting the species, one should take into account the heat output as well as silvicultural factors. One should not only select a species that grows fast, but also one which regenerates easily and naturally by seeds or coppices.

In Khumbu, the most common species for fuel wood plantations are fir (Abies sp.), pine (Pinus sp.) and juniper (Juniperus sp.).

2. Production of sawn wood - When the main objective of a plantation is to produce sawn wood, we must consider the trees that we plant today will be harvested after only 30-100 years. Timber is an extremely scarce resource in the Khumbu region today. This is due to the lack of millable forest trees and the difficulties in transporting imported wood.

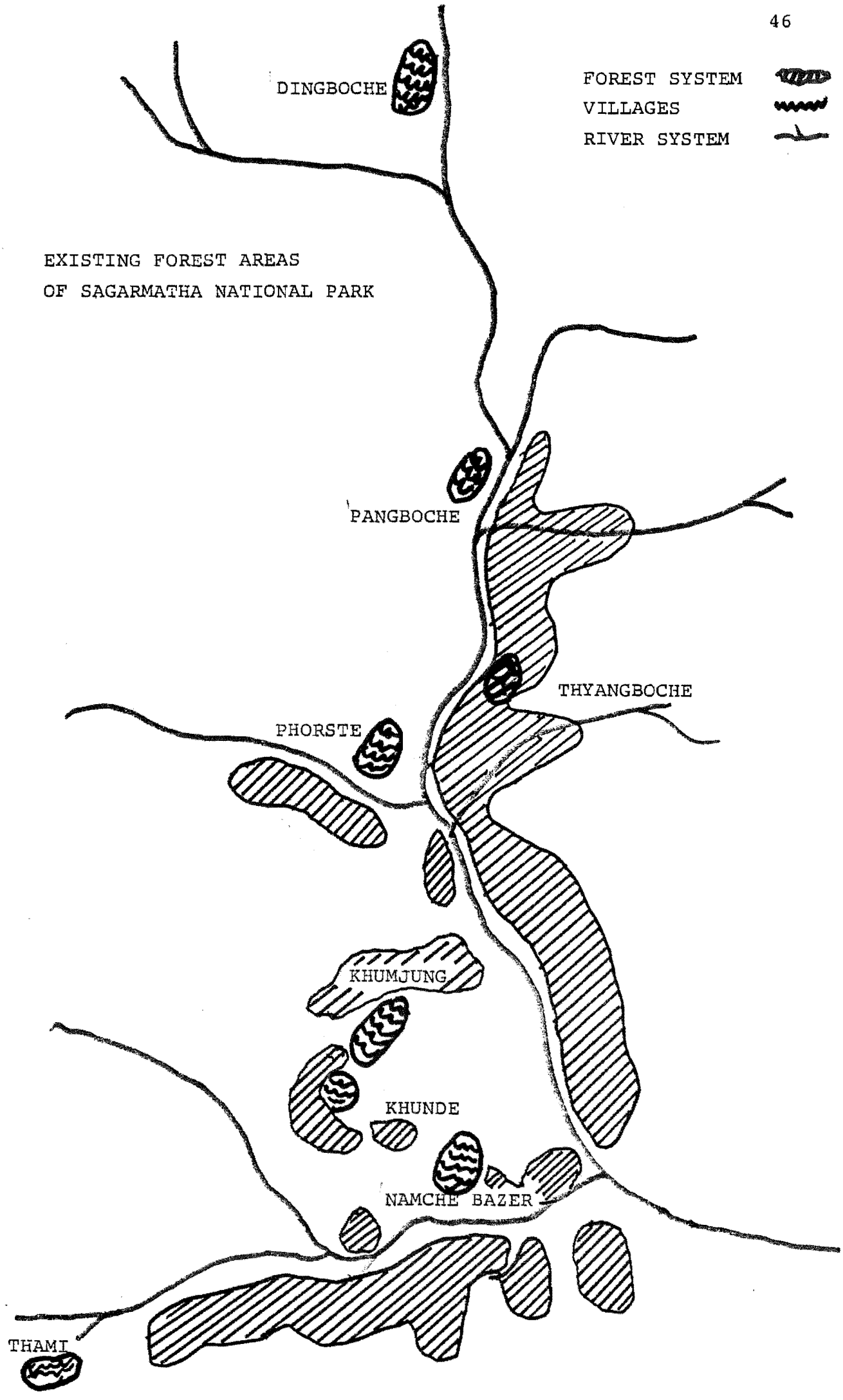
3. Erosion control - For erosion control, not only trees but also shrubs, grasses and other plants can be used. Very often the native vegetation can be used, even if the plant has been regarded as a weed and has not been propagated before.

4.4.3 Necessary Sites for Reforestation within the Khumbu Region

Mather (1973) advised that areas totalling about 200 acres were recommended at four sites in Khumbu. These four sites are as follows:

1. Namche.
2. Namche.
3. Khumjung.
4. Phorste.

1. Namche - The barren hillside above the cultivation at the town up to the crest of the hill which lies


FOREST SYSTEM
VILLAGES
RIVER SYSTEM
EXISTING FOREST AREAS
OF SAGARMATHA NATIONAL PARK
DINGBOCHE
PANGBOCHE
THYANGBOCHE
PHORSTE
KHUMJUNG
KHUNDE
NAMCHE BAZER
THAMI

just below Shyangboche air strip. It is about 25 acres. Recommended species: *Juniper recurva* and *Abies spectabilis*.

2. Namche - To the s.e. of the town on the bald hill. About 50 acres in the first planting year. Recommended species: *Pinus wallachiana* up to 3,000m then *Abies spectabilis* and juniper on the upper slopes.

3. Khumjung - Immediately above the villages. About 25 acres in the first planting years. Recommended species: mainly *Juniperus recurve* with *Abies spectabilis* in a few depressions.

4. Phorste - Immediately to the south towards the Imja kola. About 100 acres. Recommended species: *Pinus wallachiana* at low elevations up to 3,300m on the Khola, then *Abies spectabilis* and juniper on higher ground.

4.5 NURSERIES ESTABLISHMENT

4.5.1 Types of Nurseries in the Region

Permanent nurseries should be established where a demand for a large number of plants is likely to continue for a number of years. This must be centrally located within the reforestation areas.

4.5.2 Selection of Nursery Sites

The important factors to consider in the selection of nursery sites are: water supply, size and ownership of the area, labour supply, location and accessibility.

1. Water supply - The most important aspect in the selection of a forest nursery site is the availability of water throughout the year. The adequacy of water should be determined at the end of the dry season. The quantity of water required depends upon the size of the nursery, kind of soil, the species, and the number of seedlings to be raised. The water supply for nurseries at Namche and Tashinga is sufficient because it runs throughout the year.

2. Size and ownership of the area - The nurseries should be wide enough to accommodate the seedbeds which are necessary to produce the required number of seedlings. The area must be owned by the national park or must be established within the park boundary, so that the foresters in charge are free in their decisions concerning the nursery.

3. Labour supply - The nurseries should be sited near a stable labour supply. This will make it easier to maintain the production over time. In Namche, the park headquarters are not that far from the present nursery and the nursery can be maintained by park staff regularly, but it is very necessary in Tashinga where the park is depending on local labour.

4. Location - As much as possible, a forest nursery should be centrally located within the planting area so that the planting stock need not be transported over long distances. The nursery should not be established where main roads do not exist. It should be protected from parching winds during the dry season, but on

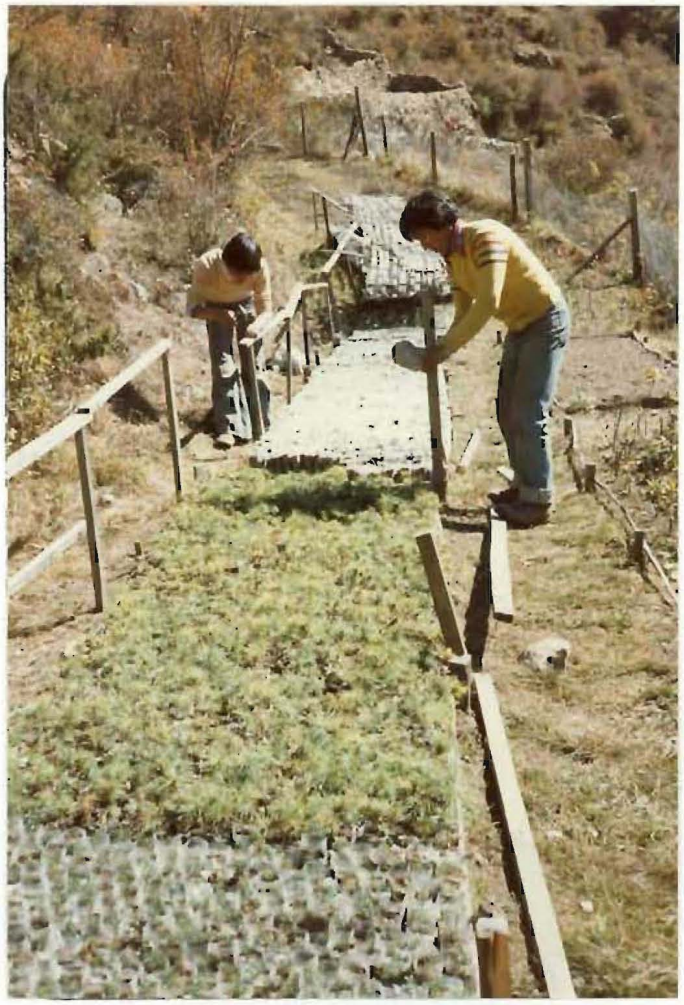


Plate 11: Nursery established at Namche.

Plate 12: Nursery established at Tashinga.

the other hand, must receive full sunlight. The elevation on the site is not that important, as long as the species grows well on the selected areas.

5. Accessibility - The nursery should not be located at a public road. It should be located where the area is not affected by humans or animals.

4.6 HUMAN INTERFERENCE AS THE MAIN CAUSE OF EROSION

"If Khumbu is a desert, who will come, who will live here, where will be the job?"

John McKinnon (May, 1974)[4]

4.6.1 The Causes

1. Fuel Wood Cutting: Excessive fuel wood cutting has to be made responsible for forest destruction over large areas in the Khumbu region. Large supplies of fuel wood for tourism and mountaineers by local people have been blamed for the denudation of wide areas in the region, particularly the main route to Everest base camp. The situation is aggravated by chopping and felling these slow growing trees, which in turn destroy ground vegetation by sliding downhill.

2. Overgrazing: The Sherpa keep a considerable number of animals, on which to a great extent their economy depends. In summer the yaks are grazed on high pastures just below the snowline, but they are too few in number to cause serious erosion. Above the village of Namche, the hillside is bare and has every appearance of being badly overgrazed by yaks, zopkios (cross-breed) as well as sheep

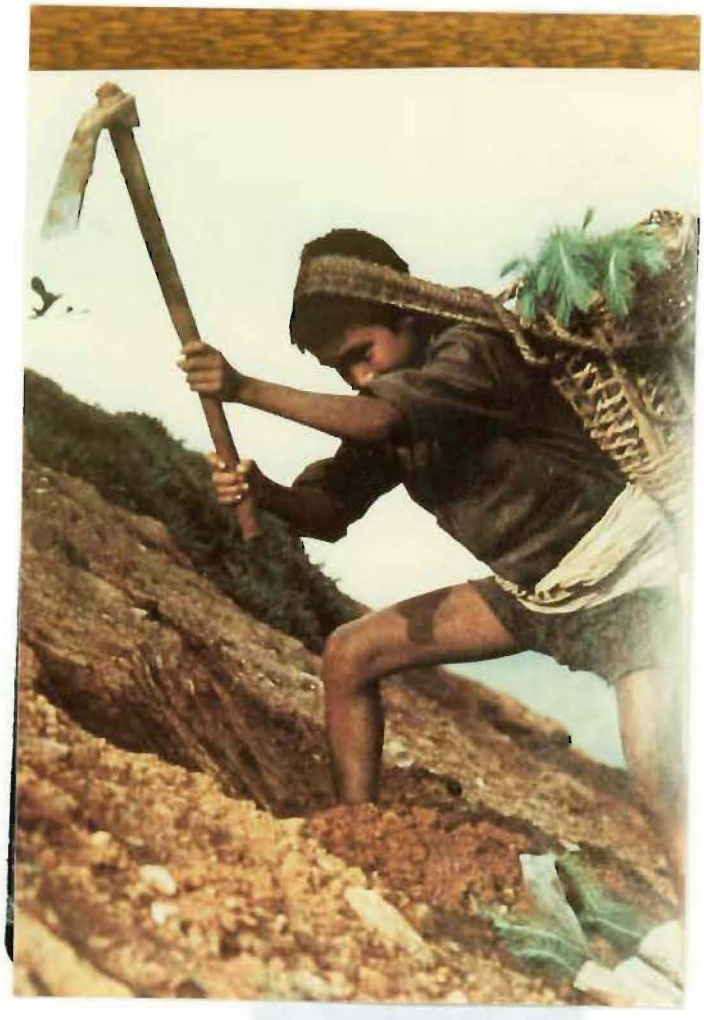


Plate 13: Seedling plantation in Khumbu region.

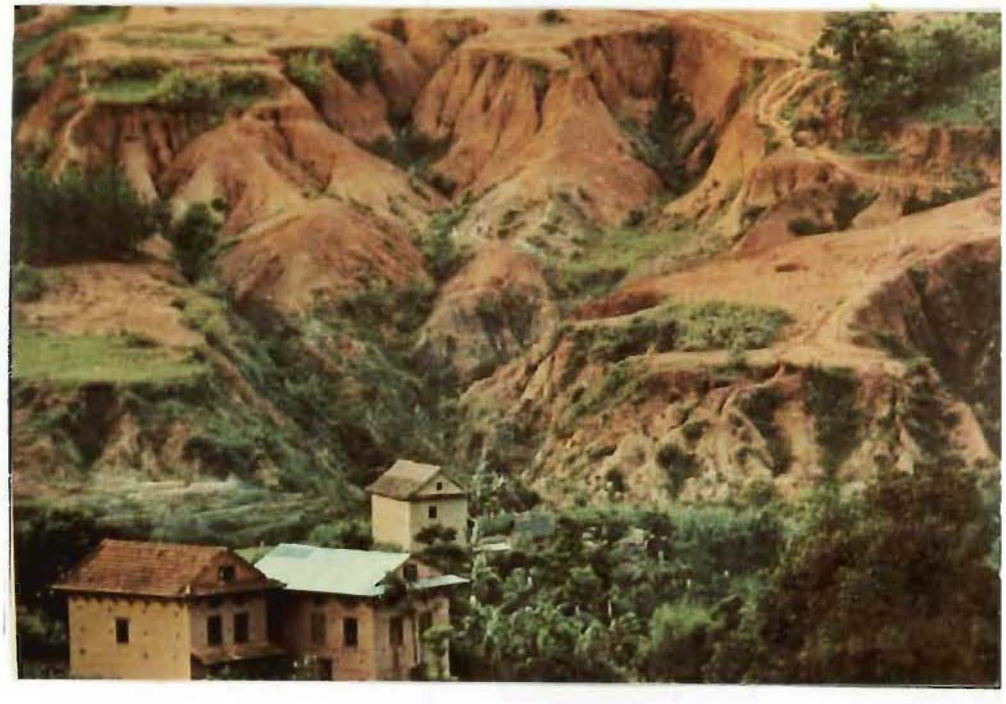


Plate 14: Deeply eroded hillside within Solu Khumbu. Over-cutting and over-grazing have devastated many hillsides around this region.

and goats, resulting in erosion and a loss of soil. The zig-zag shape around the hill above Namche has come from over-grazing by animals.

3. Fire: There are several places where trees and vegetation on steep slopes have been destroyed, either intentionally or by careless lighting of fires. This occurred above Khumjung village. The inevitable results of this will be baring of the soil and increased erosion.

4.7 SUGGESTED PREVENTIVE MEASURES AGAINST EROSION

Indirect measures of erosion control are preventive by nature. In general it is much cheaper to prevent than to repair the damage of erosion. Prevention of damage is therefore the most important phase in erosion control. The following are preventive measures.

4.7.1 Educational Campaign

As many people do not know the dangers of erosion, an educational campaign is the first step of erosion control. There should be seminars for teachers in every school who will impart their knowledge to the children. Pamphlets, displays and class trips would play an important role in such campaigns. The National Park Authority is the responsible agency for this task.

4.7.2 Fire Prevention and Control

This is the most preventive measure against erosion. The lighting of fires in the forests or on open hillsides

should be totally prohibited by the local Panchyat as well as the Park Authority, and at the same time the people should be taught the destructive nature of fires.

4.7.3 Fencing

If grazing and browsing are responsible for destroying the ground vegetation in an area, suitable enclosures to avoid instrusion of livestock would be a good solution. The enclosures should not be too large to have better control and not to inconvenience local people so as not to lose their co-operation.

4.7.4 Restrictions on Cutting Firewood

Cutting of wood should be for local people only and not more than one load a day, and to include dead wood only. In critically deforested areas, clear cutting must be avoided.

4.8 PROBLEMS AND ALTERNATIVES TO THE BANNING OF CAMP FIRES WITHIN SAGARMATHA NATIONAL PARK

Until 1979, the forest of the Khumbu region was still heavily used by local people, and tourists also used wood. As tourism increased in this region, there was a great demand for fuel. In 1980 the national park put out regulations to ban the sale of wood to trekkers and mountaineers. Since then the park users have been asked to bring their own fuel from outside the park boundary. The park regulations on burning firewood for camp fires did not

work properly and firewood is still being sold to campers.

Before the national park started putting out regulations related to firewood in the region, mountaineering and trekking groups camped in the grass fields or potato fields when they were empty. Local people took their firewood to the campsites to sell. They could sell and buy freely because there were no regulations. Since the park banned the sale of firewood to mountaineers and trekkers, these groups started hiring houses around the villages. This made it easier to use local firewood as fuel. Locals eagerly participated in this as it was an easy way of making money.

The new regulations gave problems for the local trekking operators. It was hard for them because they had to provide fuel from outside the region, but it was easier to run a trekking operation from a home base for logistical reasons. Another problem was that the high altitude made the fuel inefficient. For instance, stoves were of a low quality and getting spare parts was a problem.

It has been proposed that it be illegal to rent out houses and sell firewood. Special camping grounds should be set up at key locations such as Monjo, Namche, Thyangboche, Pheriche, Lobuche, Dingboche, Go Kyo, Macherma and Thami. These would be run by the national park. Fees would be charged to the Sirders (trekking leaders). These camping grounds would have tent sites and a communal cook house providing bulk fuel and reliable stoves. To counter the possible problem of overcrowding, the Sirder should give notice of party numbers and length of stay to the park headquarters.

CHAPTER 5

DEFORESTATION IN KHUMBU REGION

"The single most important problem is the condition of Khumbu forest."[1]

There are several reasons for the deforestation in Khumbu region. They are given below.

1. Human Population: Almost 3,000 people live within an area of 1,243 sq. km. This figure does not include the refugees from Tibet and some people from other parts of Nepal who work for Government offices. The Khumbu population doubled between 1950 and 1970 both from an influx of Tibetan refugees and from the result of modern medical care. The increase of population in the Khumbu region has placed demands on agriculture to support the extra numbers. There has been an increased demand for land for agricultural purposes rather than the forest for its resources. At the same time, the tourism development has introduced commercial interests which have placed considerable pressures on the unoccupied land areas.

2. Saw Milling: The forest of Khumbu provides the Sherpas with timber for construction, roof shakes, litter for latrines as well as animal bedding. Due to tourism in this region, investments occurred in the provision of tourist facilities on both public and private land, these being such things as building hotels, lodges and various tea shops along the route to Everest

base camp. This has increased the demand for building timber.

3. Over-grazing: Animal husbandry is a symbol of wealth for the Sherpas of the region. They are largely dependent on the animals and their products for trade in early summer between Nepal and Tibet. Large numbers of animals have grazed freely in the open areas and these have created threats to mountain forests. The larger trees are not affected directly, but regeneration has been affected seriously by seedlings being grazed out.

5.1 FEATURES OF DEFORESTATION IN THE KHUMBU REGION

1. Reduction of natural habitats for wildlife species. This is particularly important for wildlife that is endemic to an area as it would have difficulties in adapting to new habitats.
2. A deterioration of soil and water quality which can extend further than the deforested areas, e.g. increased erosion and lack of soil nutrients.
3. Deterioration of religious, cultural and natural values held by the indigenous people because of the encroachment of Western values and development.
4. A dramatic change in landscape character often from the beautiful to a harsh and ugly view after deforestation.
5. Possible lack of resources for future use if natural timbers are not used conservatively.

6. Deforestation can lead to a reduction in tourist numbers because of the change in attractiveness of an area.

"Tourism increasingly provides an alternative economic justification for the protection of the environment."[2]

7. Deforestation leads to increasing aridity in agricultural areas.

5.2 FOREST USES BY THE SHERPAS

In Khumbu, wood and timber are obviously essential requirements for living. Moreover, the timber, whether fir, pine or juniper, from the nearby forests is used in the construction of all the Sherpa houses, which are roofed with wooden shingles.

Importantly, the houses have to be solidly constructed to stand exposure and to keep out the cold at these high altitudes. Similarly, the people must have an abundant and accessible supply of firewood for heating and cooking. This is obtained from the birch, fir, juniper and rhododendron trees which are a feature of Khumbu.

Newer, and no less important, sawn timber is now used in new hotels and lodges around the villages. The influence of tourism in this region has brought a new life and this has improved the living standard by building new houses and hotels for tourists.

5.3 FOREST ADMINISTRATION BY THE CENTRAL GOVERNMENT IN THE KHUMBU REGION

The Khumbu region was a politically isolated and not greatly influenced by Central Government control until 1957. The Sherpas have introduced the forest guard system in this region. Limited felling is permitted only for special purposes, such as house building. Fines are imposed on offenders of forest regulations.

In 1963 Nepal democratised the entire nation by dividing it into a series of local governments called Panchyat and forests that were not privately owned became state forests. These are controlled by the Panchyat rather than by the Sherpa guard. Permits to cut building timber are issued by the administration office at Namche if the application is recommended by the Panchyat office.

According to records kept at Namche, 35 permits were issued in 1972/73 for a total of 1,186 cu.ft., costing two rupees per cu. foot. Today the permits for the building materials are available from the district office which is four days walk from the main villages.

CHAPTER 6

RECOMMENDATIONS

1. Banning the sale of firewood to trekkers and mountaineers by the local people.
2. Encouraging the local people to become involved in the conservation as well as the day-to-day running of national parks.
3. Advancement and development of reafforestation within the park.
4. A conservation education programme for inhabitants who live in the areas where deforestation is prevalent, and this should be organised by park staff from time to time.
5. Continuation of existing regulations regarding firewood use for tourists coming to the area.
6. There should be restrictions on the building of hotels and lodges inside the park, which may create a large impact in the future.
7. Reintroducing the local forest guard (Shingi naua) and giving payment for their services.
8. Providing an alternative source of energy, e.g. hydro electric, solar water heating, charcoal and methane gas to protect the natural resources as well as to fulfil the energy requirements of the people in this region.

9. There is a need for proper planning for new transport and communication in this region. Random movement of people will ruin the landscape and seriously affect the natural vegetation and water quality.
10. Restricting livestock grazing to open areas.
11. Encouraging the use of portable cooking stoves by tourists, and the use of kerosene as an alternative to firewood.
12. Growing trees outside the park boundary at Pharak which provides a better environment for faster tree growth.
13. The need to enforce existing regulations regarding tourists and expeditions coming to the park has already been put into action by the national park since it has been established. It should be mandatory that visitors bring all their own energy and pay for it so that local resources are not depleted and that things like the provision of showers for tourists are not made available unless the water was heated by solar power.
14. Campaigns to educate the public on the subject of the conservation of nature and landscape should be systematically pursued, in order to enlighten the public as to the dangers of the deterioration of natural resources on which they live.
15. There is a necessity to ensure the problems of rubbish disposal is kept at a manageable level and to

maintain the environment in its natural areas. Information on this concept should be made available at the visitors' centre as well as each camping ground.

CHAPTER 7

APPENDIX I

HIMALAYAN NATIONAL PARK REGULATIONS 2033 (1976)

In exercise of the power conferred by Section 33 of the 1972 National Parks and Wildlife Protection Act, His Majesty's Government has framed the following regulations:

1. Key Words: Unless otherwise meant with reference to the subject or context, in these regulations.
   - A. Act means the 1973 National Parks and Wildlife Protection Act.
   - B. Park or National Park means a Himalayan National Park.
   - C. Warden means the chief officer of the National Park appointed by His Majesty's Government.
   - D. Himalayan shall mean areas of the Kingdom of Nepal lying north of latitude 27^{o}.
   - E. Mountaineering or mountaineers shall mean those as defined under the Ministry of Foreign Affairs Mountaineering regulations or, as amended from time to time.
   - F. Trekker shall mean visitors undertaking sight-seeing or travelling in accordance with existing laws of Nepal. Others shall be as included in Act.

2. Boundaries of National Parks: The boundaries of national parks shall be as described in His Majesty's Government Nepal Gazette Notice under Section 3 of the Act.

3. Entry:

   1. Any person desirous of entering into the park shall pay the fees. The person paying such fees shall be given a pass by the warden or any other employee designated by His Majesty's Government for the purpose.
   2. Mountaineers or trekkers travelling in a group have provision made for payment as a group in Kathmandu or in any other places as designated by His Majesty's Government.
   3. No entry fee is required for people of villages within the park areas.

4. Burning of Vegetation Prohibited: No person shall set fire to any grass, scrub, forest or other vegetation, other than fuel wood lawfully collected, nor shall cause or allow the introduction of fire, whether or not with deliberate intent, from an area outside the park boundaries; and, in such an event the person or persons starting the original fire shall be held responsible for any resulting damage within the park.

5. Litter: No person shall leave any litter, refuse or other obnoxious or unsightly material in the park unless buried or otherwise effectively concealed from view to the satisfaction of the warden.

6. Interference with Signs and Notices: No person shall destroy, damage, move or otherwise interfere with any boundary mark, fence, sign or notice within or on the boundaries of the national park.

7. Grazing: Free grazing is permitted in areas as designated by the warden on the advice of the park authorities in consultation with the park management committee.

MOUNTAINEERING AND TREKKING

1. The rules and regulations under the Mountaineering Regulations shall apply, but the following is additional for mountaineers and trekkers:

   a) All materials imported into the park have to be exported out of the park or disposed of at places as designated by the warden.

   b) Artificial fuel for all members of parties, including porters, must be provided.

   c) Use of wood plants or any type of vegetation, dead or living, for the party including porters is prohibited; this applies to fuel for cooking, heating, ladders, tentpoles or for any other purpose.

   d) Any mountaineering expedition intending to climb a peak within the park boundaries is governed by their permit issued by the Ministry of Foreign Affairs for inspection by the warden.

2. Sale or Purchase Prohibited - with the boundaries of the national park, the sale of and purchase of wood or any kind of vegetation is prohibited from local or other people.

CHAPTER 8

CONCLUSIONS

> *"About 25 years later I repeated this very same journey. The valley of the Dhud kosi river was still very beautiful, but the forests were woefully thinned by the axes and saws of the Nepalese who had been cutting timber for buildings. The trees below Namche Bazer had been scarred by the heavy knives of Nepalese porters taking branches and bark for fuel and gummy heartwood for torches and lighting fires. The forests around Thyangboche had lost many of their mighty trees, and the Pangboche area was almost bare. Up the Khumbu glacier valley there was hardly a juniper to be seen."*[1]

It is apparent that the 3,000 inhabitants in this region have begun to recognise the value of trees and forests, and realise that without them quality of life in Khumbu would be greatly reduced. Therefore, they have protected the forests to a considerable degree from the destruction of the very recent past.

Much of this region is more or less unsuitable for intensive or extensive, local development, due to the environmental conditions. In all areas except some pastures, the disturbance of the soil would increase erosion and consequently increase the likelihood of floods and droughts.

The vegetation growth in this region is very slow due to the cold climate. The reforestation which is being carried out in the Khumbu region is going to be very slow. It will not provide useful energy timber or construction timber for many years. It will take a long time to make Khumbu as it was 30 years ago with much greenery and an unspoilt landscape. Strong emphasis on conservation, fire design and provision of forests in Pharak as well as a better usage of solar energy will ensure an eventual improvement in the Khumbu forests.

> *"The establishment of a national park in the Everest region seems appropriate to maintain a balance between nature and tourism. Such a national park could provide a source of national income and is foreseen to bring international support."*[2]

This dissertation makes recommendations for the Sagarmatha National Park's management plan to deal with the problems that have been discussed. This includes reforestation, the use of alternative energy sources, changes in design and the heating of houses and education programmes that would hopefully bring about changes in people's attitudes towards the conservation of Sagarmatha National Park.

CHAPTER 9

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