

# HIGHLAND - LOWLAND INTERACTIVE SYSTEMS

(draft of document for FAO - FORC/IYM 2002)

Jack D. Ives, Ottawa, Canada. 15th March, 2001

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## INTRODUCTION

This report examines the social, economic, and political relationships between highlands and subjacent lowlands. The practical justification for the study arises from the recent growth in awareness of the importance of highland-lowland interactions as the processes of globalization continue to accelerate. The terms 'highlands' and 'lowlands' are loosely defined: 'highlands' as synonymous with 'mountains' and, therefore, 'lowlands' as those areas beyond and beneath the mountains that are influenced by down-slope physical processes and by human relationships linking the two.

Attempts to develop a physical definition for 'mountain' have consumed much time and energy. Yet no universally acceptable result has been obtained. The problem becomes the more intractable in the present context with introduction of the term 'highland-lowland interaction'. When social, economic, and political aspects are included, quite different visions on 'mountain', 'highland', and 'lowland' will arise. A review of this problem is provided as Appendix I. Nevertheless, it must be emphasized here that the term 'lowland' cannot be construed to represent a distinct physical entity as the areas involved will vary because physical, social, economic, and political realities do not necessarily overlap

The growing impact of the global market on economic and political interactions extends to what were hitherto very remote regions. The

interrelationships between highlands and lowlands can be categorized in the first instance as the impacts of mainstream political and economic power bases on remote mountain areas and communities. However, this is not a one-way process from the lowlands to the highlands – in many instances events within highland communities have significant effects on the power structure and way of life in far distant lowlands.

As recently as fifty, even twenty five, years ago most mountain regions were at the far periphery of mainstream societal concerns. Remote, relatively inaccessible, they were generally pictured as difficult, unyielding, and unprofitable environments – amongst the world’s last remaining arenas for exploration and mapping, and privileged enclaves for mountaineering and adventure. Within academia, a small group of anthropologists had focused attention throughout the twentieth century on mountain peoples and cultures, but emphasis usually seemed to be on exotic features – extreme longevity, primitive religion, marginal survival, unusual adaptation to very high altitude, fraternal polyandry – and this tended to obliterate informed communication and more meaningful analysis in any practical sense.

Early mountain research in the natural sciences concentrated mainly on specialized studies with little cross-disciplinary endeavour. For example, the geomorphologist regarded mountain environments, especially those above timberline, as prime field areas because the steep slopes and scarcity or absence of vegetation ensured much more rapid mass transfers which led to ease of

precise measurement and therefore to improved understanding of geophysical processes within a set time interval. Unfortunately, with some exceptions, such as avalanche and landslide research, this did not lead to immediate or significant practical applications.

There have been few attempts to forge links between the human and natural sciences in mountain regions. During the last fifty years there have been spasmodic accounts in the popular press of mountain regions and their relationship with the subjacent lowlands, mainly induced by events of great economic or political significance, such as the initial burst of two-season tourism in the Alps; the absorption of Tibet by lowland Communist China; the opening of Nepal to mountaineering and tourism; and the increasing popularity and subsequent overuse of North American mountain national parks by urbanized lowlanders.

Since the Rio de Janeiro Earth Summit (UNCED, 1992), awareness, concern, and commitment to mountain issues has increased to an extent that would have been considered only remotely possible ten years ago. The underpinnings of this increase in awareness are four-fold. First, increasing water shortages, together with growing demands for hydroelectricity, in various parts of the world have reinforced the realization that mountains constitute the source of more than half the world's available fresh water, whether for domestic, industrial, or agricultural use; in arid and semi-arid countries this may exceed 80 percent (Mountain Agenda, 1998). Second, with the end of the Cold War and the

accelerating globalization, the news media have ensured that human society as a whole has been constantly informed about a series of extremely ugly wars, disproportionately concentrated in mountain regions – Kashmir, Afghanistan, Caucasus, the Balkans, Colombia, Kurdistan, Tajikistan, the Horn of Africa, and Ruanda (Libiszewski and Bächler, 1997). Third, the general belief that mismanagement of mountain environments, for example, by deforestation and overgrazing, may have catastrophic downstream effects, has further focused concern. Such effects include massive flooding in Gangetic India, Bangladesh, the lower Yellow River, China, and in various part of Southeast Asia (Ives and Messerli, 1989), as well as devastating mudflows in Colombia, whether or not the actual cause--effect relationships have been satisfactorily analyzed. Fourth, current widespread alarm about the predictions of harmful global climate warming throw emphasis on mountains as one of the areas where some of the earliest imprints of such warming will become apparent (Beniston, 2000; Beniston and Fox, 1996).

The lack of reliable data and understanding about mountains and their interactions with the subjacent lowlands has kept many of these issues shrouded in uncertainty. Political misrepresentation (not necessarily deliberate) has led to political tension as well as to large-scale waste of resources in efforts to provide solutions to incorrectly identified problems. Mountains, therefore, have moved from far back stage on the world's political and development agenda to front and centre (Messerli and Ives, 1997). This provides full justification for thorough

evaluation of highland-lowland interactions, especially within the context of the International Year of Mountains -- 2002.

## WHY FOCUS ON MOUNTAINS?

Mountainous lands occupy at least twenty percent of the world's terrestrial surface and provide about ten percent of humankind with their direct life support base. Indirectly, mountains provide extensive material resources, such as water and forest products, as well as the more intangible benefits, such as recreation, tourism, and religious inspiration, to well over half the world's population.

Mountains constitute the most diverse landscapes on earth and thus hold a very large share of the world's biodiversity and cultural diversity. The complex physiography and relative isolation have led over geological time to the evolution of a very large number of endemic plant and animal species. Similarly, the geographical remoteness has ensured the emergence of a high degree of cultural diversity and its preservation. It is this biological and cultural endemism that is one of the reasons for much of the current growth of lowland interest in mountain areas. However, the degree of inaccessibility or, alternatively, the high cost of establishing and maintaining modern communication links, is a major cause of lower economic returns for mountain communities (Kreutzmann, 1991; Hewitt, 1993). Thus, in an open market system

imported goods from the lowlands are very costly while exports from the mountains to the lowlands have reduced net returns. Mountains are not necessarily 'resource poor', and in many instances successful specialization can result in considerable added value. Examples include Swiss mountain cheese, Hunza apricots, and widespread adventure tourism.

The general lack of understanding of the highly complex dynamics of highland-lowland physical and cultural interrelationships, and especially the large range of ill-defined interactions, has led to the uncritical acceptance of assumptions and environmental orthodoxies. For example, the once popular *Theory of Himalayan Environmental Degradation* erroneously attributed flooding on the Gangetic Plain to deforestation in Nepal (Eckholm, 1976; Thompson *et al.*, 1986; Ives and Messerli, 1989). Inadequate research and lack of understanding of the processes of environmental degradation led to the adoption of unsound responses and unwise development of resources, if not to actual exacerbation of ill-perceived cause-effect relationships.

Actual and perceived environmental degradation in mountain regions appears as a threat to subjacent lowland population centres. Events in the highlands may lead to disruption of power and water supply, siltation, landslides, and floods. Where such effects transgress international frontiers political tensions are further exacerbated.

Mountains have frequently formed border zones between the major political and economic power bases of the lowlands, and today a high proportion

of the world's international frontiers under dispute are in mountain regions, or even along the crests of precipitous and imprecisely surveyed ranges. With increasing globalization of the capitalist market system and the heightened nationalistic and ethnic tensions, many of these areas have become zones of political and military conflict – resulting in heavy losses in goods and materials, cultural values, and environmental assets, as well as the spread of disease, even genocide (Mountain Agenda, 1992; Stone, 1992).

It follows that the enormous increase in concern about mountains since the Earth Summit (UNCED) of 1992, together with the closely approaching International Year of Mountains (IYM) of 2002, carries with it an imperative: to begin the process of identification of the numerous interrelations between highlands and lowlands. And while the physical interactions require much more careful assessment than they have received hitherto, the social, economic, and political dimensions stand in urgent need of identification and clarification. Hence this initial attempt to address these complex issues. This report, however, should be regarded not as an exhaustive study but as a first step to draw some early principles, to outline misunderstandings, to identify gaps in knowledge, and to suggest further steps for future consideration.

It must be recognized that people have lived for centuries in ecologically and culturally rich mountain regions of the world. They have faced, and continue to face, severe constraints that impinge on their well-being; but there are also many opportunities available to them. Mountain people have an

inalienable right to rewarding, sustainable development; the old approach taken by powerful, and usually lowland, elites to development of highland resources for the benefit of downstream users must be very significantly modified. As the current increase in international awareness progresses and serves to drive innovative development policies, all stakeholders must be involved. Potentially the International Year of Mountains should prove a great force for this process. Failure to realize the opportunities now presented could lead to grave losses and dislocations that would affect both highlanders and lowlanders.

## MAJOR DIMENSIONS OF HIGHLAND--LOWLAND INTERACTIONS

### ECOLOGICAL DIMENSIONS

A general understanding of the ecological dimensions of highland-lowland interactions can be derived from a group of natural science disciplines: biology; climatology; ecology; geology; geomorphology; glaciology; hydrology. The basis of such understanding is the underlying relationship between mountains and plate tectonics (neotectonics). Thus the world's major mountain ranges and high plateaus are the product of the geologically most recent episode of plate tectonics (Alpine Orogeny). This has produced the greatest relief on earth (8,000 m of vertical relief within a horizontal distance of little more than 100

km in Nepal), extremely steep slopes, a myriad of micro-climates (from tropical to arctic/alpine within the same horizontal distance), an enormous array of vegetation belts, soil types, biodiversity in general, and, above all, slope instability. Slope instability is best characterized by reference to examples of major highland - lowland systems : the Tibetan Plateau - Yellow River/Yangtze systems; the Andes - Amazon system; the Himalaya - Ganges/Brahmaputra system. In effect, gravity, range of altitudes from 8,000 m to sea level, intense monsoonal rainfall, and high seismic activity have created Gangetic India and Bangladesh and many other lowlands as they are the product of massive sediment transfer from the mountains and accumulation to form the riverine floodplains over geological time. Thus, from an ecological point of view, the watershed is the most satisfactory unit of study. The complexities of scale and variations in time must be taken into account, as well as the great range and diversity of landscape units. This complexity defies generalization. In simple terms, measurements and conclusions from work in a micro-scale watershed (drainage basin :  $>20,000 \text{ km}^2$ ) do not necessarily apply to a meso-scale watershed ( $50-20,000 \text{ km}^2$ ), and especially not to a macro-scale watershed ( $<50 \text{ km}^2$ ). Lack of attention to this truism has been one of the chief causes of the misrepresentation and misunderstanding that have led to inappropriate policy adoption in the past.

Germane to our overall concerns is the assessment of the impacts of human activities on these predominant geophysical processes. The impacts of

human activities on the physical landscape are far more complicated to determine if not, in some cases, impossible to disentangle. But while the external geophysical forces are primarily governed by gravity (mass transfer) and, therefore, are highland impacts on the lowlands, human processes are both highland to lowland and the reverse. Once the human element is introduced the complexity, therefore, is far greater and the larger number of dependent variables more difficult to isolate. A few concrete examples of the linkages between highlands and lowlands are given briefly here so that the reader can obtain a clearer picture of the types of issues that are encompassed. The approach, inevitably, will lead to a certain degree of overlap amongst the different sections of the report.

### **New England and New York State, USA**

Extensive loss of forest cover culminating over a century ago had the potential for prolonged downstream deleterious consequences, such as damage to New York City's water supply. Today the scene is one of widespread, renewed forest cover. This illustrates that over a long period of time land-cover changes respond to changing socioeconomic conditions that can dramatically influence the ecological balance. Environmental degradation is not necessarily irreversible.

### **Switzerland: Deforestation in late-19<sup>th</sup> Century**

Floods, debris flows, and soil erosion reached crisis proportions by the late-19th century in Switzerland. This prompted the introduction of strict forest

laws and their equally firm enforcement. Swiss forest cover today greatly exceeds that of a hundred years ago. While these changes have led to other associated problems (over-mature forests of uniform age), nevertheless, the case demonstrates the feasibility of reversing ecologic and economic losses. This contrasts with present-day worldwide political assumptions that tend to cite all reduction in forest cover as irreversible catastrophe.

### **Ecuador: Hydroelectricity and siltation on the eastern slopes of the Andes**

The situation of Ecuador in the context of highland-lowland interactions represents an inversion of the 'normal' case. Historically, areas of population concentration have been in the highlands. As these populations have grown rapidly after about 1950 and as farm land has been progressively overused, there has been a tendency toward unplanned and planned migration and resettlement to lower altitudes. The situation referred to here is the unplanned migration down the eastern slope of the Andes into the lower mountain slopes overlooking the Amazon basin in connection with development of major hydroelectricity projects in the same general area. This case concentrates on the Paute River drainage where the large Daniel Palacios dam was constructed in the 1980s at an altitude of 1,855 metres above sea level. Regrettably, there was no systematic survey of potential soil erosion or siltation rates in the upper reaches of the Paute prior to construction. Given the importance of this large source of electricity, beginning in the late 1980s, to the ever faltering economy of the country, eventual realization of the extreme rapidity of reservoir siltation amounted to a disaster.

With an assessment that the expected longevity of the project was likely to be reduced to a fraction of the original pre-construction optimistic predictions of the consulting engineers, an extremely expensive dredging operation had to be put in place. The situation was made much worse by the fact that the long access road to the dam site from Cuenca in the highlands was used by downward migrating peasants who were abandoning their impoverished fields. Many settled on forested slopes above the reservoir; this led to clear-cutting for small holdings only capable of sustaining subsistence agriculture for a few years, leading to further land abandonment and the opening of additional plots in a repeated cycle of land degradation. The process further augmented the rate of reservoir siltation. Management of this project, vital to the economy of the country, rapidly reached crisis proportions. A relatively small investment in research and consultation during the planning stage could have ensured avoidance of the worst elements of the problem.

While this example is an inversion of the usual highland-lowland interaction, it still represents one of unwise resource development based upon Western and international expertise and aid (essentially lowland) without appropriate consideration of the mountain environment.

### **Cape Verde Islands: Mountain Irrigation**

The growing pressures to augment economic returns on natural resource development become particularly stressful in small mountainous island countries. In the case of the Republic of Cape Verde Islands governmental

authorities sought to apply Western-based scientific methods to improve irrigated agriculture in the mountainous landscape and so move closer to self-sufficiency in food production as well as to increase production of cash crops. The total area of the republic is about 4,000 km<sup>2</sup> and it supports a population of some 300,000 persons. Santo Antao is the second largest island in the group with an area of about 780 km<sup>2</sup> and altitude to 1,800 m. It supports a population of 45,000 people and accounts for about 60 percent of the total irrigated land of the republic. The extremely rugged relief has produced a field system of very small and irregular units. Water flow is very low. This combination over many generations has led to great complexity in traditional water management and outsiders have criticized the local mountain farmers for their archaic, unscientific, and assumed inefficient methods of water distribution. Such opinion, including accusations of actual waste of precious water, proved especially critical in this community of small islands with arid climate and periodic severe drought. Since irrigation for agriculture consumes by far the largest proportion of available water (at times even drinking water is in short supply) attempts to rationalize and 'improve' the traditional irrigation systems came as no surprise. Thus, after independence in 1975 extensive state intervention, with outside aid, occurred, including construction of infrastructure, largely to rehabilitate and extend existing systems as well as to create new ones. Perhaps of equal importance was the employment provided for the growing numbers of the poorest classes of the islands who had no access to land.

Large expenditures and prolonged efforts through the 1980s and early 1990s have had little apparent success. In part, this is related to determination of the State to ignore the experience of the local mountain farmers and to pay scant attention to the rationale of the traditional irrigation systems. Fortunately, research funded by the government of the Netherlands (Santo Antao Rural Development Project) has drawn attention to the basic compatibility of the traditional systems with the local environmental and socioeconomic circumstances (Haagsma, 1995). A new approach to State intervention is needed but the progress of change is likely to be extremely slow. However, one of the major constraints to change is the importance attached to the secondary objective of provision of employment for increasing numbers of landless poor.

This example is representative of the many ill-conceived lowland-based schemes worldwide that have been imposed on supposedly ignorant and inefficient local mountain people.

### **The Atlas Mountains of Morocco**

Substantial changes in land management have occurred in both the Middle and the High Atlas mountains of Morocco throughout the twentieth century. The Middle Atlas presents an especially interesting example of the results, at least in part, of outside lowland intervention. During the late-19th and early-20th centuries the traditional pattern of land use was one of extensive pastoral nomadism with seasonal movement of herds, combined with low-altitude agriculture. Winter herding in the highlands was not feasible due to

heavy snow and low temperatures in a system that did not include permanent animal shelters.

French colonial settlement and the acquisition of prime low-altitude land in the first half of the 20th century induced significant changes on this pattern of indigenous life, mainly herding on a year-round basis at high altitudes.

Accompanied by increasing population size, this change led to increased pressures on available land and to the need for intensification of use, increased technological inputs, and for earned cash. These forces set in motion a scramble for control of resources between those segments of society with access to political and financial capital, newcomers to the region who had entrepreneurial skills and capital but no access rights to communal land, and the majority of the rural population. This has produced a web of social conflict for which no solution is apparent, especially between insiders and outsiders. The indigenous groups tend to deny pasture rights to newcomers. There are also conflicts between large-scale herders who are heavily extractive of resources and small herders who support the need to limit herd size. It is the former, however, who are the more influential politically. Finally, there are conflicts between segments and clans within an individual group over access rights to grazing land. The basic problem appears to be the apparent refusal of all sectors to integrate agriculture and pastoralism and particularly to limit total numbers of grazing animals (Bencherifa and Johnson, 1991).

In discussing Moroccan economy as a whole, Funnell and Parish (1995) indicate that a combination of growing population pressure and deliberate government policy is leading to more efficient intensity of land use. Despite identification of some sites of extensive erosion damage, there is little evidence of a general fall in productivity. This is partly due to the efforts of the mountain inhabitants to adapt their production systems to the opportunities created by interaction with the national economy. Nevertheless, they argue the need for a much better integrated highland-lowland resource-use policy and a more holistic planning framework.

### **Colorado, U.S.A. Rocky Mountain Gold Mining**

Gold mining in the San Juan Mountains of Colorado has taken place intermittently since the 1870s along with secondary production of copper, silver, and lead. In 1986 open-pit operations began using cyanide heap leaching to recover gold, but ceased six years later. The new mining penetrated 19th century workings and released excessive amounts of toxic pollutants in the Alamosa River system. Clean-up operations, to comply with the laws of the United States Environmental Protection Agency (EPA) bankrupted the mining company and left the problem in the hands of EPA with a management cost of US \$40,000/day. This has become a *cause célèbre*. In 1993 the Colorado Division of Minerals and Geology had only six inspectors to oversee 2,500 mining and exploration operations. A Study Group was established to seek a better understanding of the magnitude of the problem.

## Overview

The several foregoing examples illustrate the wide range of issues, the degree of uncertainty, and the need for unbiased collection of relevant data and their rigorous analysis. There is no wish to imply that problems can best be solved by simply stopping the processes of 'development'. The complexity of many highland-lowland issues needs to be recognized and informed decisions taken so that inevitable trade-offs can be designed to ensure maximum benefits and to avoid unnecessary losses. Yet these mountain - lowland challenges are further complicated by the geophysical instability that characterizes mountains. The very process of mountain building is still very active today in the form of tectonic plate movements. Seismic activity is primarily aligned within mountain systems, or parallel to them with epicentres beneath the adjacent lowlands. Earthquakes are hazard enough in themselves, but as the majority occur within or close to mountain ranges, they serve as critical release triggers for a wide range of secondary natural catastrophes.

Recognizing the ecological dimensions as underpinnings, the social, economic, and political dimensions of highland-lowland linkages will now be outlined. There is significant overlap between them. Similarly, the physical interrelationships will underlie much of the discussion since it is the high degree of contrast between highland and lowland that provides the primary justification for this treatment. Thus, many of the processes that are driven by the rapid penetration of world market forces and post-Cold War political developments

into all remote and marginal regions of the world have a particular significance in the context of highlands and lowlands.

Institutions change through time, so that the actual and perceived value of different elements, such as natural resources -- endemic and rare plant and animal species, and cultural and ethnic differentiation, will also change. Another factor that significantly affects highland-lowland interactions is the quality of governance. Frequently, bad governance is a primary cause of many of the negative reactions between highlands and lowlands. This will become apparent as the following case studies are examined.

As emphasized in the opening sections, the combination of remoteness, isolation, relative inaccessibility, and extremely complex and difficult terrain (which may be subsumed under the term 'marginality') has set a centuries-long pattern for evolution of the ways in which mountain communities have adapted to their environments. The concepts of 'mountain refuge', and 'mountain barrier' (to communication), frequently have been over-used in attempts to contrast societal development in highland regions with those in lowlands. 'Remoteness' and 'inaccessibility' must be treated as relative terms. Even the highest, most inaccessible, and most difficult mountain regions have yielded routes for trade, the spread of religion and culture, and the movement of conquering armies. For example, the various tentacles of the ancient 'Silk Road' had penetrated the most formidable terrain of Central Asia hundreds of years ago. Hannibal crossed the Alps with his entourage of elephants. Today, the Alps

are barely a physical barrier between Central Europe and Italy. Nevertheless, while the 'obstacle' of the Alps has been greatly reduced by modern communication systems, heavy commercial traffic is still limited to a very few mountain routes and this has created its own peculiar problems, including congestion, air pollution, and political-economic tension between the Alpine countries and the industrial powers to north and south.

In a very different setting, the tourist can now bicycle the Karakorum Highway from Islamabad to Urumqi, and onward to Lhasa or Beijing, if personal compulsion matches the challenge. However, any discussion of mountains as barriers, or of remoteness and inaccessibility, needs to consider the balance between possibility, feasibility, and economic viability. For example, the construction of the Karakorum Highway was extremely expensive, both in terms of finances required and of workers' lives lost. Its motivation was political and military. It would never have been attempted if trade (the world market) had been the sole driving force. And once completed, maintenance costs of mountain routes remain formidable and unstable slopes and severe weather ensure that passage is unreliable and routes may be blocked for a significant number of days in the year (Kreutzmann, 1991; Hewitt, 1993).

The construction of approximately 44,000 km of roads throughout the Indian Himalaya after 1962 was motivated by the Indian government's reaction to the perceived threat of Chinese invasion. The impacts of this roadbuilding programme, however, has been most significant, not in military terms, but in the

social and economic consequences. Some of these changes have been positive – the introduction of schools, hospitals, and communication links that have opened up trade. But many impacts, at least up to the present, have been negative -- ease of access for illegal exploitation of mountain forests by power brokers on the plains, traffic in illegal narcotics, accelerated landslide and soil erosion incidence, and destruction of agricultural terraces.

## SOCIAL DIMENSIONS

Social aspects vary according to the degree of development of the region under consideration. While the situation that prevailed in Switzerland, for instance, 150 years ago, may have some parallels with Nepal or Ecuador in 2001, any direct comparison in the present context would not be very instructive. Despite this, there are some common principles that can be identified.

Migration is perhaps the most significant and far-reaching of the highland-lowland linkages -- human transfers become the precursors of commodity transfers, both commercial and cultural, as well as the setting for potential ethnic conflict. This aspect, therefore will receive special emphasis.

### **Migration Patterns**

Migration is an age-old response to limited resources, going back to nomadic and transhumance activities in prehistoric times. Individuals and entire communities have searched for 'greener pastures' and the movements have been both uphill and downhill depending upon an array of circumstances. As

globalization accelerated during the 20<sup>th</sup> century, so local life aspirations changed. Thus, when a subsistent farming or herding community begins to covert elements of Western material culture (wrist watches, radios, TV, lap-top computers) and demand what have come to be regarded as basic essentials, such as health care, safe water, sewerage, Western urban facilities in general, the definition of 'poverty' inevitably changes. The acquisition of increased material assets requires cash. Contact with tourists, development agency expatriates, and urban societies in the lowlands, enhances the local self-perception of poverty (often leading to loss of pride). The so-called bright lights of the city, coupled with improved road access and local absence of wage-earning opportunities, have prompted various forms of out-migration. Such movement of people affects the various sectors of subsistence communities in different ways and at different times. Today, migration from mountains to urban areas is usually a response to differences in employment opportunities, real or imagined, although many other factors are involved.

Migration from the highlands often begins with young males seeking wage employment in the neighbouring lowlands during the agricultural off-season or, depending upon local conditions, on a daily basis. This has been facilitated by the recent penetration of road networks. Later, individual males and young couples may migrate, or entire families, even communities, for a year or more, or permanently. Especially where such a process involves large

numbers of people, as it frequently does, then the consequences are highly significant.

Andean Migration Patterns: The results of studies in the Andes by Paul Baker and his research team (Baker and Little, 1976) illustrate some of these principles. Although this work was completed during the 1970s, and conditions in Peru and Bolivia have since changed substantially, Baker's experience and insights are fully germane today.

Baker's group were able to show that the main flows of migrants were as follows: highland rural to highland urban; highland urban and rural to lowland urban; and highland rural to lowland rural.

The highland-to-lowland transfer had two major components: to coastal lowland (primarily the desert coast of Peru) and to tropical Amazon forest lowland and the Yungas (mountain forest belt between 1,000 and 2,000 m asl.). The consequence of this pattern of migration was under-populated highland villages with the demographic structure skewed toward the aged and female, thus severely limiting the viability of highland subsistence villages. Equally important were the impacts on the receiving areas. The already over-stressed urban infrastructure incurred additional pressure, accelerating the massive build-up of slums (*barriadas*). It is estimated that during the decade of the 1960s alone, there were 660,000 migrants out of the Peruvian highlands to the coast and 75,000 to the Yungas (Little, 1981).

This transfer of highlanders to low altitude led to an increase in respiratory and other health problems, an unskilled immigrant population, often not Spanish-speaking, subjected to exploitation and highly susceptible to industrial accident. The result was social unrest, at times becoming violent.

Where the migrants moved into lowland forest areas there also were serious environmental impacts. For instance, the highlanders brought with them farming methods totally unsuitable to a forested landscape, including deforestation for its own sake because of the oppressive feeling of forest living by people brought up in an open-sky puna environment.

Lima, the capital city, has been the recipient of the majority of the migrants, adding to its appalling slums, devoid of safe water, sewerage, police protection, even adequate shelter. It can be argued that the brutal insurgency of the *Sendero Luminoso* (Shining Path) was at least in part provoked by the government's inability to combat the enormous social inequalities. The subsequent events surrounding the elimination of the *Revolucionario de Tupac Amaru* must be considered in this context: it is remarkable that the military force that attacked the Japanese embassy to free the hostages managed to kill every insurgent without themselves suffering injury. And while military force has made Peru safe for tourists once more, prevalence of highland, and related lowland, poverty may well lead to even more serious catastrophe in the future. The ousting of President Fujimori and the political turmoil faced by Peru during 2000 give further credence to this viewpoint.

However, there have also been positive outgrowths from the highland-to-lowland migration. Successful migrants who subsequently return to their home villages provide leadership and the means for financial investment. Frequently, remittances and innovative ideas have been of considerable importance. Part of the problem, however, has been the sheer scale and speed of the population movements that may overwhelm any attempts to coordinate them, even when such efforts were initiated by the state.

Himalayan Migration: The pattern of out-migration from the Andes to the subjacent lowlands has some parallel in the Himalaya and Karakorum. Goldstein *et al.* (1983) argued nearly two decades ago that Nepal was transforming from a mountain-rural to a lowland-urban society. This process has certainly accelerated since Goldstein's group completed that study. It is tempting, however, to over-emphasize the negative early-phase effects: a desperately polluted and unsightly Kathmandu with uncontrolled urban spread and land speculation consuming prime agricultural land, and deforestation and the spread of urban slums in the Terai. These adjustments in demographic balance presumably will have longer-term effects that *may* be far from negative; the intervening period, however, is one of significant hardship.

The Industrialised Mountain Countries: In strong contrast to the Andes and Himalaya, there is also an important movement of people from crowded lowland urban centres to the highlands, attracted by clean air, relatively undisturbed wildlands, and open skies. This is best described as 'amenity migration' (Moss,

1993, 1994; Price *et al.*, 1997) and is typical of extensive areas of the American mountain West. Such migration is made possible by modern technology, such as telecommuting, personal helicopter transport, and other leading-edge 'hi-tech' developments. Yet there are negative impacts here also: fragmentation of mountain forest landscapes as the new 'ranch-style' mansions are constructed and friction between the new rich immigrants and earlier settlers.

The problems of mountain-lowland population change in the Alps are ably demonstrated by Bätzing *et al.* (1996). Their study shows the need for data collection at the smallest possible administrative level (in this case, the commune). They conclude that current development trends indicate a growing concentration of jobs and the bulk of the population into a few favourable locations (transportation corridors and nodes) while the real Alpine Zone, with a few notable exceptions, is losing its productive potential. It is argued that any proposed new 'European policy', based upon the false assumption of overall rapid and fairly uniform growth throughout the Alps, would accentuate this process. This would lead to highly productive centres within comparatively small mountain areas and the potential for break-down of economic activity in all others. Thus a crucial question arises: would this lead to serious ecological, social, cultural, and economic problems throughout much of the Alps? Even without the impact of new policy based upon the European Union study, Bätzing *et al.* (1996) predict that unless present trends are arrested a total collapse will

occur, accompanied by the effective disappearance of several hundred mountain communes, paralleled by vigorous growth in the more favoured areas.

Similarly, the continued movement of urban Norwegians into the mountains for recreation (amenity migration) and the pressure for expansion of the national mountain parks is causing friction with the mountain farmers who have maintained the landscape for generations. Here the definition of 'wilderness' is in contention since the mountain farmers, in fact, have created and maintained a very attractive semi-wild *cultural* landscape and feel that they are best able to ensure its appropriate use (Kaltenborn *et al.*, 1999). There is additional recent controversy over the spread of wolves and contrasting legislation between Norway and Sweden (Thor Midteng, personal communication, January 2001). In this instance the Norwegian mountain farmers are pressing for a legalized culling of the wolf population as a defensive response to loss of sheep that graze unshepherded across the mountain landscape. In contrast the urban recreationalists and 'green' elements demand protection for the wolf. This is further complicated by the situation across the border whereby Sweden, which practices sheep enclosure, wishes to maintain a population of about 500 individuals that do not recognize the international border.

The foregoing discussion has focused on a few migratory patterns between highlands and lowlands. There are many more. For instance, in the Assam Himalaya lowland people are moving upward in response to land

shortage on the Brahmaputra plains. In Northern Thailand ethnic Northern Thai farmers, in response to increasing fragmentation of land holdings in the river valleys as population pressure increases, are expanding upward into the nearby hills. Here they practice some of the most environmentally damaging forms of slash-and-burn (swidden) agriculture and transgress onto traditional lands of the Hill Tribes who lack Thai citizenship and thus have no title to lands they have used for generations

A fascinating, and possibly unique form of highland-lowland population transfer has occurred in Tajikistan. During the Stalinist period many thousands of mountain Tajiks were forced out of Gorno-Badakhshan in the Pamir Mountains to labour in the cotton fields of the southwestern lowlands (initially to meet the urgent demands for gun cotton during World War II). With the onset of *perestroika* in 1987, many mountain Tajiks began to return to their home villages (*kishlaks*). However, it was not a complete re-migration; many of the middle generation had come to prefer lowland and urban living to the hardships of mountain life and the prospect of having to rebuild, often from the rubble of their original homes that had been dismantled by the Red Army. The returning people, therefore, consisted mainly of old folk and their grandchildren. Another aspect of this episode is that, for almost half a century the mountain vegetation had been virtually undisturbed, so that the western Pamir, in particular, emerged as one of the best preserved mountain forest landscapes in Central Asia. These trends were then disrupted by the onset of the Tajik civil war in 1992; the

situation remains tense, if not unstable (Cunha, 1994, 1997; Badenkov, 1997; Ives, unpub.).

The Tajikistan scenario introduces political and military aspects that require full and separate treatment. Nevertheless migration, whether in-migration or out-migration, forced migration and refugees fleeing from war and famine, or the movement of individuals and small groups seeking better economic and social conditions, is a late-20th and early-21st century phenomenon of world-wide proportions. It probably affects all countries on earth. However, highland-lowland migratory interactions represent a special case because of the great contrasts in environment and economic opportunities that occur over very short horizontal distances.

Of urgent concern is the frequency of forced migration that often arises from ethnic divisions. The case of Bhutan, unfortunately, illustrates this rather well. Today over a hundred thousand refugees, who claim themselves to be citizens of Bhutan, have been living in totally unacceptable conditions on the Terai of eastern Nepal. They are Bhutanese of Nepali origin, Hindus by religion, many of whom maintained themselves as subsistence farmers in lowland Bhutan for several generations. Large numbers were forced to leave their homes and to cross into India for rapid transfer to Nepal. The refugees, together with their Hindu compatriots who remain in Bhutan, constitute about a third of the total Bhutan population. Some of the abandoned farmland has been allocated by the Bhutan government to highland people of Buddhist persuasion, further

complicating the situation. Currently, high-level talks between Nepal and Bhutan government authorities may lead to a form of refugee classification and repatriation, although the outcome will be fraught with problems.

### **Cultural Diversity**

As a result of the historic isolation and difficulty of access mountain regions are some of the most culturally diverse on earth. The retention of traditions, languages and dialects, ethnic dress, architecture, methods of land management, and farming techniques and food crops, have tended to portray many mountain areas as virtual cultural museums. At least, the glossy brochures of large tourist enterprises give this impression.

Increased contacts between highland and lowland communities that have been accelerating rapidly over the past half century carry significant implications such as the migratory movements already discussed, interventions by aid and development agencies (national governments, UN and bilateral aid agencies, and NGOs), tourism in its many forms (mass tourism, ethnic or cultural tourism, adventure tourism, eco-tourism, and mountaineering).

There have also been deliberate attempts by national governments to forcefully integrate ethnic 'outliers', especially those close to ill-defined or contested frontiers. The function of political boundaries is the more formidable when large and distinctive ethnic groups occupy traditional territory that transcends frontiers of the 20th century. The lands occupied by the Kurds, the Uigers, and the Kazaks are pertinent examples. Serious difficulties also arise

because of religious compulsions as in Kashmir, Afghanistan, the Balkans, and Armenia.

In many instances the problem is not simply the strong sense of ethnic affinity, but the very way of life that extends across these frontiers. In particular nomadic peoples who traditionally travelled great distances to ensure access to sustainable grazing for their flocks found difficulty adapting to modern political reality. On a less extensive horizontal scale, transhumance, for instance in the Spanish Pyrenees, has almost disappeared as more recently introduced land-use practices, such as cereal growing under irrigation in the lowland winter grazing areas, and ski resorts at high altitudes, tend to prevent the effective seasonal movement of large numbers of animals.

The Chinese closure of the frontiers of Tibet (Xizang Autonomous Region) in 1958 has had a severe impact on patterns of movement for grazing and trade and has induced the transformation of many high mountain societies such as the Sherpa. Within-country transhumance, as in the case of the Gaddis and Gujars of the Indian Himalaya, has been extensively disrupted resulting in severe damage to high alpine pastures and the very restricted travel routes that have now been enforced (Hoon, 1996; Chakravarty-Kaul, 1998).

The visits of large numbers of lowlanders to mountain regions in the form of mass tourism that has expanded exponentially over the last 40-50 years have had far-reaching impacts. Long perceived as a great panacea for elimination of poverty in developing countries, tourism has both social and economic overtones

and will be detailed more fully in the next section (pp. 38-43). Nevertheless, the overall consequences for distinctive mountain cultures of these rapidly increasing numbers of contacts have tended to be heavily negative (albeit with some exceptions).

Where the mountain communities have a strong control over access to local resources and stable local institutions, increased contact with their lowland neighbours can be positive. The local people of the Ötztal, Austrian Tyrol, children and grandchildren of poor mountain farmers of the first decades of the last century, retain control of their inherited land and have become hotel owners and ski resort operators. Local pride and a sense of independence ensured the preservation of local culture, if not its actual enhancement. This has led to a 'neo-Tyrolian' style that has become a primary attraction for the tourist from the lowland and urban hinterland. Yet, as Moser and Moser (1986) demonstrate, the costs have been high and there are significant negative consequences, both environmental and in terms of social division with creation of a considerable economic gap between the successful entrepreneurs and those continuing to farm. The irony is that the perception of landscape beauty by tourists, essential for commercial success in summer, and the stability of the environment itself, depends heavily on the continuation of traditional farming practices. The apparently obvious solution, transfer payments from affluent hoteliers to farmers, has its own set of social difficulties.

## **Environmental Management**

This is a very complex topic, if only because of overlapping individual, community, and government authorities. Generalization, therefore, is not warranted. Traditionally, many mountain communities had a much more egalitarian set of institutional arrangements than found in many other parts of the world. There tends to be greater community-wide decision making participation regarding access to natural resources. For example, in the Swiss Alps, the closed-corporate village ownership of alp pastures and mountain forests in conjunction with individual family control of cropland, vineyards, and domestic animals has been the traditional pattern for centuries in Canton Wallis (Netting, 1981). The small village of Torbel, situated above the Rhone Valley, was the focus of an exhaustive anthropological study by Netting. He demonstrated that the preservation of local traditions and pre-modern sustainable living were such that, during a 300-year period, only three families emigrated into the village from 'outside'. Even so, to maintain a stable population and local self-sufficiency the village also depended upon out-migration of young men as mercenaries in foreign armies, together with remittances to their home families, and the accumulation of a significant proportion of unmarried spinsters ('aunts', as domestic labour). These are attributes where the good of the community was set as more important than individual rights, something that would hardly be acceptable today.

Present-day mountain communities have been encroached upon by the larger institutions of more powerful lowland centres. A telling instance is the detrimental impact of the Kathmandu government's nationalization of forests in the 1960s. This caused the break-down of many village institutions that had served to safeguard the local environment, especially the forests. Nevertheless, as centrist control has been reduced, the resilience of those village institutions has been demonstrated repeatedly, a justification of enhancing local access to resources.

In contrast, there are large-scale developments of mountain resources where powerful lowland institutions have completely overwhelmed local interests. These types of development have frequently resulted in total alienation of local institutions. They include the construction of medium-scale, and especially, mega-hydroelectric facilities as well the establishment of many mountain national parks worldwide. The national park movement has been motivated, at least in part, by the desire of national governments in developing countries to increase their access to foreign exchange. The hydroelectric projects for water and power are primarily, if not solely, for lowlanders, or lowland elites and industry. These types of development have frequently resulted in severely reduced local access to environmental resources. In the case of the power projects, large areas of forest and fertile agricultural land have been submerged, large numbers of poor people have been forcibly displaced, frequently with inadequate, or even no, compensation. Often, the viability and safety of the

projects themselves have been in doubt. In the case of national parks, traditional hunting and collecting rights of the indigenous people have frequently been eliminated or constrained. Here the resources involved are often the intangibles of scenery, clean air, and adventure, on the one hand, and indigenous access to hunting, logging, grazing, and the gathering of medicinal plants, on the other. The additional all too common combination of corruption and collusion between government officials and lowland timber industries have caused serious destruction of forested mountain slopes. These clearly environmentally and socially disruptive activities have also resulted in an upsurge of local unrest. The expansion of the Chipko Movement and the current determined opposition to the Tehri Dam in India are oft-quoted examples, although these types of local unrest are widespread throughout the mountain world. The extraction of mountain resources for lowland sectoral benefit has become a major source of contention; the more extreme cases amount to ruthless exploitation.

Much more favourable and constructive examples of development of mountain resources, however, can be identified in Switzerland and Italy, where mountain farmers receive financial compensation when high alpine valleys are submerged as part of hydroelectric developments. In many instances, the highlanders receive proportionate benefits from the overall sale of electricity to the predominantly lowland customers. Even here, however, there are instances whereby mountain communes perceive their compensation to be inadequate, or the powerful lowland institutions are unwilling to modify original contractual

agreements despite significantly changed economic conditions over time.

## ECONOMIC DIMENSIONS

From the large array of economic interrelations between highlands and lowlands, only a few are introduced here and the degree of overlap between the social, economic, and political linkages needs to be emphasized once more.

### **Tourism and Transfer of Economic Costs and Benefits**

The development of tourism has been an accelerating world-wide phenomenon since the 1950s. It is never a local phenomenon and has depended upon the growth in rapid transportation links; it has also served as a driving force for such growth, a self-reinforcing process. Two primary areas of tourist destination have come to dominate: seaside and mountain. Tourism is frequently claimed as the world's largest industry, employing over 200 million people in the early 1990s -- a tenth of the world's workforce -- and ensuring a cash flow of US \$ 3.4 trillion. These figures are expected to double within the next decade (World Travel and Tourism Council, 1995). One of the noticeable trends has been pressure on the tourist industry to locate and develop new, exotic, remote destinations. The very success of such a process causes the eventual stagnation of the 'new' destinations as the *avant guard* press on to another set of even newer and more exotic destinations. Today, with the exception of areas of armed conflict, there are very few mountain areas that have not been probed by this voracious industry.

Tourism has also developed its own series of specializations: general mass tourism; eco-tourism, adventure tourism, culture tourism, and even specialities such as group tours to view butterflies or to photograph a single rare species of animal. Mountaineering, of course, is classed as one specialized form that dates back to the evolution of alpinism and skiing in the Alps in the 1870s; its expansion over the last three decades has led to a special set of problems, such as the need for highly expensive and dangerous ecological clean-up on Mount Everest (Tabei, 1999) and the loss of lives of wealthy would-be summiters who have limited mountaineering experience, but are willing to pay as much as US \$50,000 for a guided climb.

Each of the various forms of leisure travel has had its own impacts on mountain communities, wildlife, and environment in general, despite the original optimism that such commercial undertakings would be a sure antidote to poverty in many of the 'target' developing countries (e.g. Nepal, Ecuador, Kenya, Ethiopia, Kalimantan). Tourism must also be considered in conjunction with the associated demands for modern amenities and the setting up of rivalry between different local destinations.

What has happened? Much of the financial investment needed for tourist infrastructure has been derived from corporations in the industrialized countries. Consequently, most of the profits have returned to the sources of investment. Landscapes and communities have been exploited and transformed; remarkable mountain ethnic minority cultures have been disrupted. Yet seldom is there any

repatriation of profit from the lowland-based entrepreneurs to the mountain communities.

As local (destination) facilities, such as hotels, ground transport systems, and airports have been established ownership has only rarely been in local (village level) hands. And while hundreds of thousands, even millions, of jobs have been created, the vast majority have been at the lowest pay scales -- waitresses, porters, cooks, laundry maids, or much worse (prostitutes). This, together with lack of affordable housing for the lowest-paid workers, hardly constitutes significant benefits. In addition, the original local people frequently have difficulty coping with the associated rapid rise in property values.

There have been exceptions, most conspicuously where the destinations had a strong pre-existing infrastructure and effective local institutions ensuring local access to resources. These tend to be destinations in the industrialized countries, with the European and New Zealand Alps as notable examples, but by no means universally so. It can be postulated, however, that the greater the financial and educational gap (represented by the standard of living) between the tourist source area and the destination, the greater the likelihood for exploitation and environmental and cultural disruption, whether deliberate or unwitting.

In this context, however, Bhutan is frequently cited as an exception. Here the numbers of tourists, fees charged, as well as their itineraries, are tightly

controlled by the government. Thus this exotic mountain destination has become a reserve of the wealthy tourist. Another exception, although much less extreme, is the case of the Sherpa of Khumbu, Nepal. Here a fiercely independent and institutionally well-functioning mountain minority has retained a large degree of control and has found an outlet for traditional entrepreneurial spirit. Since trekking tourists with large numbers of porters started walking to Namche Bazar and the Mount Everest base camp in the 1960s, the influx of visitors has come to outnumber the inhabitants by about 3 : 1 (Stevens, 1993) -- by 2001 this had probably reached 6 : 1. Life styles have certainly changed. The Sherpa standard of living has risen remarkably. Schools, hospitals, and health care centres have mushroomed, as have the large number of small hotels and tea rooms, and there has been a resurgence of local financial support for the traditional monasteries. Yet this progress has been gained at a considerable cost. At the very outset, the original plans for the establishment of the Sagarmatha (Mount Everest) National Park called for the forced evacuation of the Sherpa. Today, friction between the local village enclaves and the park management remains. The demand for, and the high wages and prestige vested in the position of high-altitude support climbers and porters (the very word 'Sherpa') has resulted in the disproportionate elimination of many of the finest young men through accidental death and debilitating injury at high altitude.

An entire sector of what may be classified as another form of specialized

tourism is pilgrimage. All the major religions, and many of the lesser ones, have sacred sites in mountain ranges (Bernbaum, 1990). This phenomenon dates back many centuries, if not millennia, and is world-wide in extent. This is as characteristic of the Andes as it is of Navajo country in the American Southwest, Greece, the Middle East, Indonesia, China, and Japan. Several hundred thousand Hindus annually visit the sacred sites of the Himalaya; Mount Kailas is as much a major sacred destination for Hindus as it is for Buddhists. During recent decades this mass movement of pilgrims into the mountains itself has attracted more tourists who accompany them to witness the spectacle rather than for their own religious fulfillment. The resulting over-crowding is causing environmental deterioration and pollution. Yet in at least one instance sensitive intervention with some of the high priests has resulted in a partial harnessing of the pilgrim traffic to carry in and plant thousands of tree seedlings.

There are many other aspects to this enormous process. For example, specific nodes become 'gateways' for the outward spread of tourism's tentacles, which is a form of lowland to highland linkage as seen in the rapid growth of such central places as Interlaken, Switzerland, Colorado Springs, USA, Innsbruck, Austria, and Kunming, China and their transport facilities. In mid-latitude mountains the delicate balance between summer and winter tourism must be considered, both in terms of timing and the ski season potential damage to beautiful meadows essential to maintain a frequently different summer clientele.

In conclusion, it is contended that mountain tourism, one of the most dramatic development processes in terms of affects on local culture and environment, has been more damaging than beneficial. The massive increase in contact between the relatively wealthy visitor from distant places and the local inhabitant, has been a powerful force for changes of all kinds. The dangers of uncontrolled tourism, however, have been widely recognized over the past decade or more and there has been a strong upsurge of environmental and cultural awareness together with attempts at more appropriate management.

### **Environmental Resources: Transfer of Economic Costs and Benefits**

Throughout human history, transfers of peoples and two-way cost-benefit exchanges between lowlands and highlands have persisted. These traditional forms of interaction have involved primarily contractually-shared access to renewable natural resources. The prime example is seasonal transfer of domestic animals from winter grazing at low elevations to high-altitude summer pastures. These transfers have involved many different forms: full nomadism, transhumance in many forms, and mixed farming, such as *Almwirtschaft* in the northern Alps.

Frequently there have been centuries' old contracts whereby sedentary lowland and mid-altitude cultivators open their winter fields to fallow grazing for the livestock of the transhumants in return for animal fertilizer, milk, and meat. As the on-coming summer results in the movement of the transhumants and their animals to progressively higher pastures, the fallow land is sown with

the next season's crops by the sedentary farmers. The herds finally spend several weeks grazing the nutrient-rich pastures above timberline and, as recently determined, help to maintain the biodiversity of the meadows. Finally, completing the ancient cycle, herds and people descend again with the approach of autumn (Uhlig, 1995).

These delicately balanced systems have been disrupted by modern 'development'. Chemical fertilizer and irrigation provide the nutrients for winter cultivation; hydroelectric projects, closure of international frontiers, and/or imposition of customs duties for border crossings all impede or destroy these traditional ways of life. The negative effects are both environmental and cultural and it is being realized that many of these age-old forms of resource use have considerable environmental advantages. Hoon (1996) and Chakravarty-Kaul (1998) have pointed out that much of the damage is unnecessary and, at least partly, is the result of ignorance and lack of understanding on the part of government officials: the transhumants are disadvantaged in any negotiation for compensation because their traditional 'rights' usually cannot be documented -- also, they are frequently regarded as an undesirable, uncooperative, and 'shifting' people. This has been a burden carried by nomadic groups over the centuries.

The modern sets of lowland-highland economic transfers frequently involve large-scale engineering enterprises, such as hydropower development, mining, strategic highways, tunnels and avalanche sheds, and exploitation of

mountain forests. Two special cases of national parks and world heritage sites have been considered below (pp. 87-95; 96-102).

In the past mining in mountain regions tended to be totally exploitive and extremely destructive, both of the mining site itself and its ultimate abandonment, and downstream in the context of irresponsible disposal of toxic wastes. This type of massive environmental damage also has frequently devastated indigenous populations. There have been several major controversies in recent years. One of the most conspicuous cases is the Ok Tedi mine near the summit of Mount Fubilan in Papua New Guinea. Another *cause célèbre* is the Panguna copper mine on Bougainville, also Papua New Guinea, where the extensive environmental damage and lethal dispersal of toxic waste has caused destruction of livelihood and serious health risks to the local Bougainvillians; this in turn has led to armed insurrection, temporary mine closure, and a nationalist independence movement with a drive to achieve unification with Fiji.

Fox (1997) has contributed a comprehensive overview of the pros and cons of mining in mountains. As indicated above, environmental and cultural damage has been on a colossal and global scale. However, Fox demonstrates that the principles of sustainable development and 'green mining', Ok Tedi and Panguna notwithstanding, have recently been adopted by most of the large multinational mining corporations. It remains the lot of the poor indigenous miners, and the smaller mining companies controlled largely by the governments of developing countries, to perpetrate the worst effects of 'negative' mining. The

history of the centuries-old mining at Potosi, Bolivia, provides a good illustration. Despite identification of the old mining core as a World Heritage Site, giving a new source of 'green' income from tourism, the remaining large areas are still being exploited on an individual miner, or family, basis and are a threat to human life and environment.

The effects of large engineering works in mountains (roads, railways, tunnels, avalanche sheds, hydroelectric projects) are complex and there is a great contrast between extant conditions in the industrialized and the developing countries, and between the situation today and that of 50 or 100 years ago.

The Alps have been the site of some of the earliest large-scale engineering works: for example, the great rail tunnels that were built at the beginning of the last century. While each project should be assessed individually, the overall effects may be regarded as highly positive, in terms of economic benefits, both lowland and highland, the provision of new jobs in isolated mountain areas, and a general increase in standard of living for mountain communities. However, the construction of large dams remains controversial and the 'green' movement today is routinely challenging the damming of additional mountain valleys, whether in the Alps, Scandinavia, or the Rocky Mountains. It can be argued that the era of big dams is over for the industrialized countries; some dams may even be dismantled. In contrast, big dam construction in the mountains of many developing countries has barely begun. Even so, local protests are becoming

increasingly vociferous. It is worthwhile examining the reason for this, since the central cause is often an issue of inappropriate highland-lowland interaction.

It would appear that today the opportunities for reinforcing the more equitable sharing of benefits from hydroelectric developments are exceptionally good. Within much of the industrialized world, while compensatory arrangements are often contested as inadequate, financial compensation to highland communities has become the norm. Unfortunately, this is not so in many of the developing countries, even when the financial investment comes directly or indirectly from United Nations or bilateral aid agencies.

Entire ethnic minorities, either in small villages, or communities of over several hundred thousand population, have had their land confiscated or today are under threat of disruption. The Himalayan countries seem to have a special propensity for forced expropriation of land with no, or minimum, compensation for the dispossessed. In Tajikistan, in the early 1980s work began on the Röggen Dam on the Vakhsh River which was set to become the world's highest earth-filled dam. At its originally designed height over 200 mountain villages would eventually be submerged. Events were overtaken with the onset of *perestroika* and the emergence of a strong 'green' party in Dushanbe. Their efforts, ironically, were aided by the repatriation of many of the engineers and architects to Russia as Tajik nationalism began to be reestablished. Civil war in 1992-1997, brought progress on the dam to a standstill. Today the region of the

upper Vakhsh River -- which includes the dam site -- is in the uncertain hands of a militia group that did not participate in the UN brokerage of peace between warring factions. The stalemate appears to be indefinite; even so it is doubtful that a complete peaceful resolution would ensure construction of the dam to its full design height.

The Middle Mountains (*Mittelgebirge*) of Germany provide an excellent example of cost-benefit exchanges between highlands and lowlands (Stadelbauer, 1991, 1996). This has been achieved over the years at the level of the state governments. There is a complex of programmes and subsidies that differ from state to state, although much of their impact is comparable. The Middle Mountain regions have become progressively more marginal in terms of the economic viability of agriculture within Germany and the European Union. Preservation of the mixed farm-forest landscape, however, is seen as vital not only to the success of tourism. It is also important in broad considerations such as landscape preservation, watershed protection, air pollution, and maintenance of recreational outlets for the large, stressed urban areas. The overall political aim is to preserve the cultural landscape within this densely populated and urbanized country. This involves the transfer of funds from the richer lowland and urban centres to the mountain inhabitants by a series of direct and indirect subsidies. Preservation of highland beauty and recreational amenities coincides with ensuring environmental stability and is achieved by transfer payments from the lowland beneficiaries.

This process of mountain landscape preservation, typical of European countries and taken up specifically within the Alpine Convention, could become a valuable model for appropriate highland-lowland interaction in the Himalaya, the Andes, and elsewhere. While the basis of any such undertaking will be economic, the short-term chances for successful application will depend upon the development of the necessary political willpower.

### **Remittances**

The age-old pattern of mountain communities supplying a nearly constant flow of young males to the lowlands to serve as mercenaries in foreign armies continues to this day, although the source areas have changed over time. The best-known historical example is the provision of mercenaries from Swiss alpine cantons. The disastrous defence of the Tuileries, Paris, 1793 is an outstanding example, made the more dramatic by the French government's recent settling of the compensation for lives lost nearly 200 years after the event. The Swiss Guard at the Vatican is the surviving symbol of a proud tradition. Yet the implications of this transfer of young men from the mountains to the lowlands had characteristics in addition to the simple financial transfusions into poor mountain villages. Undoubtedly the soldiers who survived and returned home introduced new ideas and technologies. But there was a further very important factor - de facto population control in the mountain villages, both from soldiers' lives lost, and from children not conceived.

The British Empire in India initiated the equally proud tradition of

incorporating Gurkha regiments into the British army. The flow of Nepalese mountain soldiers became firmly established following the provision of troops by the Nepalese government to assist the British during the Great Indian Mutiny (Sepoy Rebellion) in the mid-19th century. The Gurkhas became known worldwide as the most loyal and most feared fighters of World War I. More recently, Gurkha service during the Falkland Islands War and current recruitment into the Indian and British armies, albeit much scaled back, are indications of continuation of this tradition. The return effect on the village source areas has also been dramatic. Villages with increased cash income from army wages sent home, the eventual retirement of the soldier back to his home community with his pension and with the experience he acquired in foreign service, have a greatly enhanced standard of living compared with the less 'favoured' villages whose young men did not qualify for army service. Presumably loss of life from a highly valuable and demographically critical segment of village population has been another strand in this process of highland-lowland transfer.

Remittances, however, are not necessarily restricted to military ventures. Over the past two decades there have been a growing number of people, especially young males, working under fixed-term contracts in the oil-producing countries of the Persian Gulf and Middle East. These have included Nepalese and Indian hill people, but especially young Muslims from Pakistan's Northern Areas, Sri Lanka, and Indonesia. The pattern, however, is not restricted to

mountain regions but these work contracts have significant social, economic, and political effects in mountain regions.

### **Technology Transfers**

This element of highland-lowland interaction tends to be predominantly from lowland to highland in form. The construction of large-scale engineering works has been dealt with under a different section above (pp. 46-48). There has been a concerted effort to ensure transfer of technology in the form of small-scale 'appropriate' additions to mountain living. Part of the objective has been to reduce pressure on local forests, for instance, by introduction of wind and solar energy generators, mini-hydroelectric plants, and passive solar housing construction and, at lower elevations, biogas plants. Many high mountain areas are ideally located for both active and passive energy technologies, given their specific climatic conditions. A valuable overview has been presented by Schweizer and Preiser (1997) who point out the relevance of these technological advances to alpine areas of the industrialized countries. For example, the rapid growth in national alpine clubs has accelerated demand for high-altitude accommodation which at the same time must conform to stringent 'green' standards. This is characteristic of Bavaria, Austria, and Switzerland, and in American national parks it includes sun-powered disposal of human waste.

For such technology transfer in developing countries, the financial basis depends upon international aid agencies and NGOs. It is only in the

industrialized countries that market forces can apply directly. Nevertheless, this contrast will likely fade in the future.

## POLITICAL AND MILITARY DIMENSIONS

The political elements of highland-lowland interaction are worldwide in importance and the most significant factor is military power. They also have serious social, economic, and environmental repercussions. Libiszewski and Bächler (1997) have postulated that, when all on-going violent actions are considered, there is a disproportionately high number occurring in mountain regions. The news media have highlighted this situation and some of the more widely known and more calamitous instances include the Caucasus, the Balkans, 'Kurdistan', Ruanda, Ethiopia/Eritrea, Afghanistan, and Kashmir. Lesser known, or less frequently televised, examples include Tajikistan, and the actual warfare that is taking place in Colombia and southern Mexico.

Many other marginal mountain areas remain 'hot-spots' of political tension, including the entire length of the Himalaya and Karakorum. And while international frontiers that trend along the Andes have been less tense in recent years, it is still possible for visitors to Mount Sajama, in Bolivia, to witness the gross spectacle of alpaca and llama haphazardly detonating explosives in the frontier minefields between Bolivia and Chile. Moreover, when the Drug Wars resulting from the illicit cultivation and trading of narcotics are taken into account the scale of highland-lowland transfers must be enlarged considerably.

Libiszewski and Bächler (1997) argue that many of these conflicts, whether actual warfare and armed confrontation, or simply 'border tension', have the desire for control of water as a primary source. As examples, they cite the Tigris and Euphrates in terms of tensions between Syria, Turkey, Iraq, and Iran, the guerrilla war between the 'Shanti Bahini' insurgents and the government troops in the Chittagong Hill Tracts of Bangladesh, and the Golan Heights as part of the Israel--Arab conflict.

Central to many of the political and military aspects of highland-lowland interactions are three overarching themes. The first is the concept of mountains as niches for minority peoples (ethnicity and conflict). The second, which is closely related, is the concept of mountains as last frontiers (migration and conflict). A third theme might be added: that of mountains as enclaves of poverty (marginalization and conflict).

In all of these situations, actual warfare, and even relatively stable defensive alignments, greatly exacerbates environmental losses. For example, the commitment of large numbers of troops to sensitive mountain border areas multiplies many times over the total number of resident human beings present, and their environmental impacts. The use of live ammunition, of course, greatly augments the damage, and less apparent, but also important, is the soldier's propensity to use highly effective fire power to eliminate endangered mountain animals, both for meat and for recreation.

## SUMMARY

Resource management in mountains is driven mainly by lowland economic power resulting in the development of mountain resources for benefit of lowland urban populations and industry -- for example, the case of water, or even tourism. Such developments are often influenced by the perception of some lowland elites that mountain communities are inferior, ignorant, ethnically undesirable, primitive. This situation has been aggravated by recent exertion of greater central control on mountain peripheries and imposition of lowland laws and customs on highlanders, leading to their further loss of access to resources. Full citizenship may even be denied minority communities, hence, producing difficulties of land tenure and equality of treatment before the law. This disadvantage is aggravated by the fact that many mountain communities do not necessarily have any documentary evidence upon which to base claims. Thus their legal claims on human rights and access to resources are weakened dramatically.

These attitudes are often highlighted by relief response to 'natural disasters' -- for example, in the case of earthquakes. Until recently, earthquake hazard assessment was based on geophysical data and hazard zones on maps became concentric circles with the epicentre as the focal point. To a certain extent, this approach still prevails. But in mountain areas the hazard configuration relates as much to the physiography and bedrock composition as to the geometric position of the epicentre. Moreover, much of the loss occurs

after an earthquake, such as results from landslides, mudflows, avalanches, so that human relief response is often delayed or even prevented. The more severe weather of the mountains ensures greater after-effect losses and frequently inhibits relief efforts (Hewitt, 1993, 1997).

Many of the problems discussed in this section, however, have recently received an increasingly widespread and sympathetic reaction amongst aid agencies. There has been a rapidly spreading realization that improved local access to resources, in many areas of concern, can be beneficial in social, economic, and even political terms. Thus, efforts are under way to persuade governments of developing countries that decentralization of control over resources can be extremely beneficial, and in many areas these efforts are becoming successful. Nevertheless, the larger issues, and especially those perceived as being central to national security, remain intractable. It is to be regretted that the post-Cold War accentuation of nationalism has become a factor in the prevalence of armed conflict, contention over frontiers, and access to, and control of, water. These are some of the primary driving forces that ensure the concentration of military confrontation in mountain borderlands. Socio-economic and environmental damage emanating from these various forms of conflict have likely more than off-set the strong gains that have been made following the 1992 United Nations Conference on Environment and Development (UNCED) and the dissemination of AGENDA 21.

## CASE STUDIES

A series of case studies is presented; the intention is to illustrate the range of economic, social, and political issues deriving from highland - lowland linkages and to show how these are related to the physical conditions. The objective is not to be exhaustive nor even representative, but to illustrate the very wide range of issues, the varying degree of complexity, and the frequency of extenuating circumstances resulting from sensitive feedback relations between the various factors that affect the relationships between highlands and lowlands.

### a. THE EPPALOCK CATCHMENT, AUSTRALIA, 1960-1985

The Eppalock Catchment (Australian Government, 1978), with an area of 2,000 km<sup>2</sup>, extends northward from the watershed of the Great Dividing Range in Victoria, Australia. It slopes gently from about 1,000 m asl along the divide to 200 m at the Eppalock reservoir. The climate is humid in the south, becoming Mediterranean with cool moist winters and hot dry summers in the lower northern area (annual precipitation from 1,100 to 500 mm). Precipitation shows marked annual variation, especially in the northern, drier area.

By the 1950s the entire catchment was extensively degraded due to a long period of inappropriate management. This included overgrazing, impacts of the gold mining boom of the 1850s that produced an influx of 40,000 people,

the accidental introduction of rabbits, over-cultivation of land not suitable for crops, and clearing of forests for firewood and timber.

From the early years of the twentieth century discussion had arisen over the possibility of constructing a dam at Eppalock to provide irrigation water. Several attempts were stillborn, in part because of costs, and in part because of the realization that the extensive and worsening soil erosion would lead to severe reservoir siltation problems. There was also the hitherto unresolved challenge of obtaining cooperation amongst landholders of widely different circumstances.

These obstacles were eventually overcome and, by June 1960, work had begun in three badly eroded sub-catchments. Government funding had been made provisional on landholder cooperation in large-scale soil conservation such that both government and private funding was required. The Eppalock catchment, in the 1960s, had presented the Soil Conservation Authority with a unique challenge in soil conservation extension. In the northern portion of the catchment pastures had not been improved and soil conservation practices had not been introduced. Farm productivity was poor. The Government's decision that soil/water conservation projects must proceed simultaneously, in effect, 'forced' a special situation on the district. The erosion-control works had to be undertaken prior to catchment improvement because it was necessary to control reservoir siltation. Additionally, many landholders, especially in the badly eroded areas, did not live on their properties; there were many part-time

farmers also dependent on the firewood industry, contract work, sheep shearing, and casual labour.

The overall success of the project would depend on careful planning, and especially on the establishment of good working relationships between the Soil Conservation Authority officers and the landholders. This was facilitated by creation of the Eppalock Catchment Committee which held regular meetings. The process of enabling the landholders to realize that they had a major part to play in the planning for management of their own property was critical to the success achieved. Authority officers, by working with the landholders to effect the construction of farm dams to ensure water supplies for cattle proved especially significant. Moreover, the high level of cooperation produced improvements in all aspects of land management.

Given the size of the project, there were very many ramifications. For instance, it was fortunate that, prior to the 1960s, several problems associated with pasture improvement in this difficult hill country had been solved. The use of the chisel seeder for a 'one hit' method of pasture sowing had been proved successful and economically feasible by a few of the local landholders; this turned out to be especially significant. A lime-superphosphate mixture with the trace element molybdenum was found to be effective for good clover establishment. Aerial top-dressing was established as both practical and economic for applying maintenance fertilizer dressing. Also, myxomatosis and '1080' poisoning was counteracting the severe rabbit problem. An improved

design for protective fencing was adopted that proved most effective in reducing maintenance problems for landholders.

These and other collaborative activities became cumulatively effective as they were introduced simultaneously and extended across the project area. The construction of many erosion control works required the development of special skills and experience. Work teams, therefore, were recruited locally. These teams became skilled in construction of small gulley-control structures, such as silt traps and groynes, the building of grassed chutes, the erection of protective fencing, tree planting and other vegetative works, and the construction of earthworks within the range of specially-equipped wheel tractors.

One of the terms of the Eppalock planning required landholders to assume responsibility for maintaining the protective fencing immediately upon erection and for all other works installed by the Authority within three years of their completion. If a landholder were not able to demonstrate a reasonable level of compliance then the Authority would defer the carrying out of its work on that property.

By 1985, the degraded landscape of the Eppalock Catchment of the 1960s had been transformed. The improvement had resulted primarily from the success of the massive erosion control and catchment improvement programme undertaken between 1960 and 1975. Bare hills had been converted into productive pastures and gully erosion had been largely checked. There had also been a dramatic reduction in the amount of silt reaching the reservoir.

While many of the changes are hard to visualize -- a measure of the project's very success -- the many kilometres of tree-planted gullies serve as a lasting testimonial. One especially interesting side benefit has been the return, or introduction, of 22 species of birds into the area.

Not only has the landscape been transformed, but significant changes in land ownership have occurred. By far the biggest change has been the development of rural subdivisions, creating blocks 2 - 20 ha in size. These are found mainly around the towns and villages and along the shores of Lake Eppalock. Pursuits other than farming have been introduced, including hobby farms that have resulted in the regeneration of trees and shrubs. The increasing popularity of Lake Eppalock for recreation is especially significant. There is now overnight accommodation for about 7,000 people. In addition, up to 18,000 visit the lake on day trips during the peak holiday seasons of Christmas and Easter.

The severe drought of 1982-1983 was seen as one of the biggest tests of the entire project. This pushed to the limit the catchment's heavily grazed paddocks that were exposed to wind erosion. Soil losses of up to 10 mm occurred in the worst affected areas and emergency erosion control measures were being introduced when the drought broke. The impressive drought resistance characteristics of the introduced perennial grass species of *Phalaris* were demonstrated both during and after the drought.

What has the Project achieved? The primary purpose had been to minimize the amount of silt reaching Lake Eppalock. It has been estimated that this has been

reduced to one-sixth the estimated possible amount. Productivity has been increased three-fold in places, and continued improvements are anticipated. Thus, a new sense of stability and security has been achieved.

The earlier total dependency on wool as a source of income has been replaced by the raising of fat lambs and cattle. The landscape itself has been transformed; it is not only much more productive, but aesthetically pleasing thus augmenting the recreational developments. One of the most important gains, however, is the demonstration that a large section of a farming community was willing to work under the guiding control of a government agency. The combination of a peaceful rural location, enhanced landscape aesthetics, recreational opportunities, proximity to the lake, and ready access to Bendigo and Melbourne, has resulted in the building of subdivisions and new settlements. In purely economic terms, with a thirty-year evaluation period, at an annual discount rate of 8%, a net value of US \$4.0 million and an internal rate of return of 25.4% ensured a benefit : cost ratio of 2:0.

The basic question raised by this project at its outset was: why should the wider community, through a public agency such as the Soil Conservation Authority, become involved in an undertaking that was intrinsically a good investment for a number of private landholders? Four points are relevant:

1. the Soil Conservation Authority had the initiative, funds, expertise, and legal backing; it was also able to accept the 'risk' of failure;
2. the landholders were unlikely to be able to organize and finance such a

venture on their own;

3. the increase in the community tax base proved to be considerably in excess of the public costs;
4. it proved to be a demonstration project that had great value for application further afield.

For Australia, the Eppalock undertaking is an unusual example of extensive and comprehensive evaluation and provides guidance for the future evaluation of other projects. However, when considering its feasibility for possible overseas implementation, the relative social and cultural homogeneity of the participants must be taken into consideration. Extensive modification would be necessary, for instance, before such an approach could be introduced into Asian, African, or South American mountain situations. Nevertheless, its very success should provide encouragement for such attempts.

#### b. MOUNT KENYA: INAPPROPRIATE SETTLEMENT OF HIGHLANDS BY LOWLANDERS

Mount Kenya (5,200 m) is a prominent volcanic cone rising more than 3,000 metres above the surrounding semi-arid plains of central Kenya close to the equator. The upper slopes support nival, periglacial, and afro-alpine vegetation

belts that, while dramatically conspicuous topographically, occupy only a small proportion of the total area. Nevertheless, in conjunction with the forest belt, between about 3,000 and 4,000 m, they receive copious precipitation (in excess of 2,000 mm per annum). The southeast slopes at all levels are the most humid, while the north and northwest slopes are appreciably drier. The upper belts (forests to permanent ice and snow) are vital as water sources and supply a number of perennial rivers and subsurface aquifers to the plains below.

The ecological gradient from the lower timberline northwestward is extremely steep. Within a distance of 40 km and a descent in altitude from about 3,000 m to 2,000 m, annual precipitation declines from 1,500 mm to below 600 mm. In terms of vegetation, this gradient witnesses rapid transition from forest through shrub and savanna to semi-desert. Reliable rain-fed intensive agriculture is feasible only in a relatively small area close to the lower timberline.

During the early part of the 20<sup>th</sup> century the area was used mainly by Massai and Samburu pastoralists who practiced a form of nomadism which suited the seasonal and annual variations in water availability. The colonial period witnessed a radical transition for large areas of the plateau and mountain foot zone with the development of ranches and large farm holdings by white settlers. Much of administrative district of Laikipia became known as the 'White Highlands'. Cattle raising was the primary occupation and, given this very extensive form of land use, water problems were virtually non-existent.

Following independence in 1964 the government authorities in Nairobi came to perceive this extensive region west and northwest of Mount Kenya as a vital resource of land for settlement to accommodate a rapidly growing landless and land-poor population further southeast. During the period 1976 - 1982 the region was subjected to an intensive land development scheme of purchase, subdivision, and sale. The process of land distribution – or more accurately, the private development business – and the accompanying social, financial, and political ramifications was ill-conceived. Implementation followed a potentially disastrous course that has led to the serious water conflicts of the present day.

Most of the large number of landless, or land-poor, families attracted from source areas considerable distances away could afford to purchase only very small plots of land, frequently as small as 0.5 to 2.0 ha in comparison to the 1,500 to 10,000 ha of the original European farms and ranches. The annual rate of population growth was maintained between 7.0 and 8.0 percent and 70 percent of the total population were immigrants. Total population increased from about 50,000 to more than half a million in scarcely forty years. Furthermore, the land was surveyed and subdivided on a geometrical grid. Lots were sold arbitrarily, regardless of soil quality, topography, vegetation cover, road access, or water availability. The new owners, therefore, obtained their lots by chance, some on good locations, some on bad, but most in parcels too small for effective subsistence agriculture. Those who found themselves further to the northwest,

of course, were the worst off, and many survived the first years only because family members remaining in their area of origin were able to assist.

With increasing distance northwestward from lower timberline on Mount Kenya annual precipitation not only declines, it also becomes less reliable bringing the threat of periodic crop failure. In addition, available research and environmental knowledge during the primary period of settlement was strongly skewed in favour of the upper belts on the mountain. Little information was available that would have been relevant for planning.

The initial reactions of the newly emplaced population have been varied. Some managed to survive as subsistence farmers; some have sought distant off-farm labour where road access allowed; others found a variety of local service jobs to supplement their unreliable production of food. Penetration of the forest belt also occurred and illegal timber cutting and farming within the forest have had negative impacts on water availability at lower levels. Further downstream and out onto the Rift Valley escarpment national parks and other nature protection areas have been established. The ensuing development of tourism (also on the mountain itself), an important source of foreign currency and employment, has placed additional demands on the ever decreasing water supply. The entire area is beset with overgrazing, over-intensity of agricultural land use, soil erosion, and gullying.

Given the continued growth in demand for water, the pressure on the perennial rivers has accelerated. This has led to a dramatic decrease in the low

flow, for instance, of the Ewaso Ng'iro River in the lower lands. Median decadal flow for February in the 1960s was 9.0 m<sup>3</sup>/sec. This was reduced to 4.5 m<sup>3</sup>/sec by the 1970s and 1.2 m<sup>3</sup>/sec in the 1980s. The current flow is below 1.0 m<sup>3</sup>/sec.

During drier than normal years the lower river dries up completely; this occurred in 1984, 1986, 1991, 1994, 1997, and 2000. Thus the downstream populations, as well as the wildlife and related tourism, are placed in a disastrous predicament.

The situation described above has been brought about by the activities of all the stakeholders who are frequently unaware of individual group demands for water by their downstream neighbours. Worse still, conflicts have erupted, although the source of conflict has been subverted from water into ethnic clashes that are sometimes violent.

During the period 1970 - 2000 the Swiss Development Cooperation supported a sustained applied research study through the universities of Nairobi and Berne in cooperation with the government of Kenya (Messerli and Hurni, 1990; Winiger *et al.*, 1990). This has assessed the array of environmental and socioeconomic problems facing Laikipia District and emphasized the importance of preserving the forest belt. In the first instant, the forest belt on the mountain represents a critical buffer zone between the Mount Kenya National Park above and the agricultural landscape below; it is the zone of conflict between environmental protection and land resource overuse. Second, diminution of the

protective role of the forest belt will further restrict water availability for agriculture on the plains.

Detailed investigations on water conservation in different agro-ecological zones were carried out to test the influence of different land-use methods on water loss, soil erosion, and plant productivity both on crop and grazing land, thus identifying better choices in farming practices in order to achieve the most efficient use of available water (Liniger, 1990, 1992; Wiesmann, 1992; Wiesmann *et al.*, 2000). Subsequently, on the southeastern slope of Mount Kenya, the Swedish Agency for Research Cooperation and the Swedish International Development Authority supported research to explore the possibilities of interaction between indigenous soil and water conservation and crop protection practices (Tengberg *et al.*, 1999).

The on-going research investigations have clearly indicated an urgent need for development of a multi-level strategy ranging from sensitive political intervention from the top down to changes in farming practice to reduce water use as well as efforts to achieve more effective water storage and distribution. This will require additional research and data acquisition across the many relevant disciplines. It also needs an education programme that embraces both researchers, decision makers, and water users.

In this example it can be seen that the obstacle to successful development, in the first place, has been lack of data, both economic and environmental, as a basis for the initial decision making. Second, however, has been the initial lack of

recognition of the highland situation by lowland or central government authorities. Mount Kenya and its surrounding area is a forceful example of a highland-lowland interactive system involving many environmental, social, economic, and political elements. Mistakes made in one part of the system will always have serious consequences for all other parts. A central theme, however, is recognition of the high equatorial mountains as vital 'water towers' for the surrounding lower lands and the need to conserve and use them efficiently.

### c. NORTHERN THAILAND: SWIDDEN AGRICULTURE, WATERSHED MANAGEMENT, AND ETHNIC MINORITIES

The hill regions of Northern Thailand present a series of inter-related problems characteristic of many other areas of Asia, Africa, and South and Central America. Several groups of ethnic minorities (in this case, the Hill Tribes of Thailand) have lived in the mountains in near-isolation for centuries practicing slash-and-burn (swidden) agriculture which, in many instances, involves the cultivation of the opium poppy.

Geographically, the North is a region of mountains and hills with narrow valleys and occasional intermontane depressions forming a highly complex relief that merges across the international borders into Myanmar, Laos, and Yunnan (China). The highest summits exceed 2,000 m asl and the region can be regarded

as the southeasternmost extension of the Himalaya. Situated between 16° and 20° North, it experiences a pronounced monsoonal climate with heavy summer rains between mid-May or June and October. The main physiographic alignments trend north-south. The largest, and central, section is drained by the main headwaters of the Chao Phraya southward through Bangkok and into the Gulf of Siam. Other important rivers are the Mekong, the Salween, and the Irrawaddy.

Chiang Mai, Thailand's second largest city, is the regional capital and a dense population of ethnic Northern Thai have occupied all the valley floors and lower land for generations; wet rice is the basis of the intensive agricultural system. In contrast, the highlands, densely forested until about 40 to 50 years ago and sparsely populated, have been the domain of several distinct ethnic minorities. For the most part, they have practiced various forms of swidden (slash-and-burn) agriculture until recently. While swidden agriculture persists in many areas throughout the North, population growth, combined with economic and political pressures and increasingly determined suppression of opium cultivation, has wrought great changes. In addition to these forces, tourism and the rapid expansion of national parks and protected forest areas are also having an impact.

The international borders have not been well demarcated until very recently and this controversial region of the so-called 'Golden Triangle' has experienced extensive trans-border migrations for generations. However, the

movement of Hill Tribe peoples accelerated during and after the Vietnam War, and current tensions between Thailand and Myanmar ensure a continuation of this kind of population movement. Moreover, during and after the Vietnam War, the Thai government felt obliged to more rigorously incorporate its border regions into the national mainstream. This policy was marked at times by alarmist assumptions, for instance, that many of the minority peoples were actual, or potential, communist sympathizers.

International aid has been directed at Northern Thailand since the 1960s. In its early stages aid policy, as well as the policies of the national government, was strongly influenced by a number of simplistic assumptions, even fallacies. The primary assumption was that swidden agriculture was the overall cause of extensive environmental degradation -- deforestation, soil erosion, lowland water shortages and siltation of the fields and irrigation works of the ethnic Northern Thai, and impacts all the way downstream to the Gulf of Siam. Some of the early responses to this perceived threat were harmful to the well being of the ethnic minorities in the highlands: forced conscription of young men into the Thai army; government-controlled replanting of hill areas by fast growing pine species; eviction of entire communities. There was also a wide array of genuine aid efforts: introduction of numerous cash crops intended to replace opium; construction of government housing and roads. Nevertheless, an abiding obstacle has been that, under the Thai constitution, the ethnic minorities are not

considered to be citizens; thus they have no legal right to own land, even though vast areas of mountain forest land have been freely used by them for generations. Only during the last decade has the Thai government become less restrictive in the approach to citizenship and a degree of land ownership has been permitted.

Over the last twenty years the approaches taken by government and aid agencies have been extensively modified. In addition, continued population growth and accelerated penetration of world market forces have combined to render the situation much more fluid and to bring about non-planned changes. Nevertheless, new environmental and socioeconomic policies, both in their conception and in their application, are hindered because of the complexity of the situation and, not least, because elements of the myths, or misunderstandings, have persisted.

From the 1960s onward, swidden agriculture, not only in Thailand but throughout the world, has been regarded as a singular threat to forest preservation. In Northern Thailand, as indeed in other regions, the actual swiddeners, almost invariably ethnic minorities, have been regarded as destroyers of their own environment. By extension, they have been accused as the perpetrators of damaging downstream effects, such as rainy season flooding and siltation, and dry season water shortage. The simplistic argument is that, as minority populations increase, the essential long period of forest fallow is perforce reduced. Thereupon a vicious circle is depicted whereby continued population growth further shortens the period of forest fallow, from 25 – 30 years

early in the 20th century, to 15, 10, 6, and less today. Sometime during this progression a point is reached whereby secondary forest succession is truncated and grassland (in Northern Thailand, *Imperata* grassland) replaces the trees. With hill tops and steep slopes cleared of forest cover, soil erosion and dramatic changes in the hydrology occur and all the auxiliary ailments are assumed to follow. When opium production, ethnicity, and sensitive and ill-defined national frontiers are incorporated into the environmental equation, harmful anti-minority prejudice is likely to develop. The minority people (technically not even classed as 'human' under some national constitutions since they have no formal citizenship) become scapegoats for all manner of mainstream national ills or, at best, are sincerely believed to be the cause of serious environmental damage.

The Hill Tribes of Northern Thailand also have had their ardent advocates. Kundstadter *et al.* (1978) produced a fundamental analysis and demonstrated that each ethnic group had its own unique swidden system – in other words, there were as many different swidden systems as there were practicing groups, some environmentally damaging, some environmentally sustainable. Chapman and Sabhasri (1983), McKinnon (1983), and McKinnon and Bhruksasri (1983), with additional contributions from many other colleagues, exposed many of the complexities of the situation amongst the Hill Tribes.

Drawing from the work of these scholars, Ives (1983: 311) was able to postulate:

“... some broad issues emerge: (1) existing Thai development policies may not be adequately based upon the behavioural patterns and perceptions of the local people; (2) the perception of highlanders by the

Thai and outsiders are not necessarily accurate, and in particular the ethnic Northern Thai are probably responsible for much more deforestation than are the highlanders; (3) the role of *Imperata* grassland is not perceived clearly and the problems are neither technical nor scientific, but social and economic . . . . . the problems of the hill country of Northern Thailand, and of many similar areas, are neither scientific nor technical. Rather they are *people problems*. Throughout the developing mountain world solutions imposed by outsiders will frequently fail; success depends upon the degree to which the local people are enabled to take the initiative.”

During the last two decades many studies have corroborated the initial assessment. Alford (1992) challenged the basic assumption that highland deforestation caused the downstream lowland damage, a process that had been traditionally assumed as self-evident in Thailand. He analysed all available hydro-meteorological data. The abstract of his paper is worth quoting in full:

“In the mountain watersheds of northern Thailand, the calculated runoff efficiency (that is the ratio between input as precipitation and output as surface runoff) is extremely low for a mountainous region, with an average of 20-25 percent. In those catchment basins for which data are available, the volume of suspended sediment is low, averaging approximately 100 t/km<sup>2</sup>. Furthermore, time-series analyses of the existing data bases show no evidence that streamflow or sediment regimes have changed significantly since the 1950s. There is no empirical substantiation for the hypothesis that land-use practices have altered the hydrologic regime of these basins, or have contributed to an increase in the sediment load of the rivers. At the present time, the most pressing need for the government of Thailand is to organize the existing data bases, and publish annual statistics. This would increase the efficiency with which planning and management of water resources could be undertaken.”

Alford argues that there is a strong correlation between the amount of suspended sediment moving through the river systems of the northern mountainous region of Thailand and the mean annual discharge of those rivers. His analysis of the available data demonstrated that this relationship has remained virtually unchanged for the entire period of record. While it is not possible from this to argue conclusively that land-use practices (especially deforestation and swidden agriculture) have had no significant impact on the volume of sediment transported by the rivers, it does indicate that such increases cannot be detected at the existing scale of monitoring. However, it can be concluded that the volumes of sediment being carried by the rivers of Northern Thailand are among the lowest of all river systems world-wide. Alford's work points up yet another example whereby gross assumptions, regardless of available data, become the basis for policy development. The actual cost of establishing an adequate data base so that such vital ambiguities can be resolved is cited by Alford (1992: 268) to be very slight, especially compared with the costs being borne by failed and partially failed environmental and socioeconomic policy implementation.

Schmidt-Vogt (1998) took the investigation into the detailed inter-relationships between ethnic land-use practices, deforestation, and soil erosion a big step further: this entailed study of the relationship between the practices of different ethnic groups and biodiversity. He urged reconsideration of the 'orthodox' definitions of forest degradation. He examined changes in vegetation

caused by swidden farming near three ethnic minority villages in the highlands of Northern Thailand and showed that the commonly supported belief that swidden is a degrading land use, causing species loss, soil erosion, and water shortages, is highly simplistic. His very detailed case studies revealed that the swiddens of Lawa and Karen ethnic groups actually provide better land management and biodiversity than reforestation, largely because of the indigenous practice of using 'relict emergents' - or retaining trees in cleared fields. In contrast, a different form of swidden, practiced in one Akha village led to species loss and less useful secondary forest growth. Schmidt-Vogt argues that policy makers need to evaluate the various forms of swidden farming in recognition of the great diversity of species that are often encouraged. This evaluation should pay attention to the economic values of species and the cultural needs and practices of the different forest users.

Forsyth (1994,1996,1998) has investigated different swidden systems and the wide variation in soil losses between the different practices. He has stressed the need for much more rigorous assessment of the results of mountain science in relation to the prevalence of the gross assumptions (myths) that are so frequently used as a basis for policy making. Ganjanapan (1996,1998) also takes a critical look into the complex personal and political agendas of agencies of the Thai mainstream that are having such an impact on policy evolution and the well-being of the Hill Tribes.

While rapid change over the last 10 to 20 years has resulted in spontaneous acceptance by villages of an increasing range of cash crops (and this process has been greatly aided by national government and donor intervention), there has also been a rapidly accelerating trend toward the acquisition of off-farm wage-earning jobs (Rerkasem, 1996). Nevertheless, Ganjanapan (1996, 1998) argues that many of the government policies are conflicting. For instance, national parks are established and, on an ad hoc basis, minority communities are evicted from their traditional lands. In other instances, easier access to citizenship status and land ownership is enabling villages to protect local forests by establishing common property protection. In yet other cases, forests that are being ably managed by village communities are put at risk through corrupt manipulations between government officials and Thai business men whereby trees belonging to village communities are cut and sold illegally for individual profit. Ganjanapan (1998) points out that conflicts in the highlands of Northern Thailand represent a clear case of the politics of environmental discourse in the sense that conservation has played a role in lending legitimacy to both government agencies and ethnic communities in the struggle for control of forest resources. He stipulates that, only recently have government agencies begun to show some positive concern for social issues. This can be seen in the drafting of a new community forest act, yet the emphasis is placed on individual ownership of land, not common property ownership; and there is still no serious

discussion of the legal recognition of the rights of minorities to live in the forests and continue their traditional use of the local resources.

#### d. TAJIKISTAN: LAKE SAREZ AND THE PAMIR MOUNTAINS

Lake Sarez, high in the Pamir Mountains, was created by a massive landslide dam that was caused by an earthquake in 1911. This case study centres on the question of how to determine the likelihood of occurrence of a potentially catastrophic natural event. Geophysical considerations are at its core, although the consequence of the outbreak of this very large volume of water, in the worst case scenario, would become one of the world's most disastrous natural events in human, economic, and political terms. There are many ramifications, especially since the potential disaster would affect highland and lowland settlements and would cross several international borders. The World Bank, various agencies of the United Nations Organization, several national governmental agencies, and NGOs are already taking steps to respond to the eventuality. It is an instance whereby a **potential** highland-lowland natural event, rather than an **actual** occurrence, is causing social, economic, and political repercussions.

Lake Sarez is situated in the Pamir Mountains of Tajikistan close to 3,000 m asl. Its location is one of the most remote in the world. It formed following a very large landslide, set off by an earthquake in the winter of 1911. The

landslide, with a volume of some 2-3 km<sup>3</sup>, plunged down a mountain side to form a dam between 500 and 600 metres in height and two kilometres wide to block the Murgab River. This river is a tributary of the Bartang River which, below the confluence with the Murgab, flows for 120 km through a gigantic mountain gorge to join the Pianj River, itself a tributary of the Amu Darya. The Amu Darya is one of the two major rivers that drains into the Aral Sea 2,000 km below the dam site. The Pianj and Amu Darya rivers form part of the frontier between Tajikistan and Afghanistan and further downstream their combined waters flow through Uzbekistan and Turkmenistan.

The fallen mass of rock and earth was named the Usoi Dam after the village that it completely annihilated. The dammed waters of the Murgab River produced Lake Sarez, named for a village that was submerged by the rising waters. Initially, the level of the lake rose at a rate of about 75 metres a year. Today it is more than 60 km in length and has a maximum depth in excess of 500 metres. Its total volume is about 17 km<sup>3</sup>, approximately two-thirds the volume of Lake Geneva. The lake surface is close to 3,200 m asl, surrounded by peaks rising to more than 6,000 m. The Usoi dam is the highest dam, natural or man-made, in the world. Set in the heart of the Pamir Mountains, the lake itself and its surroundings form a magnificent mountain landscape. It is also located in a region that has been central to major political and military tensions for more than 200 years. During the 19th and early 20th centuries the three rival empires, Czarist Russia, Great Britain, and China competed on a gigantic and heroic scale

that became known, following the writing of Rudyard Kipling, as the 'Great Game'. Much earlier a main branch of the Silk Road passed through the Pamir and carried Marco Polo and his uncles to the court of Kublai Khan. The present republics of Central Asia were moulded by Soviet Russia from a series of Khanates, together with territories of no clear political allegiance. Currently, with a massively disturbed Afghanistan, Pakistan, Kashmir, and India, all virtually within walking distance, and with Iran, Iraq, and Turkey as neighbours with more than a passing interest, political instability may seem the order of the day.

The Pamir Mountains, in general, represent one of the most active seismic regions on the world's geophysical map. Lake Sarez, therefore, is a focal point for a great amount of concern. A disaster of significant proportions could be triggered in several ways. A major earthquake could shatter the Usoi dam and send an enormous flood wave down the Bartang Valley and into the Pianj and Amu Darya rivers; the dam could collapse under the pressure of the water as the lake continues to rise; the piping of water through the dam, which is occurring today, could enlarge and cause the dam to collapse; or collapse could be induced by the continued rise of the lake level (by about 5 cm/yr during the 1990s) and eventually over-topping it. Finally, another large landslide, caused either by an earthquake, or the spontaneous failure of the mountain wall above the lake, could fall into the lake and generate a giant wave to over-top the dam. Even if the dam was not broken by such a wave, the wall of water rushing down the

Bartang Valley could set off fast moving mudflows and trigger secondary landslides by under-cutting the talus slopes along the valley sides. This could be sufficient to eliminate all the thirty villages in the valley, and even more as the disturbance entered the Pianj Valley. It has been estimated that, in the worst case, the lives of five million people could be affected. Furthermore, the torrential flood waters could extend as far downstream as the Aral Sea itself, with the additional danger of disturbing the toxic sediments that have been exposed as the sea has dried up.

The problem is rendered the more complex by a number of other factors. The vicinity of Lake Sarez is extremely remote and physical access along the Bartang Valley is a challenge. The final approach to the dam involves a difficult ascent on foot along steep mountain slopes, with a gain in altitude of more than 1,000 metres. This would render road construction, if heavy equipment would be needed, extremely expensive and technically difficult to maintain. The regional approach also constitutes a challenge; there are two main roads into the upper Pianj Valley and Khorog, the regional capital. One of these is very long and involves transit through a small part of the territories of Uzbekistan and Kyrgyzstan and a high-altitude section (above 4,000 m) across the Pamir Plateau. The other, more direct, requires passage of the Pianj gorge, with very unstable slopes and a narrow road bed subject to rockfall, mudflow, landslide, and avalanche. Both roads are closed by heavy snow for several months of the year.

The difficulty of access alone would appear to eliminate large-scale engineering solutions, such as reinforcing the dam artificially, or attempting a controlled partial drainage and lowering of the lake level.

Below the Usoi dam there are more than 30 small villages in the Bartang Valley, with a total population of about 7,000 mountain people (Ismaili). Most villages (*kishlaks*) are sited on alluvial cones near to the river and use all available gently sloping land. Many of the villages are subject to floods, landslides, mudflows, and avalanches annually; while these natural hazards are individually of small magnitude, compared to that posed by a potential failure of the Usoi dam, they are frequent in occurrence and constantly restrict access to the valley and would constrain any needed evacuation. Any landslide-induced flood wave capable of over-topping the dam would place all or most of the villages at risk.

Soviet and Tajik scientists became aware of the threat posed by Lake Sarez some decades ago. Early warning and lake-level monitoring systems were established. The warning signals, however, were only directed to Moscow and Dushanbe. Thus, in the event of a medium- or large-scale flood, any secondary warning to reach the Bartang villages from either Moscow or Dushanbe would likely arrive after the event, if at all. With the collapse of the USSR even this approach to early warning and lake-level monitoring ended. Then followed the civil war of 1992-1997 when the problem of Lake Sarez was put aside.

Over the last three years, the dangers posed by Lake Sarez have begun to be taken seriously. Various reconnaissance visits have been made to the lake and dam and to the Bartang Valley. Several high-level planning meetings have been held: in Dushanbe, Geneva, and Washington, DC. The involved Asian republics, and especially Tajikistan, appear to favour a development approach based on the assumption that the worst case scenario (total collapse of the Usoi dam) was credible. A major investigation was mounted during June 1999. This was financed primarily by the World Bank, with additional support from the UN disaster relief organization, Focus Humanitarian Assistance (one of the Aga Khan family of organizations), and the government of Tajikistan. An international group of engineers, geophysicists, geologists, and geographers visited Lake Sarez and examined all the approach routes. There was unanimous agreement that the prospect of a worst case scenario was sufficiently remote that it should be accorded a low level of priority. However, there was strong support for installation of monitoring and early warning systems. Unlike the earlier Soviet approach, the new approach would relate to all the villages in the Bartang Valley and ensure the direct input of the local people. Concurrently, it was recommended that computer mapping and simulation of the potential impacts of various levels of natural disaster be undertaken. It was also pointed out that further, and much more detailed, studies should be undertaken of the cultural and socioeconomic situation of the local people. Sites for safe havens should be located and equipped, and a full accounting made of the attitudes of the local

people toward the various levels of possible danger. One additional, and very important point, is that steps should be taken to ensure that the likelihood of actual large-scale disaster (worst case scenario) not be over-stated, so that the risk of any government-ordered forced evacuation of the Bartang Valley could be avoided.

By February 2000 it appeared that, under the leadership of the World Bank and with contributions from several major donors, the recommendations of the June 1999 reconnaissance team were to be acted upon (United Nations, 2000). A year later, at time of this writing, significant planning progress has been made. Thus, the case of Lake Sarez, while representing one of the largest ever potential disasters based upon a natural situation in a high mountain region, embraces many complex inter-relations between highlands and lowlands. Ultimately, the challenging task of seeking collaboration amongst several independent countries on the use and management of a large international river, the Amu Darya and its headstreams, will have to be faced. Given the international rivalries prevailing in the region, this might well be the single most difficult task. Nevertheless, while the magnitude of the problems emanating from the potential instability of Lake Sarez may be an order of magnitude, or more, higher than other mountain hazards in the same region, their identification, evaluation, and treatment should provide a formula for ways in which other hazardous situations could be approached.

## e. NORTHERN CHILE: COPPER AND WATER SUPPLY

Mining at the base of a major mountain range, the Andes, is dependent on underground water sources that are believed to have accumulated by subterranean flow from high altitudes thousands of years ago when the high mountain precipitation was much heavier than today. Artificial extraction of water by pipeline construction to high-altitude lakes might provide only temporary relief yet would seriously damage the way of life of indigenous graziers. What highland-lowland compromises, if any, can be effected to ensure the best possible solution for all stakeholders?

The Andes in northern Chile are separated from the Pacific Ocean by the Atacama Desert and the much lower coast range. In those latitudes ( $18^{\circ}$  to about  $26^{\circ}$  S), the cold Humboldt Current and the generally easterly atmospheric circulation accentuate the rain-shadow effect of the western Andean slope to create one of the driest regions on earth. Arica, in the far north, for instance, claims a record of 27 consecutive years without measurable precipitation. Even at the highest altitudes of the Puna de Atacama (Altiplano) precipitation is slight: for example, the total absence of glaciers above the permafrost limit on Volcan Llullaillaco ( $24^{\circ} 43' S$ ; 6,739 m asl) is remarkable. This dry northern region has a very few open, and mostly saline, water bodies. These are located above 4,000 m.

In addition to mining, human activity is restricted to agriculture around the stable oases along the Andean foot and rare seasonal pasturing on the

Altiplano, and to the coastal towns of Antofagasta, Tocopilla, Iquique, and Arica. The aridity from sea level to the high mountains is extreme and vegetation so sparse that there is no soil formation at any altitude.

Mining, especially for copper, has long been the dominant economic activity of the area. One of the more famous open pit copper mines at Chuquicamata has produced the world's largest man-made hole. The mines, for the most part operated by multi-national corporations, provide Chile with more than 20 percent of its GNP. This activity has expanded rapidly over the last fifteen years and urban industrial settlements have mushroomed. Water availability is the major issue.

With no surface water in the vicinity of the mining towns, ground water is the main resource, both for the mining activity itself and for human domestic requirements. It is remarkable that one of the largest mining companies has no precise knowledge of its underground water reserve (Ives, pers. notes, 1992). Research carried out by Messerli *et al.* (1993) has indicated that the recharge of the essential aquifers depends upon infiltration from the Altiplano. The rate of this infiltration, based in part upon tritium dating, is either extremely slight, or even that there is no present-day flow. Most of the presently available water is probably fossil from a period of much wetter climate on the Altiplano that occurred more than 7,000 years ago. The late-glacial period (17 - 11 k yrs BP) experienced lake levels 5 -10 metres higher than today. This indicates a large increase in precipitation at about latitude 23-24° S. Moreover, the early Holocene

( 11 - 7 k yrs BP) also experienced wetter conditions than today with summer temperatures about 3.5° C higher and significant ground water recharge. These conditions were favourable for an early hunter-gatherer economy. About 3,000 years ago conditions became much drier, although the intensive pastoralism may have accentuated the climatic impact on the vegetation. Ground water recharge was certainly curtailed. Present conditions, throughout the transect from the highest mountains to sea level, are probably the driest experienced in the last 20,000 years.

The mining companies' growing concern for access to water has resulted in pressure being placed on the government to permit construction of water pipelines to tap several of the rare fresh water lakes on the Altiplano. Environmental organizations are adamant in their resistance to this exploitation. At best, access to this water would be no long-term solution and the present-day high-altitude indigenous pastoralism, supplemented by a small, but growing tourism, would be severely impeded. While more research is required, it is reasonable to assume that, even if some very slow recharge of the ground water is occurring, the amount is far out-stripped by industrial and domestic consumption of what is essentially a fossil source.

## f. NEPAL: KHUMBU HIMAL, SHERPAS AND LANDSCAPE CHANGE

The visitors to these highest of the world's mountains are overwhelmingly lowlanders from the urban centres of the industrialized countries. Similarly, the scientists who undertook the initial research that induced the Government of Nepal to establish Sagarmatha (Mount Everest) National Park were Westerners and predominantly lowlanders. Western and lowland concepts have been applied to development of a world class highland natural and cultural resource. Tourism has been a primary vehicle. Results have been both positive and negative, but misunderstandings and misconceptions have frequently acted as powerful driving forces.

The names 'Khumbu', 'Sherpa', and 'Mount Everest' have been entrenched in the minds of adventurous youth and all mountain *aficionados* for at least a half century. Aside from the continuing increase in mountaineering ventures, Namche Bazar and the Everest base camp have become synonymous with adventure tourism and trekking to the point that, by the mid-1990s visitors to the Sherpa homeland outnumbered inhabitants by about three- or four-to-one (the present ratio may be as high as 6 : 1).

Closure of the frontier with Tibet by the Chinese in 1959 brought with it a significant flood of Tibetan refugees into the Khumbu, some of whom stayed, while some moved on. It also heralded a potentially disastrous impact on the

indigenous Sherpa way of life which had depended upon free access to Tibet for trade and yak grazing. Disaster, however, was averted as employment opportunities for high-altitude guides, sirdars, cooks, and porters presented themselves to the very adaptable Sherpa, almost simultaneously with the closure of the frontier. Nevertheless, the numbers of visitors continued to increase and central government control from Kathmandu began to be felt. Nationalization of Nepal's forests in the 1960s and establishment of the Sagarmatha National Park in the 1970s were two of the major administrative changes that carried heavy implications in terms of traditional Sherpa autonomy and control of the mountain environment (forest nationalization proved to be a mistake nationwide and has since been rescinded by new forest legislation).

This case study seeks to review briefly the changes that have occurred in the Khumbu since about 1950 and attempts to explain at least some of these changes. In terms of highland-lowland interactions, once again there are many cause-effect processes with some positive, some negative. These include political and economic pressures from outsiders (HMG of Nepal, development donors, NGOs, trekking companies, and individuals), the Sherpas' own varied responses to opportunities presented by the growth of tourism and mountaineering, the actual and potential impact of high-mountain natural hazards, the creation of the world's highest garbage dump and its many consequences, and a construction boom that has included hydroelectricity plants in supposedly protected World Heritage territory.

The Khumbu has also attracted an enormous amount of scholarly research, involving a wide range of disciplines. There has been, it might be said, the expected series of misinterpretations, mis-statements, and determined adherence to cherished mountain myths that, especially during the first half of the period under consideration, distorted development policy.

The early campaign to establish a national park produced some surprising recommendations. First, the Western scientists and scholars, whose expert advice was requested by the central government of Nepal, appear to have been committed to the traditional United States concept of national parks as untouched wilderness areas. This goes back to the establishment of Yellowstone and Yosemite national parks in the previous century. Rumours abounded to the effect that, with establishment of the Sagarmatha National Park, it would be necessary to evict all Sherpa communities from within the proposed park boundaries. Had this been carried out, it would have destroyed a world-renowned mountain culture.

Many reports were also submitted (and many were published) inferring that within the proposed park boundaries deforestation was rampant. This was intended to accelerate the political process for official park designation before the predicted catastrophic landscape degradation occurred. The supposed process of deforestation was related to a number of factors: indigenous population growth with increased demands for fuel wood and for timber for new houses; exponential increase in the numbers of trekking tourists and their supporting

porters with associated tree cutting for cooking fires and recreational camp fires, as well as a boom in construction of small hotels and tea houses.

These alarms even included specific published statements by internationally respected scholars; for instance, “forests in the vicinity of the [Khumbu] villages have already been seriously depleted, and particularly near Namche Bazar whole hillsides which were densely forested in 1957 are now bare of tree growth and villagers have further to go to collect dry firewood” (Fürer-Haimendorf, 1964,1975:97-98, 1984). Hinrichsen *et al.* (1983:204) postulated that “more deforestation [has occurred in Khumbu Himal] during the past two decades than during the preceding 200 years.”

It is generally assumed that these alarmist and supposedly scientifically-based observations and recommendations had the desired effect of influencing the creation of the Sagarmatha National Park. Fortunately for the Sherpa, their world-wide fame ensured international reaction to the prospect of eviction from their homeland. For this, and other reasons, the Sherpa villages were ‘saved’ and now exist as enclaves within the park.

The claims of imminent and disastrous deforestation were shown to be gross exaggerations, some as completely inaccurate. Dr. Charles Houston, a member of the original Mt Everest reconnaissance, reported that there “was as much or more forest cover [in 1981] than there was in 1950 and I have the pictures to prove it” (Houston, 1982). Byers (1987a, 1987b) corroborated this and replicated photographs taken by Erwin Schneider and E. Maillart between 1955

and 1963. Several of Schneider's high quality photo-theodolite prints depicted hillsides that Fürer-Haimendorf had described as densely forested in 1957. Byers was able to show that certain hillslopes had already been bare of trees in 1955, two years before Fürer-Haimendorf had made his oft-quoted statement of their being densely forested (in fairness to the latter, much of the exaggeration was due to the way he has been quoted by others). Regardless, Byers made three relevant conclusions:

1. that most forested areas in the Khumbu-Khunde-Khumjung area appear relatively unchanged between 1955-1962 and 1985;
2. considerable thinning of juniper woodlands has occurred in the vicinity of treeline;
3. little medium- to large-scale geomorphic change is discernible.

Byers also undertook detailed fieldwork that included palynological investigations of a series of soil profiles and maintenance of more than 30 soil erosion study plots throughout one entire monsoon season. From this he was able to propose that while deforestation in the Khumbu has occurred, it had extended over a period of more than 200 years. Furthermore, he produced evidence from radiocarbon dating of charcoal within his soil profiles, together with identification of grains of cereal pollen, that human modification of the Khumbu landscape may have occurred long before the traditionally accepted date of the arrival of the Sherpa about 400 years ago (Byers, 1987b: pp. 204).

Since the initial work of Byers, there have been several highly relevant publications (Brower, 1990, 1991; Brower and Dennis, 1998 ; Stevens, 1993) that provide general support for the original challenge to the alarmist literature. Byers (1997) has also refined and further developed his photo-replication work. As is usually the case when a period of basic reconnaissance is followed by more intensive research, it has become clear that the patterns of landscape change in the Khumbu are much more complicated than hitherto believed. Nevertheless, this progression of the search for knowledge demonstrates how the highly simplistic (and politically oriented) approach of the 1970s has unduly influenced policy formulation.

The foregoing discussion is not intended to leave the impression that change in the Khumbu has *not* occurred. There has been socioeconomic change on a grand scale, both positive and negative. Brower (1991) has demonstrated that the transition from a trading-plus-subsistence farming economy to a trekking-tourist dominated way of life has had far reaching effects. For instance, the use of livestock (yak and yak-cow cross-breeds) for portering in support of the trekking groups has radically changed the pattern of transhumance (as well as the very cross-breed mix). Today there is less grazing in the more distant, higher altitude pastures and more close in to the villages where the trekking groups seek to hire the animals. This in turn has affected vegetation growth patterns, as well as crop management, and the manner of fuelwood collection. The demand for young male Sherpa for high-altitude expeditionary work has led

to reduction of available farm labour. This has been further augmented by the outflow of some of the younger Sherpa from the Khumbu to operate small hotels and trekking company offices in Kathmandu. With this loss of Sherpa male workers from local agriculture (including mountaineering death and injury), temporary labour is hired by the female household heads left behind, usually from other ethnic groups from the lowlands. Furthermore, the substantial increase in overall Sherpa wealth, albeit with inequalities between villages according to their proximity to the main trekking routes, has permeated the entire Khumbu region.

Another impact, the result of foreign aid, has been the introduction of hydroelectricity. The first serious attempt involved Austrian construction of a small power station at Thame (Namche Small Hydel Plant). In August, 1985, when the plant was nearing completion, a glacial moraine-dammed lake, further upstream in the Dudh Kosi valley, burst and released about 5 million cubic metres of water. Within minutes, the hydroelectric plant was destroyed. Subsequently, all the Dudh Kosi bridges were washed out for a distance of 60 km downstream (Ives, 1986; Vuichard and Zimmermann, 1987). This catastrophic event caused remarkably little loss of life because of its timing during the monsoon season and on a day of religious festival when the local people were mostly well away from the river. However, it did bring into focus the acute danger of the sudden outbreak of glacier lakes. Three such events have now occurred in the Khumbu alone since 1970. Furthermore, rapid emergence and

expansion of a lake on the lower surface of the Imja Glacier was observed in 1986 and has since been closely monitored (Watanabe *et al.*, 1994, 1995). 'Imja Lake' is now more than 1 km long and 120 m deep. While the likelihood of a catastrophic outbreak cannot yet be precisely calculated, if such an event were to occur, and if the timing were to coincide with the trekking season, it would directly imperil long stretches of the main trekking route to the Mount Everest base camp. In a worst case scenario, this would place at risk the lives of hundreds of trekkers and their porters. Furthermore, the very large volume of water available in 'Imja Lake' would likely extend the downstream effects out onto the Terai lowlands.

The impacts of hydroelectric development and the threat of glacier lakes are significant and deserve special treatment as they relate to large areas of the Himalaya and Karakorum, and other glacierized mountain ranges, such as the Alps, Caucasus, Tian Shan, Pamir, Andes, and Alaska Coast Ranges. However, it is beyond the object of this case study (Lliboutry *et al.*, 1977; Hewitt, 1985, 1997).

In conclusion, the 'opening up' of the Himalayan mountain landscape, with its distinctive Sherpa culture, to lowlander access has brought change on a vast scale. There has been increased wealth in general, better health care, higher levels of education and literacy, a national park and World Heritage site have been established and, contrary to earlier speculation, the natural landscape has survived remarkably well. Nevertheless, there has been a disproportionate loss of young male lives; a degree of localized deforestation has occurred although this has been partly compensated by replanting. With increased wealth, the

Sherpa community as a whole has reinforced its traditional contributions to preservation and development of the monasteries. A very large number of lowlanders have experienced the joy of trekking in very high mountains, although some have lost their lives to accident and hypoxia, but probably fewer than if they remained on the streets of New York or Rome. The penetration of a World Heritage landscape by hydroelectric power lines creates a quandary, likewise the early mis-reporting, even falsification, of environmental conditions in order to influence policy making. One of the important lessons to be learned, however, is the critical role played by the very resilience and adaptability of the Sherpa ethos. Their long tradition as 'Tigers of the Snows' through their association with the British pre-World War II expeditions to the north side of Mount Everest, and similar ventures, as well as their indigenous entrepreneurial abilities as long-distant traders and travellers, equipped them to face the enormous changes that swept over them after about 1960.

The more strictly physical and hydrological aspects of highland-lowland interaction, in the form of the periodic outburst of great volumes of glacier-melt water, may well accelerate in the future as the glaciers of the Khumbu continue to thin and retreat. This is by no means unique to the Khumbu. Nevertheless, an unfortunately timed catastrophic release from the Imja Glacier could conceivably eliminate hundreds of lives and have a major impact on trekking tourism that is the region's current mainstay. The central government certainly has not done enough to mitigate this potentially serious problem.

## g. NORWAY, RONDANE NATIONAL PARK

Efforts to 'protect' nature are accelerating world-wide. The United Nations list of National Parks and Protected Areas in 1993 included 9,832 sites and more than nine million square kilometres, a land area equivalent to that of the United States (Furze *et al.*, 1997). The majority of these sites are located in mountain regions. The continuing growth in the number of sites and in the total area protected is also causing increases in management issues and conflicts. One of the overarching problems, especially germane in the developing countries and countries in transition, is that the inspiration behind the drive to protect 'wilderness' or 'nature' is based on Western philosophy, usually emanating from an urban and lowland elite. The first national park to be created (Yellowstone, USA, 1888) was perceived as a 'wilderness' and the American-style national park philosophy envisages such areas being preserved with only minimal impression of human activity and large areas to remain essentially 'pristine'. This approach, although now being modified, has challenged long-standing common property rights of indigenous peoples, frequently mountain peoples, and in some instances has led to conflicts at various levels.

While the issue of common property rights and national park designation, in the first instance, brings to mind conflicts in the developing world (e.g. the Karakorum national parks, Pakistan; Ruros National Park, Nepal -- see also the case study on the Khumbu, pp. 87-95), equally significant problems arise in the

well established countries of Western Europe. The situation facing the Rondane National Park, Norway, is introduced in this case study as an example of changing mountain land use, common property rights, and the increasing demands of urban dwellers for recreational access. It is adapted from a detailed study undertaken by the Eastern Norway Research Institute supported by a grant from the Norwegian Research Council (Kaltenborn *et al.*, 1999).

Norway has created a national park system that is almost entirely located in its mountainous hinterland. Most of its parks are on state-owned land of low productivity, much of which is regarded as 'wilderness' by the urban and lowland populations who, in a democratic system, represent a national majority. Nevertheless, these state-owned lands also represent the local environment for many rural highland communities and have been used for generations, in the minds of the users, with care such that today they are far from being 'wilderness' areas but are special cultural landscapes. Currently, the Norwegian Ministry of Environment (1992) is planning significant expansion of the protected areas system and this has become a contentious situation as many of the stakeholders remain uncertain about the motives for expansion. Efforts are under way to achieve increased integration of local interests in the planning process. A vital part of this is to ensure a better appreciation of the perspectives of the affected rural and highland communities.

The movement to establish national parks in North America during the late 19th century was quickly taken up in Europe and in other parts of the world.

Sweden (1909), Finland (1922), and Iceland (1928) were early examples. Poland actually made one of the earliest attempts to establish a national park in the Tatra Mountains although the political situation delayed the establishment until after the end of World War II. Australia, New Zealand, and South Africa also established national parks. Norway designated 21 national parks between 1962 and 1990 including the high arctic archipelago of Svalbard.

Two dominant factors seem to have influenced this world-wide process of park establishment. One is the *specialness* of the environment concerned; the other is the relatively limited degree of conflict associated with the provision of new and stricter management regimes. *Specialness* implies landscape aesthetics, or 'wilderness', as perceived by non-rural groups and/or a particularly rich degree of biodiversity. The second factor has led to the frequent establishment of protected areas in economically marginal regions; by definition, these have been overwhelmingly mountain, desert, and arctic. In the past, local populations were rarely consulted and were sometimes even regarded as obstacles to the interests of the greater society.

The sponsorship for new protected area designations has usually arisen from special sectors of society, such as urban elites and scientific experts who could be categorized as the rich and influential, or privileged, in contrast to the traditional rural and/or indigenous user groups. Protected areas, therefore, are instruments of society created by politically influential forces. Thus, conflicts are inevitable, and it is this that has produced extensive re-thinking. The broader

issues of defining 'wilderness' and ensuring a more equitable approach to human rights constitutes a major topic beyond the scope of this case study. Nevertheless, mountain conflicts arising from protected area designation, with their conspicuous highland-lowland interactions, will only be assuaged as these issues are more fully recognized, if only from a pragmatic point of view.

Kaltenborn *et al.* (1999) explore these issues more fully and include a number of relevant references. They make the important point that "What scientific ecology describes as a well functioning environment may not match what 'ordinary' people, such as mountain farmers, perceive to be sustainable use of natural resources." (Kaltenborn *et al.* 1999: 53).

In 1962 Rondane became the first national park in Norway; it covers an area of 580 km<sup>2</sup> and consists mainly of state-owned land above timberline. It is surrounded by privately-owned alpine and forest lands. Historically, the local communities, which date back for at least 300 years, have used all these lands (private and state-owned) for harvesting various resources by hunting, gathering, forestry, summer grazing, and even small-scale mining. Many of these activities are still important in the buffer zones surrounding the park. Traditionally, these areas comprised common property lands with a management regime that is much less strict than that within a formally designated national park.

Today, Rondane National Park is used extensively for recreation and tourism. It contains a trail system and lodges, although motorized vehicles are

excluded. Second homes, hotels, and other tourist facilities have been developed in the surrounding areas. Current plans involve expansion of the park onto private lands but will have little impact on several of the traditional activities, such as summer grazing and use of existing cabins. Nevertheless, forestry and mining will be prohibited as well as construction of new roads and outdoor recreation and tourist facilities. Realizing the possibility of conflicting reactions, the planning authorities presented alternatives during 1996 and 1997 and held a series of meetings with representatives of the local communities, individually and in groups.

The attempts to explain management planning to the local communities met with difficulty. In general, 'outside' managers were not held in high esteem. Almost unanimously, the local communities stated that management of the protected areas should be based locally. There was a low level of trust and a feeling that local competence was regarded as irrelevant and/or inadequate. New park rules were considered unnecessarily rigid and bureaucratic. Management was perceived as something impersonal and relatively abstract. However, while many of the local informants knew the area well in a practical sense, they had limited knowledge about the actual nature of a national park. Most had problems in distinguishing between national parks and other categories of protected areas.

The managers, most of whom were 'outsiders' and employed by environment management institutions far from the park area, were perceived as

less informed about the area and its qualities than the local people. They were also seen as stereotypes representing urban and lowland interests. The rural communities anticipated conflicts on issues such as welfare subsidies, agricultural policies, infrastructural development, and centralization of the school systems.

Predator control was an especially contentious issue. Norway has an international obligation to secure sustainable populations of bears, wolves, lynx, and wolverines, and large areas are defined as core habitats for these species (Ministry of Environment, 1992, 1997). Protection of wild animals conflicts with sheep farming. There is no resolution in sight and the problem appears to be intensifying ( see also pp. 29).

Tourism and its promotion and management presented another set of issues. However, the basic question was whether or not the park extensions were necessary and legitimate. The local representatives frequently asked why a large national park should be extended when the buffer zones are already well managed through other types of legislation? There were many conflicts over management styles and over the goals and intentions of the park, its benefits, and who should bear what proportion of the costs

This case study demonstrates the very significant extent of problems stemming from different educational, social, and cultural backgrounds within a single national identity. Even language, emphasized by the reaction of the local people to what they perceived as the managers' use of jargon, came to the fore. It

was concluded that participatory planning for protected areas requires the integration of fundamentally different values. Diverse values cannot be measured along a common scale, although they can usually be compared and ranked. Kaltenborn *et al.* (1999) conclude that, in these kinds of situations, it is essential to understand the complex relationships and emotions the local people develop with their surroundings so that negotiation over contested issues will be facilitated.

Given realization of the complexity of these issues in a small country like Norway with a single national language and homogeneous population, how much greater will be the problems of incorporating ethnic mountain minority communities into decision making over establishment of new national parks. Such localities as the Pamir Mountains and the highlands of Papua New Guinea come to mind; in areas such as these the planning process will have to contend with many ethnic minorities, languages, religions, and enormous contrasts in cultural and socioeconomic background. Nevertheless, the lessons learned from tackling difficulties such as these in relatively tractable areas should be extremely valuable in terms of their potential for wider application.

## h. LIJIANG COUNTY, YUNNAN, CHINA: FORESTS AND TOURISM DEVELOPMENT

Lijiang County of northwestern Yunnan, China, with its spectacular Jade Dragon Snow Mountains (Yulongxue Shan), was opened to visitors in 1985. Over the past 15 years enormous changes have occurred to the environment and the many ethnic minorities. Two themes are emphasized here: the vicissitudes of a fluctuating forestry policy and the rapid growth in tourism. Over the centuries outside influences have affected life and landscape in Lijiang County. Prior to 1950, however, these were very intermittent, reflecting fluctuating imperial will and Han military presence. After 1950 the impacts of a lowland and distant central authority became pervasive, yet many of the ethnic minority ways of life persisted. With the 1985 opening to the influence of globalization, albeit filtered through the authoritarian screen of central government, change has accelerated to unimaginable proportions. Two sources of economic and social change can be identified. One is due to a distant provincial government based in Kunming; the other is due to actions of the central government and its determination to control development for the benefit of China as a whole. Thus the varying importance of extractive forestry and the recent priority placed on mass tourism as the best force for overall rapid economic success are essentially modern lowland impacts

on a highland region that less than two decades ago was still one of the most isolated areas in the world.

The Jade Dragon Snow Mountains, located in Lijiang County in latitude 27° North, are the most southerly mountains of Eurasia that support glaciers and permanent snowfields. With elevations ranging from 1,800 to 5,600 m asl, the natural and agricultural belts extend from subtropical monsoon forest (uppermost limit of banana plants), through several natural forest belts (overlapped by the upper limits of rice and barley cultivation), to upper timberline, alpine tundra, bare rock, screes, and permanent ice and snow. It is a physically complex area, subject to recurring earthquakes. The two main mountain massifs, the Yulongxue Shan and the Habaxue Shan (the latter in neighbouring Zhongdian County), are cut through by the great gorge of the upper Yangtze (Jinsha Jiang), known as 'Tiger Leap Gorge'. This gigantic feature is nearly 4,000 m deep and is rapidly becoming one of the great tourist attractions of Southeast Asia as well as the potential site for one of the highest hydroelectricity dams in the world.

Lijiang County has a total population of about 325,000 comprising a great variety of cultures, including Naxi, Yi, Tibetan, Bai, Lisu, and Han peoples. About 82 percent of the total are minorities of which by far the largest group are the Naxi. Seventy percent depend directly on agriculture, mostly subsistence farming, and 30 percent are urban dwellers. Dayan (Lijiang Town) is the capital and by far the largest town, population given at about 60,000 in the 1990 Census

(similarly, all data in this section are derived from the 1990 Census). The average per capita annual income of the rural population is only 420 Yuan (about US\$70). Many villages have no road access and are without electricity, some have enough power to supply a few light bulbs. Water delivery and sewerage disposal are extremely primitive, or non-existent in the more remote areas. Rural poverty, therefore, is widespread and many people would be classed as living below the poverty line based on Chinese standards.

Lijiang County has a land area of about 7,000 km<sup>2</sup>: 3,900 km<sup>2</sup> is under forest; 1,200 km<sup>2</sup> is pasture; 1,300 km<sup>2</sup> is waste land (mainly non-productive ice, snow, rock, and scree) and 400 km<sup>2</sup> is cultivated. Ninety percent is classed as mountainous, of which the Yulongxue Shan Nature Preserve occupies about 260 km<sup>2</sup> of the highest and most spectacular.

In 1979-1980 the Central Government introduced a new liberal policy known as the "household responsibility system". It marked the end of the collective farms and the rigorously controlled production systems that characterized Lijiang County during the Mao Zedong era. Land, including forest land, reverted to village control and households were allocated both agricultural land and forest access in proportion to family size. Commercial logging, much of it illegal, had long been the most important enterprise of the region and, given the new market access, both legal and illegal logging mushroomed after 1985, reaching a peak in 1989-1990.

Lijiang County became only partially 'open' to foreigners in 1985, the same year that the Yulongxue Shan Nature Preserve was established. At the same time tourism, both domestic and international, was recognized by the central and provincial governments as potentially the most lucrative form of development. Early realization of the importance of environmental quality to sustainable tourism led to a crackdown on both illegal and legal logging.

In 1982 the first foreign visitors since 1950 travelled through the area (Ives, 1982; Messerli and Ives, 1984) by special permission of the Central Government, the Peoples Liberation Army, and the Naxi Autonomous Government. This facilitated a first-hand assessment of the social conditions of many of the indigenous people. It was followed in 1985 by a ten-week investigation as part of a research programme under the auspices of the Chinese Academy of Sciences and the United Nations University. Subsequent study visits were made by the author in 1991, 1993, 1994, and 1995. Generous assistance was afforded by the local government, and especially by the Governor of Lijiang who took a strong personal interest in environmental conservation and the welfare of the local people.

In the early 1980s official opinion held that massive deforestation had occurred throughout Yunnan (including Lijiang County), inducing soil erosion, landsliding and gullying, and downstream flooding and siltation. It was assumed that this massive environmental damage was largely the result of resource mismanagement after 1950, resulting from policies introduced under

the leadership of Mao Zedong and the 'Gang of Four'. The essence of this interpretation ran parallel with the views expressed within the Theory of Himalayan Environmental Degradation (pp. 131-144).

Yunnan is one of the most important sources of the country's much needed supply of timber. As mentioned above, in the early 1980s massive deforestation had been ascribed to mismanagement during the period 1950-1979. The course of a two-day jeep ride from Kunming to Lijiang Town in 1982, and again in 1985, revealed extensive damage to forest cover over wide areas. Tens of kilometres of degraded shrubland, rough pasture, gullied hillslopes, even exposed bedrock with all soil cover washed away, were visible from the road. The impression was so overwhelming that this extensive tract of the Yunnan Plateau that once carried a cover of monsoon rain forest was dubbed Yunnan's 'painted desert'. However, while some of this damage had definitely occurred since 1950, it became apparent that it represented the culmination of a long-continued process extending back in time for centuries, if not for more than a thousand years.

Further north, where it is more mountainous and mature forest stands are less accessible, the condition of the forest cover was much better. This was especially the case in Lijiang County, although even here the road north from the town to Daju was clogged with heavily-laden timber trucks 24 hours a day in 1985. The newly designated nature preserve, where the road provided easy truck access, seemed to be logged as much as other areas.

Nevertheless, replication of high-quality photographs taken by Joseph F. Rock between 1923 and 1949 revealed a complex history of forest cover change. The repeat photography study was augmented in 1985 by investigation of the age of trees in selected areas and over 1,000 increment cores were taken. The preliminary results of the forest study in Lijiang County showed that in some areas, especially those several hours walk from a road, forest cover was more complete and tree stands more mature than in the same localities in the 1920s and 1930s. In other areas, usually closer to roads, tree cover in 1985 was comparable to that of 50 to 60 years ago, and in yet other accessible locations considerable deterioration had occurred and was continuing. Some areas, with dense but immature tree cover as seen on the Rock photographs, while appearing superficially comparable in 1985, had been cleared of trees after Rock's time but had recovered naturally. Except for scattered mature trees, presumably preserved deliberately as seed sources, the vast majority of individuals in these areas were less than 40-60 years old. Forest fire, either natural, accidental, or intentionally set, was also evident.

At high altitudes, and remote from roads, mature stands of fir (*Abies spectabilis*) contained individuals more than 100 m high and in excess of 700 years in age. Incidental felling was apparent but of negligible proportions. Small pockets of almost clear cutting were often the result of illegal, or even legal, village-level logging. They included high-altitude rhododendron, and patches in the pine forests (*Pinus yunnanensis*) around villages. These clearings were, at

least in part, the consequence of the 'household responsibility system'. After the 1979 liberalization many villagers began constructing new houses and the impact on the neighbouring forests was immediate. Forest degradation was the more severe because Naxi houses, in particular, are over-constructed and require a large number of trees; the methods of logging are extremely wasteful; and the transporting of logs, by dragging with cruelly whipped horses, leads to the development of numerous skid trails, many of which become gullies during monsoon rains. Ten years later, however, remarkable forest recovery was observed around several of these villages.

During the early 1990s six minority villages were selected for detailed investigation. Three were predominantly Naxi; three were Yi. The research aimed to study the attitudes of the villagers toward the forests and the position of women in relation to forest access and also the division of labour within the two distinct ethnic groups. Also to be studied was change in forest cover over time. This was accompanied by assessment of impacts of the rapid growth in tourism both on village culture and on the Lijiang area environment.

Yuhu is a large Naxi village included in the study and is the closest one to Lijiang Town; a one kilometre-long poor dirt road connects with a modern surfaced road 15 km from the town. It is located at 2,710 m asl on the 'Lijiang Plain' at the base of a steep mountain slope that leads to the crest of a long low southerly spur of the Yulongxue Shan. The village has a spectacular site beneath the highest summit at 5,596 m. It is notable as the village used by Dr. Joseph F.

Rock for his National Geographic Society expedition headquarters for several years in the 1920s and 1930s. Of a total of 277 households, interviews and questionnaires were obtained from 20 that were randomly selected.

Wenhai village, located at 3,110 m, is the highest village studied in detail. It is also a Naxi village, although the headman is Yi. It has no road access and is reached by trails, four hours walk from Yuhu, or three hours from Baisha, a small town within easy access of Lijiang Town. The village lies on the shore of Wenhai Lake, a beautiful body of water which, however, drains away down a sink hole in the underlying limestone bedrock by late winter; it fills again during the following summer monsoon. Of the 40 Wenhai households 13 were randomly selected for detailed interviews. In addition, Ru Nan Gu, one of the three Yi villages, 1 to 1.5 hours walk away to the north, was studied briefly; the reported richest and poorest households were interviewed.

Jiazi, a Naxi village at 2,150 m, was the lowest village studied in detail. It is located 12 km east of the main north-south road that passes through Heishui. It is accessible by a very rough unsurfaced four-wheel drive road passable only during the dry season. Half of the 42 households were randomly selected and interviewed.

The three Yi villages selected for study (Heishui) are situated on, or close to, the main road leading north from Lijiang Town. The road, originally a forest road, was being improved and, in November 1994, was surfaced for a distance of 15 km out of town (this has since been extended to beyond the villages). They lie

close together at altitudes of 2,960, 2,840, and 2,830 m asl near the eastern border of the Yulongxue Shan Nature Preserve and are within easy walking distance of the Preserve headquarters and a new tourist hotel complex that was opened in the autumn of 1993. Fifty percent of all households were interviewed and an extensive questionnaire was completed for each. In addition to the six villages selected for detailed study, other villages were investigated on a reconnaissance basis.

One component of the 1993--1995 field programme was an investigation of forest cover around these villages. In addition, an attempt was made to determine the relationship between forest condition and the status of the village women (Swope, 1995; Swope *et al.*, 1997). The central conclusions of this part of Swope's research are presented here, using Wenhai as the example because of the availability of Joseph Rock photograph coverage.

Wenhai Forests: In 1982, the only year for which information is available, the Wenhai administrative village controlled a total area of 25,725 *mu*. The share of the lower village was 3,880 *mu*; the upper village controlled 5,470 *mu*. The remainder had been allocated to other neighbouring natural villages. However, the actual area recorded as being under forest was 2,370 *mu*. Thus, only about a tenth of the area suitable for trees had significant forest cover. In 1995 the forest of the upper village was in much better condition than that of the lower village, reportedly on account of the attitudes, hard work, and efficiency of the upper

village officials. This well-managed forest is dominated by *Pinus yunnanensis*, with *Quercus* spp, *Tsuga* spp and *Picea* spp as secondary species. The understory is dominated by rhododendron, azalea, bamboo, small oak, shrubs, herbs and forbs. Pines, with an average height of 10--12m and bhd 20cm, aged at 35--40 years. Selective logging, with many recently cut stumps of average diameter 25 cm, was apparent (Swope, 1995).

Forest use included charcoal making (oak) both for sale and for home heating, planks and logs, both for sale and for local construction, harvesting of non-wood products, including medicinal herbs, mushrooms, pine needles for bedding and fertilizer compost, and hunting small animals and birds.

Approximately 20 percent of the people in the upper villager were engaged in illegal logging but this was fewer than the number in the lower village.

However, the illegal logging issue is complicated by the fact that logs, illegally cut in neighbouring villages pass through Wenhai, being sold and resold, and eventually find their way to Baisha for final sale. Policing of the forest laws also is variable and often ineffective; because of the scarcity of forest service staff and familiar relationships between forest police and the villagers, a 'grapevine' system usually allows illegal activities to be concealed before the police arrive. Furthermore, there is little organized reforestation, partly because the pine and oak quickly regenerate naturally. Nevertheless, between August and October 1993, 26,000 seedlings were planted under a programme of the County Forest Bureau, which includes a small financial incentive for each tree that survives.

The seedling species in this instance were mainly Sichuan pepper and juniper, although many were reported to have died due to poor planting techniques and lack of tree-care knowledge.

Comparison of two photographs from 1927 and 1985 reveals an interesting pattern. The 1927 photograph shows areas of old growth on the upper slopes of the far side of Wenhai Lake. Much of this appears to have been cut by 1985. The lower slopes have a more extensive forest cover as agricultural fields have been abandoned and recolonization by trees, mainly pine, has occurred. On the near side of the lake a very healthy forest cover is in place in 1985, with a closed canopy; this is in marked contrast to the poor forest condition apparent in 1927.

The original conclusions, published by Ives and Messerli (1989), however, must be modified. First, the village interviews of 1993 indicated that the near side of the lake had been damaged by forest fire a few years prior to Rock's 1927 visit; this introduces the problem of identifying the impact of fire and its timing. Second, the healthy forest condition of 1985 had significantly deteriorated by 1993. Much of this was likely due to the large programme of village house reconstruction during the period 1985--1990. Now that most households have new, or well repaired, houses this form of impact will likely be much reduced in the future. Nevertheless, there had been a significant reduction in the quality of forest cover between 1985 and 1995. Furthermore, the dynamics of forest use and management are extremely complicated and preclude broad generalizations, even for a small area.

Undoubtedly, the situation in Lijiang County as a whole is changing rapidly. Total commercial harvesting has been reduced, illegal logging is being more strictly controlled, and the Yulongxue Shan Nature Preserve is now being quite vigorously protected. There is a long range plan in effect to increase overall County forest cover to 55 percent of total area by AD 2005. This is to be achieved by a combination of reforestation, reduced commercial harvest, tighter application of the forest laws, and progressive introduction of efficient wood stoves and mini-hydroelectric installations. In some Yi villages the traditional house construction, which relies 100 percent on wood, is being changed with the introduction of bricks and mortar, following more nearly the Naxi style.

There has been an assumption that in developing, and especially in least developed, countries deforestation is particularly serious in terms of its impact on women. This assumption that had widespread support amongst development agencies and social science researchers is based upon the understanding that, amongst poor subsistence and transitional communities, rigorous division of labour identifies fuelwood collection, as well as the fetching of water, cooking, and most other household tasks, as the domain of women and older female children. This unfavourable status of women is reinforced, theoretically, by the eco-feminist view that depicts an inherent linkage between women and nature; the defining metaphor (Jackson, 1993), which is also Eurocentric, is the all-nurturing 'mother earth'. The linkage, of course, is based upon women's biologically-determined reproductive role. In the development arena, women are

seen both as environmental managers, since they are the ones who interact most with nature, and as the victims of environmental degradation, since they are dependent on the products of the natural environment (Swope, 1995: 147-168).

There is a great deal of support for the validity of the eco-feminist beliefs; they seem especially relevant to the Himalayan countries, as shown by research in Nepal, northern India, and northern Pakistan. Thus part of our Lijiang County household questionnaire was designed to determine the degree of equity, or inequity, in workload between men and women in both Naxi and Yi communities. Swope (1995) and Swope *et al.* (1997) provide an overview of the impacts of varying Chinese policy through time as it has affected the position of women in Han society and, indirectly, in Chinese minority societies. A detailed understanding of household, farm, village, and market tasks was derived from the answers to questions concerning workload sharing for 21 different areas of responsibility. This was augmented by elaboration of an agricultural calendar.

Although all the highland villages are affected by the same influences and policies imposed by local authorities, the record is not simple and there is a good deal of variation between villages. In Yuhu and Wenhai, however, while most of the fuelwood collection is done by women, their men folk assist. There is also significant male input to cooking, child care, fetching water, and women are well integrated into agricultural tasks. They also play a large role in marketing. Yet there is a great deal of variation between households. In some instances the women control the way in which cash income is used, as well as having an equal

say at village-level meetings. On average, women have a lower standard of education with fewer years in primary school. Nevertheless, there is no clear-cut division of labour along gender lines. This may be, in part, the influence of a traditional matrilineal society that appears to have been a Naxi characteristic for centuries prior to total Chinese control, although this would not explain the Yi situation.

The Yi natural villages of Heishui present some interesting anomalies. First, practically all the fuelwood collection is done by men, despite the proximity of the supply to the village. This may be a reflection of traditional Lisu/Yi division of labour whereby the forest was considered the men's domain as it is the hunting area, and only men were allowed to use an axe. Another factor is that the Yi villages lie within the Nature Preserve and tree cutting is now strictly regulated. On the reverse side, women assisted with ploughing, yet cooking, child care and water fetching were predominantly, but by no means exclusively, female tasks. A uniquely female task in all villages, both Yi and Naxi, is the gathering of pine needles for use in compost. In Yuhu, which has experienced the most severe deforestation, this has become a significant task.

The inevitable conclusion is that, especially in Naxi, but also in Yi, rural life, there is no clear-cut division of labour, with the exception of the collection of pine needles. While deforestation, or deterioration of forest quality, does have an impact on women, the situation is not the one usually portrayed in the literature about highland people elsewhere. Almost all tasks are shared to some extent, the

degree of sharing being dependent upon the circumstances of the individual household rather than on societal tradition. In instances where the woman appears to be doing most of the housework, for instance, it transpires that the husband has another job, such as school teacher. It is postulated, therefore, that rural women in Lijiang County (and in China?) may be better off than in other developing countries because of the central government's emphasis on maximizing production.

It becomes clear from any detailed investigation that the original (early 1980s) assumptions concerning the timing and causes of forest clearing across Yunnan, and specifically Lijiang County, were greatly over-simplified and over-dramatized. Deforestation has been occurring for centuries. However, it has not been a uni-directional process and there are great contrasts from one area to another. The primary factors leading to forest loss during the 20th century, however, have been the persistent changes in forest policy by the central and provincial governments, that is, by the political forces in the lowlands who enact policies for land management and economic priorities in mountain communities. This affected the period prior to 1950 as well as the period of most autocratic government control between 1950 and 1979; it is also true of the last twenty years. Frequent policy changes, especially those involving total state control, or even the current policy of local control under state ownership with inadequate and ambiguous policing, tempts people to exploit their local forests. Fluctuating forest policy inhibits long-term sustainable management. The accelerating

development of tourism, however, has placed a premium on achieving environmental stability, including forest protection, which has been progressively strengthened during the 1990s. It follows that the motivation for forest protection is being driven primarily by market forces relating to tourism and not by recognition of the need to assist the local villagers.

### **Impacts of Tourism Development on Mountain Minority Peoples**

In July 1985, the State Council and Military Commission of Yunnan Province declared Lijiang Naxi Autonomous County open to foreign tourism; in December 1986, Lijiang Town was designated a province-level historical and cultural attraction. In the following decade, international tourism increased rapidly, presenting substantial opportunities and risks. As Lijiang County includes some of the poorest communities in China, presumably significant benefits could accrue from the economic opportunities afforded by successful tourism. The highland region of Yunnan has significant natural resources, including forests and potential sources of hydropower, as well as unique topographical features and ecosystems. These resources are in danger of being over-exploited by power bases in the lowlands unless they are effectively protected. The development of appropriate tourism could provide a strong stimulus for conservation. Likewise, the trend toward cultural assimilation and obliteration of minority cultures throughout China would be opposed as contradictory to the development of tourism that places an economic value on cultural diversity.

While tourism presents opportunities, it also entails risks; the primary risks are degradation of the natural and cultural environment, particularly those features that are promoted as tourism amenities. There are other risks to the hosts, including economic disruption, as well as risks for investors, and even physical risks for travellers. One area of Lijiang County where the opportunities and risks are greatest is the Yulongxue Shan (Jade Dragon Snow Mountains).

The following account documents the development of tourism in the county between 1985 and 1996 and discusses the apparent conflicts that are occurring between mass tourism and 'appropriate' tourism. It concludes with a proposal for a specific 'appropriate' tourism development. The proposal emerged from the United Nations University/Ford Foundation funded research (1991-1995). By 1993 it was apparent that mass tourism had become the driving force behind all officially planned development in the County. In interviews with the villagers, it was learned that much of their hope for future prosperity was pinned on tourism development. The 'appropriate' tourism development proposal grew out of extensive consultations with residents of the prospective host communities.

The development of tourism in Lijiang County and the Jade Dragon Snow Mountains is certainly a highland-lowland interaction. The popularity of Yunnan's provincial capital, Kunming, and of its many surrounding attractions, is critical, at least in the early stages, to the viability of tourism in the relatively remote counties of Dali and Lijiang further north. The development of tourism in

Lijiang Town, the county seat, would appear to have the strongest influence on development of the Jade Dragon Snow Mountains; the appeal of Lijiang Town derives in part from the other sites throughout the county, as well as in the neighbouring county of Zhongdian to the northwest. The tourist industry in the very recently opened county of Deqen is currently dependent on spill-over from Lijiang, but further development of amenities in Deqen - and the eventual opening of the Yunnan-Tibet Highway - could presumably equalize or reverse this influence. On a larger scale, tourism in Lijiang, and Yunnan as a whole, is closely linked to tourism development throughout China; this relationship is more complicated than local linkages. Any plan for the development of tourism in the Jade Dragon Snow Mountains, therefore, must take into account the extended geographical context. Tourism in China is benefiting from continuing relaxation of travel restrictions, from improvement in transportation, and from rapid increase in per capita income; improvements in services and accommodations have been less spectacular, but substantial.

Yunnan has many advantages for development of tourism compared with the rest of China. It is known as the 'land of eternal spring'. Xishuangbanna, an extensive tropical rainforest in southwestern Yunnan (beyond the plateau), has unmatched botanical and zoological diversity. Culturally, as well, Yunnan has a greater variety of minority nationalities than any other province and also one of the greatest proportion of minorities to total population.

At the same time, the route from Kunming to Lijiang has become much more accessible. Dali remains an attractive way stop for those using the bus, although overnight sleepers have cut the trip from two long days to twenty hours. Since 1995, the airport at Lijiang has offered a 45-minute alternative, but the impossibility of making air reservations from outside China means that it is viable primarily to business travellers and to some packaged-tour clients.

The Tiger Leap Gorge, named for an instance in Naxi legend, has become a primary tourist attraction. In addition to this world class phenomenon, limestone terrain, with fretted pavements, sink holes, vanishing lakes, and underground caverns, along with sandstone pinnacles and travertine terraces, broaden the appeal still further. The terrain, and its extremely diverse flora once supported a comparably varied fauna, including red panda, leopards, bears, tigers, wolves, foxes, and many species of birds, amongst which are a striking variety of raptors and gaudy pheasants, some endemic to the region.

Lijiang receives an exceptionally large amount of solar radiation: 2,540 hours of sunshine per year. In sum, spring and autumn are extremely attractive, winter is invigorating and essentially snow-free at populated elevations; summer, by comparison with the rest of China, not to mention Southeast Asia, is quite pleasant.

The enormous topographical and biological diversity of northwestern Yunnan Province has provided habitats for a matching diversity of distinct ethnic nationalities, including Naxi, Yi, Tibetan, Bai, and Lisu. Unlike many

other peripheral regions of the China, where dominant 'minorities' persist in a homogenized Han landscape, Lijiang County is a backwater of cultural conservatism. Naxi women wear their distinctive costumes; Yi girls in the nearby villages wear their yellow, red and green gowns and mortarboard bonnets. In part, the heterogeneity is due to centuries of resistance to outside domination and isolation emphasized by the mountainous topography.

The Naxi in particular have a long and proud history, and even claim that the pictographs of their ancient Dongba culture predate the development of Han script. Regardless of the accuracy of this claim, the Naxi culture has produced an array of architectural gems that survived the Cultural Revolution or have been repaired or rebuilt since 1980. While these are concentrated in and around the warren of streets and canals that comprise the 'Old Town' of Lijiang (Dayan), which was designated a UNESCO World Heritage site in 1997, there are numerous outlying temples and well-preserved traditional villages with manicured fields and terraces.

The charisma of Naxi Dongpa culture and the splendor of the landscape converge on the Jade Dragon which looms over the town of Lijiang. The sacred mountain of the Yulong has a commanding place in Naxi folklore, comparable to that of the Tibetan Shambala (Shangri La in Conrad Hilton's imagination). The allure of the ideal acquired a tragic overlay after the Qing Emperor, Yongzheng, in 1723, imposed more rigorous Han control on his minority subjects through the military governor in Lijiang. Confucianized political and social institutions were

enforced on a previously open and matrilineal society. Hitherto, marriages had been based upon the free choice of teenage love relations. After 1723 pre-arranged Han-style marriage contracts were required and, amongst many other changes, illegitimacy was considered shameful and pre-marital virginity prescribed. Nonetheless, young Naxi were left free to fall in love and consort with each other - until the day they were forced into their respective pre-arranged marriages. The only escape seemed to be that offered by folkloric traditions: lovers who committed suicide with the proper rituals in the proper locales could expect to be transported over the snow peaks to a mountain paradise where they would live in perpetual youth, good health, and comfort. For more than 200 years, this custom cost the Naxi population significant losses in their total number; love suicides involving up to a dozen couples at a time have occurred as recently as the 1950s. The most famous of the 'jumping-off' points is the subalpine meadow, Yunshanping, now known to the burgeoning tourist trade as 'Love-Suicide Meadow' (Swope *et al.*, 1997).

Another significant tourist asset is the now almost legendary life of Dr. Joseph Rock, who lived and worked at the foot of the Yulongxue Shan from 1923 until 1949 (Rock, 1926), with a few absences to return to National Geographic Society headquarters in Washington, DC., to replenish his funding. Joseph Rock was probably the first Western traveller to explore what is arguably the primary natural attraction in Lijiang -- Tiger Leap Gorge. When Rock ventured through it in the 1920s it was a nearly inaccessible sanctuary for bandits; it remained

virtually unvisited by tourists until it was opened as a park in 1992. The traverse involves a trek of about 30 km from Qiaotou, a rough-hewn settlement in the south, to Daju, the northern trailhead. The most precipitous section is about 16 km long, more than twice the depth of the Grand Canyon, but much narrower and with snow peaks on either side. There are many possibilities for side trips and the tourist lodges at Walnut Grove have become popular attractions in their own right. The views are breath-taking, and while rockfall and unstable trail sections are sometimes more than inconveniences, during dry weather heat exhaustion is the most serious impediment to safety.

The Tourism Market: In addition to conditions in the host area, tourism development depends on factors relating to the visitors. While the most numerous consumers of Chinese tourism are, and will continue to be, domestic travellers, of international arrivals, by far the greatest proportion have been 'compatriots' from Taiwan, Hong Kong, Singapore, and Macao. Both of these groups tend to focus mainly on the eastern and urban centres of China, either because they are visiting family, doing business, or making the rounds of the famous sites of their homeland. The strictly domestic market is of limited interest to Chinese policy makers since nationals tend to spend relatively little, overall, and contribute minimally to foreign exchange revenues, the primary goal of national tourism planning. Nevertheless, Han visitors do constitute the overwhelming majority of all tourist arrivals in Lijiang Town. Thus, while not discounting the importance of the domestic and compatriot markets, it is the

foreign market that provides the source of 'off-the-beaten-track' tourists together with much of the foreign currency.

There was a dramatic increase in foreign arrivals in Lijiang annually from 1985 to 1996 (the most recent available data); the average annual growth rate was more than 70%, culminating in 1996 in excess of 100,000 persons. The top eleven nationalities represented in a Lijiang tourist survey are as follows:

1. Netherlands	(16.2 %)
2. United Kingdom	(14.9 %)
3. United States	(10.8 %)
4. Denmark	( 9.5 %)
5. France	( 8.3 %)
6-7. Israel and Australia	(each 6.6 %)
8. Canada	(5.0 %)
9-11. Belgium, Germany and Sweden	(each 2.9 %)

In targeting the high-priority 'foreign' tourist market in the country at large, Chinese planners have encouraged the proliferation of 'luxury' hotels and attractions such as conveniently located clusters of 'minority villages' (essentially human zoos). Western tourists, however, are less tolerant than Asians of urban congestion, over-exposed and contrived attractions, poor service in ostensibly upscale accommodations, not to mention bureaucratic incompetence, noise pollution, and public spitting. Many prefer remote destinations for exotic experiences, and even 'roughing it'. For all these reasons, the outlook for foreign tourism in Lijiang is particularly auspicious. But what emerges from the demographic analysis, and what planners seem to have ignored, is that Lijiang is in the process of acquiring a reputation as a 'mecca' for low budget travellers:

young, educated, often travelling in couples, and generally 'on vacation'. They are not visiting family, they are not on business, and they are not fleeing the heat back home. They have their choice of exotic destinations around the world and this is a competitive and fragile market. The 1996 edition of Lonely Planet's guidebook to China highlighted only two locales as having the potential to become 'legendary backpacker destinations'; one was Xishuangbanna, in southern Yunnan, and the other Lijiang (Taylor, 1996: 129-130).

Costs and benefits of tourism development: The risks and opportunities of future tourism development in Lijiang can best be assessed in terms of costs and benefits that are already accruing. Of course, costs and benefits are interpreted subjectively. Since the opening of the Lijiang region to foreign visitors in 1985, the tourism scene has developed from an extremely primitive level, at the end of a torturous two-day bus or jeep drive from Kunming, to one of rapidly extending surfaced roads, four-star hotels, attractive restaurants, air conditioned luxury tour buses, and the modern airport with 45-minute access from Kunming. Additionally, the conditions tied to granting World Heritage status have drastically reduced the pressure on the Old Town for new and ugly development, although it is surrounded by unappealing modern architecture that is spreading out across the Lijiang Plain. Despite the catastrophic earthquake of February 1996 that destroyed a third of the buildings in the old town and damaged most of the others, the destruction itself was courageously and effectively used by the county and provincial officials to eliminate non-

traditional structures that did survive, to halt pre-earthquake encroachment of motorized traffic, and to reestablish much of the traditional beauty. The town is now a very comfortable and culturally interesting destination. On the other hand, the rise in property values is forcing out original residents to make room for boutiques and restaurants; they have sold out to outsiders, newcomers from distant parts of China who now manage the facilities that cater to the tourists. Overall, however, the current situation is a vast improvement on the hitherto uncontrolled development that would have eliminated consideration for World Heritage status.

Concurrently with the development of Lijiang Town and the Old Town, much of the Jade Dragon Snow Mountains is increasingly protected as a nature preserve. Nevertheless, the small tectonic basins that run along the eastern foot of the mountains have become sites for elitist hotels and amusement facilities. One of the saddest sequence of events has occurred around Yunshangping, the so-called Love-Suicide Meadow. The extremely poor Yi villages nearby seized the initial benefits from the tourist potential. They acquired horses, decorated them, and set their traditionally gaily costumed womenfolk to lead the gaudily caparisoned beasts bearing their well-heeled clients up the 600-metre ascent to the beautiful meadow. Within two years, as business boomed, the three small Yi villages had assembled over a hundred horses. The first down-turn was the spread of ugly competition between rival families; this was accompanied by the casual scattering of refuse by tourists from horseback, including plastic bags on

which Yi livestock choked to death. Next, a chair-lift was constructed with foreign investment, undermining the ideals of the Nature Preserve and undercutting the Yi business. A temporary shift to horse riding and racing in the meadow had to be terminated by the authorities because of the excessive environmental damage, and the villagers were left with dozens of horses they could not afford to feed and with neglected subsistence crops. The chair-lift was amortized within two years; a surfaced road, car park, restaurants, and guest houses sprung up overnight. As the local Yi witnessed the eclipse of their tourist entrepreneurship, two troupes of young Yi village dancers were 'imported' from further afield. The girls were paid a pittance to satisfy the curious tourists; the curiosity degenerated into prostitution. In any event, these developments involved the importation of modified Yi culture into a primary location of Naxi legend. The attraction of the Love-Suicide Meadow has continued to grow apace; by year 2000 traffic jams involving tour buses had become common occurrences.

Following the initial financial success of the chair-lift, a swath was cut through the mountain forest belts to well above timberline at 4,500 m and a large gondola system installed, providing instant access to snow fields, glaciers, and delicate alpine meadows. A second gondola was constructed during 2000. Busloads of wealthy tourists from the lowlands of Southeast Asia can now be whisked up to have their first snowball fight at hypoxic elevations.

Another area that is being negatively impacted by tourism development is Tiger Leap Gorge, a potential World Heritage site in its own right, where a road is being blasted through the length of the gorge. The number of visitors had increased from about 8,000 in 1992 to 25,000 or more in 1995. The drop to about 13,500 in 1996 was probably due to the February 1996 earthquake, the epicentre of which was directly beneath the gorge and resulted in rockfalls and increased slope instability. More recently the dust from taxis and the danger from continuous blasting have forced trekkers away from the traditional lower trails. Uncertain conditions have deterred many altogether, and the future of the gorge as a trekkers' paradise has been severely compromised.

Trekking the Jade Dragon: an appropriate tourism development proposal:

Despite the pessimistic prognosis cited above, the Jade Dragon Snow Mountains and the Tiger Leap Gorge seem to offer an opportunity for trekking tourism that would be mutually beneficial to trekker and host alike. We first completed most of the circumambulation of the mountain core in 1993. From the beginning, we were convinced that extremely poor mountain villages (Naxi, Yi, and Tibetan), that were also beautiful and sanctuaries of traditional life and costumes set in a spectacular landscape, could be assisted to evolve their own managed trekking lodges and supporting infrastructure. This, at the same time, would increase the prospects for cultural and environmental enhancement.

For our plan, the keystone community is Yuhu (2,700 m), the Naxi village within an hour's jeep drive of Lijiang Town. Here there is the prospect of

acquiring the 'Joseph Rock farm' for conversion to a museum piece with strong cultural and environmental themes, and an adjacent trekking lodge, to be operated jointly by the village cooperative.

From Yuhu, a gentle day's walk, replete with splendid views, leads over the wooded ridge (3,300 m) to the lakeside village of Wenhai, beautiful despite extreme poverty. The lake itself is an important potential tourist asset. Although it drains away down a limestone sinkhole by early spring each year, it could be stabilized and turned into a fish farm thus doubling its function as a tourist water attraction. There are also impressive views of the Jade Dragon and an easy approach to several of the summits.

From Wenhai the trekking route would proceed northwestward through a series of tiny Yi communities, continuing into the mouth of the Tiger Leap Gorge and so avoiding the dusty main road from Lijiang. Once the gorge had been traversed and Daju attained, the eastern limb southward would offer several variations via Yi and Tibetan villages. Side excursions are available, including a long but easy ascent of the northern summits to about 5,400 metres (accomplished by Rock in 1929).

The establishment of village cooperatives in Yuhu and Wenhai was initiated following village meetings in 1995. A farm house in each village was acquired and presented to the cooperatives. The support of the Governor and Party Secretary of Lijiang County was offered enthusiastically. Links were established between the tentative village cooperatives and the Lijiang

Cooperative Research and Training Centre that was being assisted by a research group from Simon Fraser University, Canada, funded by the Canadian International Development Research Council. This was intended to facilitate training in cooperative management skills among Yuhu and Wenhai villagers.

Much more would be required before the scheme was on sound footing. But already the growing impingement of the mass tourism development is being felt. The February 1996 earthquake desolated almost the entire area. The two farms obtained as the core of the trekking lodge strategy collapsed from earthquake shocks. The Old Town of Lijiang was devastated and loss of life and injury was most serious.

Overall, tourism development has clearly benefited the people of Lijiang. There are signs of prosperity in many places and especially in Lijiang Town: new businesses, more consumer goods, even beepers and cellular telephones. The recovery from a devastating earthquake was rapid and the momentum carried into further efforts at conservation and preservation.

On the other hand, there are potential hazards: economic growth tends to promote migration into urban centres from outlying agricultural areas, leading to unemployment, crime, inflation, homelessness, begging, prostitution, and other phenomena. And when development is tied to large-scale projects, including a glut of expensive hotels, any tremor (economic, political, or seismic) can have significant repercussions. Mass tourism is a risky business.

Appropriate tourism, however, is not an either/or proposition. Domestic, compatriot, and foreign mass tourism will continue. But a little of the alternative type of tourism would go a long way toward spreading the prosperity into the remote villages, stabilizing them economically, providing hope for the future and also motivation to protect the environment and to resist the negative impacts of the rapidly developing mass tourism. Unlike Nepal, where the narrow valleys channel trekkers along a self-evident course, the Jade Dragon has no ready-made trail. The mountain villages are not going to collaborate to spontaneously generate one; they need assistance.

#### i. HIMALAYAN DEFORESTATION - LOWLAND FLOODING

Throughout the 1970s and 1980s there was widespread belief that deforestation in the Himalaya after about 1950 was the primary cause of the assumed serious increase in major monsoon flooding in Gangetic India and Bangladesh. Furthermore, the direct and primary cause of the 'deforestation' was laid at the doors of the 'ignorant' mountain subsistent farmers whose uncontrolled population growth and continued dependency upon the forest for fuelwood, in the words of the World Bank (1979), would leave Nepal with no remaining accessible forest cover by the year 2000. This, and many other publications, were not only apocalyptic in spirit, but they provided lowland

Indian and Bangladeshi politicians and decision makers with a perfect scapegoat -- the Nepalese mountain farming community.

This complex paradigm, that contained many 'vicious circles' within 'vicious circles', excited a world-wide appeal. It was reported as *fact*, not only by the popular news media, but in conservationist publications, and even in the scholarly/scientific literature (e.g. Myers, 1986). Ives (1985) referred to the many variations on this general theme collectively as 'The Theory of Himalayan Environmental Degradation' in one of the earliest attempts at critical examination. The Theory embraced the Himalaya as a whole, as well as providing smaller scale examples, such as the Khumbu Himal (cf. case study e: pp. 87-95); and it was extended to areas far beyond the Himalaya *sensu stricto* (cf. case studies c: pp. 68-76 and h: pp. 103-132). It was taken into the core of the rapidly expanding extreme conservationist propaganda that predicted global catastrophe: there was a veritable news media blitz with much TV coverage. The furor was especially significant because it had a direct effect on the policy development of international, multilateral, bilateral, national government, and NGO agencies. In other words, not only were considerable financial and other resources expended by this confusion of cause and effect and by identifying the wrong 'culprits', both policies and interventions were causing harm rather than providing environmental and socioeconomic benefits to mountain farmers. Nor were they helping flood victims on the plains.

Several individuals and groups had begun contesting this vast oversimplification, if not total misunderstanding, of a presumed highland-lowland interaction. However, it was only in 1986 that many of these 'voices in the wilderness' were brought together to discuss the 'Himalaya-Ganges Problem' and to initiate a concerted reassessment (Thompson *et al.*, 1986; Ives and Ives, 1987; Thompson, 1998). This led to a detailed critical review of 'The Himalayan Dilemma' (Ives and Messerli, 1989).

The foregoing discussion occurred more than a decade ago. Yet it is remarkable that the Theory, while considerably weakened, retains much of its appeal. The conservationist literature and the popular news media continue to employ this intellectually satisfying mental construct (environmental myth) that, to the uninitiated, appears self-evident (that deforestation of steep slopes in a monsoon climate must inevitably lead to gullying and soil erosion and serious downstream effects), and so continue to cloud the real issues. For example, the *Basler Zeitung* (15 September, 1998) made the claim:

The severe floods in Eastern India and Bangladesh are not the result of a natural disaster, but of a ruthless exploitation of the forests which has been practiced over centuries in the Himalaya.

The most bizarre example was a recent reporter's claim on a CBC-TV (Canada) review of the devastating cyclone that hit Orissa, India, in September 1999 (21 March, 2000). This stated that conditions in future would deteriorate because sea level was rising as a result of deforestation in the Himalaya.

Nevertheless, many protagonists of the Theory have since reversed themselves. Indeed, Ives and Messerli (1981) were initially influenced by the then all-pervasive claims that had been encoded in the conference held in Munich in 1974 (Müller-Hohenstein, 1974). Agarwal, Chopra and Sharma (1982: 31-56) and Agarwal and Narain (1985), in the first annual reports on *The State of India's Environment* embraced the Theory. Subsequently, Agarwal is reported to have concluded that:

.....the Nepalese are being falsely pilloried for causing floods downstream in Bangladesh. Rivers such as the Ganges naturally produce huge amounts of silt. There is no evidence to believe that ecological solutions like reforestation will control floods.

(Fred Pearce: *The Guardian Weekly*, 1999, Vol. 160(14): 24)

Regardless, these strong statements remain opinions: they are not based on any field research or available secondary data. This uncritical reporting of the work of others without access to real information has been one of the difficult problems confronting this and many environmental issues -- a reliance on emotional appeal! These statements, in turn, were used to refute other efforts to, in effect, support the Theory. A forceful example is taken from a 1999 report from China whereby the central government claims that the catastrophic floods on the Yangtze in 1998, that took 3,000 lives and caused \$20 billion in damage, was the result of deforestation in the upper reaches of the great river. This prompted the State Council to formally halt timber extraction in the mountainous upper reaches of both the Yangtze and Yellow rivers and to launch a billion dollar reforestation programme.

The most recent commentary on the 'environmental degradation' debate is by Blaikie and Sadeque (2000). They prefer to be "more cautious . . . [and] take the view that there are environmental problems in the Hindu Kush – Himalayan region – in some areas, for some people and for some of the time – that, sometimes, they are serious, and that they are recognized as such by most of the stakeholders" (Blaikie and Sadeque, 2000: 14). This, however, could be read as a paraphrase of Ives and Messerli (1989: xix):

... the most serious anxiety that faces us in our attempt to demonstrate that the Theory is an over-dramatization and distortion is that our position should not be interpreted as indicating that there is no problem and that, therefore, there is no need for re-thinking, action, or alarm.

Their intent, reiterated here, was to eliminate gross generalizations, insist on conclusions based on reliable information, and shield the subsistent farmers from the role of scapegoat. Blaikie's and Sadeque's contribution is interesting but it also is hardly based upon new or first hand data. This case study, therefore, is included in an attempt to redefine the issues of highland -- lowland interactions in the context of the Himalaya and two of its three great river systems -- the Ganges and the Yarlung-Tsangpo/Brahmaputra--in the light of more recent work.

Through the 1990s a large amount of research was undertaken in the Himalayan region. Much of it was directly generated by the Ives/Messerli publication; much evolved independently, but in response to the earlier work; and much was entirely serendipitous. Only a few of the main conclusions of

these still expanding research endeavours are included here, largely because of sheer volume.

One of the more important research efforts is that stemming from the Nepal-Australia Social Forestry Project. The early phases of this work (Bajracharya, 1983; Mahat *et al.*, 1986 a and b, 1987; Griffin, 1989) had contributed to the initial challenge to the Theory. This work has continued up to the present. Of special interest, in this respect, is the documentation and confirmation of several of the working hypotheses that had emerged from the conference on the 'Himalaya-Ganges Problem'. Thus, by the early 1990s Gilmour (1988), Gilmour and Fisher (1991), and Gilmour and Nurse (1991) were able to demonstrate for parts of the Nepalese Middle Mountains, that between 1972 and 1989 there had been an actual increase in tree cover on land controlled by local farmers. Much of this 'reforestation' had been spontaneous and without government or foreign aid assistance. Continued investigation into the dynamics of the Middle Mountain environment has further refined this initial assessment. Jackson *et al.* (1998) have shown that between 1978 and 1992 community forest activities at lower altitudes have had a beneficial impact on the local environment and the stability of the land-use system. For instance, shrublands and grasslands are being converted to more productive forest land. In contradistinction, however, they produced clear evidence that on the upper slopes forest cover was being rapidly lost. This is an important qualification of the earlier work of Gilmour and associates and is directly related to the degree of local control (or lack

thereof) of the land. Thus “sustained population pressures combined with a lack of coherent and coordinated land management policies and practices, have resulted in a rapid decline in forest resources on the upper slopes, together with a loss of catchment stability” (Jackson *et al.*, 1998).

Bruijnzeel and Bremmer (1989) have undertaken a review of the literature relating to highland- -lowland interactions between the Himalaya and the Ganges/Brahmaputra and concluded, in accordance with Ives and Messerli (1989), that the Theory retained little credibility. This challenge to the established orthodoxy of the Theory was placed on a much more rigorous footing subsequently by Hofer (1993), amongst several others, and will be discussed in detail below.

Metz (1997) also, from detailed and reiterated studies in Middle Mountain forest communities, has raised the issue of natural plant succession as a hitherto ignored factor in the ‘deforestation discussion’. Metz studied seven little-disturbed stands of temperate forest 40 km north-northeast of Kathmandu between the altitudes of 2,400 and 2,900 m. He demonstrated that the only major canopy dominant that appeared to be regenerating sufficiently to maintain its current population was *Tsuga dumosa*. He hypothesized that *Quercus* species are unable to reproduce in individual tree-fall gaps and require a much more severe level of disturbance, such as produced by intense ground fires and large mass wastage occurrences (Metz, 1997:349).

Another research group effort of great significance is the University of British Columbia- -Bern University joint study of several small watersheds in the Nepal Himalaya (Schreier and Wymann, 1996). The Schreier research team studied the Chilime Khola watershed, a remote valley near the border between Nepal and Tibet, to assess the human impacts on water and sediment dynamics in the High Himal and to link the processes and their effects through the Middle Mountains to the lowlands. This was complemented by a Messerli--Hofer project in the Ganges--Brahmaputra floodplain and delta. Schreier's group added the Jhikhu Khola watershed in the Middle Mountains and initiated minutely detailed studies over a period of more than five years. They analysed thousands of soil samples and studied the impacts of farming activities, with the use of sophisticated GIS modelling. One question of critical importance was: how do the episodic rainstorms translate into run-off and sediment dynamics? They concluded that human intervention plays a significant role in sediment transfer at the local scale by redistribution of the losses incurred by cultivation of steep slopes. Wymann (1991) had already demonstrated that soil nutrient content is inversely proportionate to altitude in the Jhikhu Khola whereby the lowest rice paddies have a high nutrient status. One corollary of this is that the farmers, with their elaborate indigenous system of retaining and redistributing sediments, maintain an important control over their fields. Only in extreme rainfall events was it possible to obtain some measurable response beyond the

limits of the small watershed. This provided further support for diffusing the 'myth' of human impact on a Himalayan scale.

Schreier and Wymann (1996) had concluded that: "As we moved from a first order stream system . . . to the complexity of the Himalayan foothills we were overwhelmed by the scale of the processes, and the question of human impact simply fades away by the sheer magnitude of the natural processes."

Independently, and as part of a project initiated by the Royal Geographical Society, Wu and Thornes (1995) undertook a detailed study of Middle Mountain terrace irrigation from a geomorphological perspective. They determined that terracing does not change the hydrological behaviour of the hill slopes and that the effects of human impacts are positive rather than negative. They showed that individual terrace failures during torrential monsoon downpours do not contribute any sediment to the downslope and stream flow. The mechanisms of the large-scale terraced slope failures, which involve dozens of terraces, are much more complicated. Even on such a scale of failure, however, farmers who manage terraces and irrigation canals on land naturally prone to erosion and failure can repair most of the damage and induce lower sediment yield and reduce overland flow. Nevertheless, the problem of extrapolation to a larger region remains to be resolved.

At higher altitudes again, Watanabe (1994) demonstrated that mass transfer induced by over-grazing and yak-trampling close to and above treeline

was restricted to the immediate slope; the mass movements simply redeposited the weathered material and nothing measurable entered even the first order drainage.

From the Ganges- -Brahmaputra floodplain and delta, related meso- and macro-scale conclusions have been drawn (Hofer and Messerli, 1997). These results, in part, were anticipated by Hofer's (1993) study of hydrological changes of the rivers Sutlej, Beas, Chenab, and Jhelum, major tributaries of the Indus. This led to the understanding that, with the available data, it is not possible to demonstrate any significant changes in these rivers that cannot be explained by normal climatic processes: that rainfall events on the floodplains themselves are the most important cause of flooding.

Hofer and Messerli assessed the available historic flood data and changes in river courses by examination of available documentary information back into the nineteenth century; they analysed all available hydrological and climatic data; and they processed a large number of socioeconomic questionnaires. They concluded that the floods are a natural process, independent of human activities in the upper mountain catchments and that neither their magnitude nor frequency can be shown to have increased over the last 120 years. Hamilton's (1987) early speculation that it is direct rainfall over the territory of Bangladesh that is the primary cause of flooding was largely substantiated. In particular, rainfall patterns in the Meghalaya Hills are the main cause of fluctuation of the

Meghna River. Peak discharges on the Ganges and Brahmaputra are not generally synchronized. And from the perspective of the local farming populations, dry season low water, river bank erosion, and cyclones in the lower delta were more threatening than monsoon flooding.

Above all, it would appear that mega-projects, such as the training of entire river systems by massive input of concrete, steel, and earth, are not the solution (Rogers *et al.*, 1989). First, they will be too expensive, exceeding the GNP of Bangladesh, for instance, by orders of magnitude; second, there is the potential for many negative consequences of such an action and third, it is doubtful whether it would ever be technically possible to 'control' a river like the Brahmaputra, regardless of how much money is allocated. The foregoing discussion of the situation in Bangladesh has been extended and heavily substantiated by Hofer's (1997) definitive study.

Going westward, beyond the limits of Nepal, researchers of the G.B. Pant Institute for Himalayan Environment and Development, and several of the Indian Hill universities, have produced increasingly well documented results that indicate the need for modification of several of the generalizations derived from the 'Mohonk Conference' on the Himalaya – Ganges Problem (Ives and Ives, 1987). Road construction, accelerating out-migration of males, unequal treatment of women, increased pressures from tourism, are all contributing to a worsening of the overall environmental situation in the Garhwal and Kumaun

Himalaya. Similarly, studies by Hoon (1996) and Chakravarty-Kaul (1998) have documented serious environmental problems at high altitude – up to and above the treeline in the Central Indian Himalaya. Here the problem is poorly thought out government policies and actual prejudice toward transhumant Gaddis and Bakerwals. This is leading to a break-down in the age-long synergism between the transhumant herders and the settled subsistent agriculturalists (Uhlig, 1995) to the detriment of most members of both groups; the alpine pastures, the winter grazing areas at low altitude, and communities along the transfer routes are all affected negatively (cf. pp. 43-44).

Negi *et al.* (1997), building on the work of Tucker (1987), Richards (1987), and Guha (1989), have emphasized the importance of obtaining a full historic perspective before interpretation of the prevailing environmental and socioeconomic situation in the Central Indian Himalaya. They show that patterns of land use and forest resource extraction, established by the mid-nineteenth century in former British Garhwal and in the autonomous state of Tehri Garhwal, are central to a full understanding of present-day dynamics. They have also demonstrated that the dependence on forests for revenue increased significantly after Independence. Consequently, this accelerated environmental pressures and exacerbated social tensions. This type of study also provides insights into the origins of the Chipko Movement and its consequences.

In recent years, increasing scholarly and development-agency attention has been focused on social forestry (Jackson *et al.* 1998), indigenous knowledge, gender, and the opportunities created by a decentralized system of government. This surge in the social sciences is especially relevant to mountain studies. There is no doubt that, within the last few years, Nepal has moved from the background to the forefront of the increasing awareness of common property rights and local institutions (Jodha, 1997, 2000; Blaikie and Sadeque, 2000). Two important publications (Berkes *et al.*, 1998; Duffield *et al.*, 1998) demonstrate the reasons for the relatively more stable environmental and socioeconomic conditions of the Kulu Valley, Himachal Pradesh, compared with many other sections of the Central Indian Himalaya. Nevertheless, they do point to problems, both in terms of diversity and sustainability of resource use created by the replacement of traditional agriculture with orchards and other cash crops, and the heavy use of subsidized pesticides (Berkes *et al.*, 1998:32). They conclude that the current changes in the Kulu Valley support Shiva's (1993: 7) claim that development policies and prescriptions imported from the West "may be turning this culturally and biologically diverse world into a monoculture." Perhaps even more serious is what Shiva refers to as "monocultures of the mind" as undermining the very local social institutions that are such a positive force for sustainable resource use.

This case study has shown, once again, that what often begins as a simple explanation of highland-to-lowland environmental and socioeconomic

interaction is much more complicated when subjected to rigorous investigation. In particular, it points to the dangers of dramatic reporting of unproven assumptions. The actual assessment of highland-lowland interactions between the Himalaya and the lowlands to the south must recognize the impacts of policy formulation driven by self-interest of the political power structures based in the lowlands and internationally. In addition, it has established the effectiveness of extensive historical analysis and the need for great skepticism when reviewing alarmist conclusions based largely on emotion and short-term impressions.

## HIGHLAND – LOWLAND INTERACTIONS AND THE INTERNATIONAL YEAR OF MOUNTAINS

A search of the literature, together with the twenty years experience as Editor of *Mountain Research and Development*, prompts the conclusion that there are very few studies dealing with any aspect of highland-lowland interactions, and especially with social, economic, or political aspects. This is despite frequent comments (lip-service) about the importance of tackling the relationships between highlands and lowlands, dating back to the United Nations University formulation of the official project with the same name. There certainly is a large and rapidly growing body of mountain literature, particularly in ecology and

physical sciences in general, but this rarely embraces the concept of highland-lowland interactions. There are several conspicuous exceptions, and the growing concern about lowland flooding has resulted in a continuous flow of publications, both in the scholarly and popular press (e.g., Hofer, 1997; media reports on Three Gorges Dam project, China).

The rapid acceleration of mountain research certainly has been influenced by the Earth Summit (UNCED, 1992). More particularly, there has been a growing awareness that some of the earliest impacts of what is popularly referred to as 'Global Warming' will become apparent in mountain regions (Price and Barry, 1997; Beniston, 2000). One obvious assumption is that mountain winter sports regions, such as the Alps, could suffer severe socioeconomic repercussions (Price *et al.*, 1997). Nevertheless, there have been few, if any, major attempts to analyze and synthesize the recent additions to mountain research literature. The edited volume: *Mountains of the World: A Global Priority* (Messerli and Ives, 1997) is more nearly a 'state-of-the-art' compendium rather than a thorough analysis. A more recent overview study of the Himalaya (Zurick and Karan, 1999) becomes entangled in a discussion of the Theory of Himalayan Environmental Degradation and adds little by way of new knowledge or more valuable insights of relevance to the present report. The single most important source of new mountain literature relates primarily to the Northern Areas of Pakistan and stems from the Pakistan-German Research

Project - Culture Area Karakorum (Kreutzmann, 1993, 1995, 1998; Stellrecht, 1998). This is a crucial body of literature that admirably links the human and physical sciences. Yet even this is still in the process of primary publication, which is continuing; it is hoped that synthesis will eventually follow.

Outstanding research in the Andes that emphasizes the long-term viability of biodiversity amongst food crops and the need for international recognition of their importance to highlands and lowlands alike has been undertaken by Zimmerer (1996)

It may be too early to expect any significant degree of analysis and synthesis of this large amount of recent literature. Mountain research continues to expand rapidly; more time, or a pause, likely will be needed to ensure that the large task of synthesis can be undertaken without risk of any resulting publication being out-of-date before it comes into print. Thus, the most useful conclusion of the present report will be to highlight some of the principal issues and problems that demand urgent attention.

1. **Modelling:** A most valuable exercise would be an attempt to model the variety of highland-lowland interactions in a purely hypothetical framework. Initially, it would be worthwhile to produce two separate models, one depicting the physical processes, the other the socioeconomic and political processes. An attempt to combine the two could follow. However, when the very complex nature of mountain--lowland systems is considered, the problem of defining

'mountain' will inevitably arise (see Appendix I). Thus, it may be necessary to develop separate models for different types of mountain range. Similarly, as indicated earlier in this report (page 4) the difficulty of lack of specific areal overlap between a physical model and a socioeconomic or political one will require careful attention.

**2. Warfare in the Mountains:** Libiszewski and Bächler (1997) have indicated that, in relation to total surface area, or total population, mountain regions are the setting for a disproportionate share of armed conflicts, both in the recent past and currently on-going. To this must be added the series of stalemates or armed truces, discussed above (pp. 52-53), that also consume an enormous amount of resources. Again, the highland-lowland inter-relationship is evident since the principal power sources (national states) that provide the *raison d'être* of conflict are primarily lowland centres. As with the drug war scenario (see below), this is a highly delicate topic for inclusion in a UN agency report. Yet it must be taken into account. The inevitable damage, direct and indirect, to the mountain environments and mountain peoples is immense. For instance, Hewitt (1997:371) indicates that more than 70 percent of the almost eight million war deaths in mountain lands that have been sustained since the end of World War II have been unarmed civilians. Similarly, the damage to the lowlands, in terms of lives lost and the misdirected and destructive use of limited resources, invariably outweighs any prospect of gain to the perpetrators. Systematic examination of

warfare in its various forms within the context of highland – lowland interactions should be an essential part of the whole.

**3. Production of Illegal Narcotics:** Mountain regions, world-wide, are frequently the source of illegal (and legal) narcotics: marijuana production in British Columbia (Canada), opium from the sizable remnant of the Golden Triangle, including Myanmar, hashish from Afghanistan, and cocaine from the central and northern Andean countries. These are some of the most effective cash crops for the cultivators, and especially the middlemen traders, because of their high market value and low weight. They bring death and despair to many others and also foster organized crime on a large scale. Some of the most dangerous places in the world for outsiders to visit are the drug-producing areas of the northern and central Andes. The level of hostile encounters there amounts to full-scale warfare; herbicide defoliation by military aircraft adds to the scale of environmental and human loss and the effects of downstream transfer of the toxic overflow are literally unknown. Certainly, the movement of the products takes on the guise of a singular highland-lowland interaction. It would be useful to produce a map of these types of activity and to make an assessment of the real losses that are being incurred.

**4. Risks and Disasters in Mountain Lands and their Lowland Interactions:**

The mountain lands of the world include regions of exceptional risk for human activities as well as some unique dangers (Hewitt, 1997). Earthquakes and

volcanic eruptions are central to the processes of mountain building. Any plot of earthquake epicentres and active volcanoes will show a very close association with the Tertiary--Alpine systems of mountain ranges. Both forms of geophysical activity, of course, are primary dangers, to mountain inhabitants and to those living a short distance from the mountains in the nearby lowlands. Moreover, these primary dangers also serve as triggers for a wide range of what can be classed as secondary dangers - landslides, rockfalls, mudflows, avalanches, and the collapse of both natural and artificial dams. These secondary occurrences are also first-order risks in themselves, frequently triggered by heavy rains or accumulating slope instability and not directly related to earthquakes.

Some technological risks are also more prevalent in mountains, in large part, because of the natural occurrences identified above. Mountain highways, aviation, dams, tunnels, mines, and other infrastructure are especially susceptible. Nevertheless, the worst disasters have occurred because of warfare, whether ranked by numbers of casualties, the displacement of populations, economic damage, or habitat and environmental devastation.

Hewitt (1997) has argued that mountain peoples have experienced a pronounced disproportionate share of these disasters, whether this is calculated in terms of land area, population numbers, or their level of responsibility (or lack thereof) for the dangers involved. Mountain people also suffer

disproportionately in terms of organized relief responses. This is partly due to the blockage of access routes following occurrence of a disaster, for instance, due to multiple landslides and avalanches, and to bad weather, characteristic of mountains, that further restricts organized relief. Such emergencies are rapidly followed by famine and outbreaks of disease.

The foregoing paragraphs tend to emphasize mountains *per se* as especially dangerous places. However, catastrophic events in mountains are inevitably bound up with their surrounding lowlands. Hewitt (1997: 400) explains that the “mountain environment has often conferred some special advantages on mountain warriors and offered protection for their communities. With the scale and forms of modern weaponry [however] that becomes less and less true.” Mountain people and their surroundings are becoming increasingly susceptible to devastation and the lowland-highland relationship, in this context, is all pervading. It is also necessary to consider the direct impacts on the lowlands resulting from catastrophic natural events in the mountains.

Even these considerations, however, will be undermined in cases where military force is used to impose distant agendas on mountain societies. Any chance of achieving sustainability for mountain regions will be forfeit. In conclusion, therefore, it is recommended that the complete range of mountain risks and dangers be more fully examined and the results of such efforts widely disseminated.

**5. The Vulnerability of Mountain Women and Children:** The issue of gender inequality has pervaded the UN and the world at large for almost a generation. Much progress has been made, although even in many, if not all, of the most 'advanced' or 'industrialized' societies, inequities remain. Nevertheless, it has been argued that mountain peoples, in many regions, are amongst the world's poorest, and it is generally conceded that where poverty prevails women and children are especially vulnerable (Ives, 1996). In the context of highland--lowland interactions, the large out-migration, frequently of the poorest, from the mountain to the lowland and urban centres, exposes especially the women and children to increased stress. Yet the notion that mountain women and children are necessarily worse off than their lowland counterparts surviving in urban slums could itself have emerged as another mountain myth. Part of the problem, in this instance, is inaccurate and inaccessible data. Much of the UN data (UNICEF, 1994) is, perforce, aggregated because of the way data are collected through national censuses. Certainly, the increasing tendency of mountain women to be left as virtual or actual single heads of households burdens them with the double task of having to shoulder the work that in earlier traditional societies with more equitable division of labour would have been undertaken by men.

A socioeconomic study of pairs of villages, each pair representing a mountain and a lowland situation, would help in setting the basis for a

comprehensive analysis of several of these related problems. Similarly, analysis of the ratio of male : female educational opportunities in the pairs of villages would facilitate assessment of how such villages can adapt to the growing intervention of modernization and world market forces, and determine whether or not future changes would widen the gender gap still further.

**6. Environmental Orthodoxies:** It has been emphasized throughout the body of this report that a great amount of 'development policy' has often been driven by simplistic, and even scientifically unsupported, assumptions. These may be referred to as 'mountain myths' or 'sacred cows'. The most prominent example, in terms of its relevance to this report, is the collection of environmental orthodoxies embedded in the 'Theory of Himalayan Environmental Degradation'. The sheer simplicity and intellectual attractiveness of this particular orthodoxy has ensured its survival despite its effective scholarly rejection (pp. 132-144). There are others. The term 'deforestation', in general, has been so extensively abused as an emotional watchword of development agency, NGO, and environmental activist that, in Hamilton's (1987) words, it should be eliminated as a specific term, or at least carefully defined before being applied. Without explanation of the methods employed in cutting the trees or detail of the subsequent land cover and land use, deforestation as a term is essentially meaningless. 'Desertification' is another term that has produced extensive agency and activist political mileage; regrettably, it has also been adopted in modified form as 'mountain desertification'.

There are many 'sub-myths' arising from the above. For instance, the notion that 'slash-and-burn' (swidden) agricultural practice of South and Southeast Asian hill tribes (ethnic minorities) is environmentally destructive has commanded widespread support and has frequently become a convenient weapon for use by lowland authorities against upland minorities. This has been self-defeating, both in terms of mountain and lowland sustainability as well as the socioeconomic well-being of the maligned ethnic minorities.

Any examination of environmental orthodoxies, however, will require an assessment of why they have become so widely accepted and so persistent. This will require at least two specific avenues of enquiry. One would entail an investigation of how and why big agencies so often appear to prefer simple, even simplistic, solutions (panaceas) to solve perceived problems (Thompson *et al.*, 1986; Griffin, 1989). The other avenue of enquiry would require a critical review of the way the environmental and popular press, including the news media at large, appear determined to propagate such orthodoxies, frequently to the detriment of both environment and people. And what can be done to arrest or reverse this situation?

**7. Watershed Analysis:** The establishment of a small number of 'classical' watershed studies in different mountain ranges with standardized instrumentation and methodology would resolve many uncertainties. If both the physical and human aspects of such watersheds are studied, a strong

comparative data base could be established. This would help clarify many of the existing uncertainties in the highland-lowland context and lead to more rational development and conservationist policies. If some of the studies could be extended across national borders, it would encourage international collaboration where today, in some areas, it is extremely difficult even to share standard hydrological and meteorological data. In this context the recent development of isotope tracking of suspended material in streams is proving an effective and affordable mode of investigation. Likewise, the downstream transfer of toxic waste should also be determined. Nevertheless, the ideal nature of the small watershed in terms of natural science research is not necessarily ideal for research in the human sciences, so that selection of study areas will require great care.

**8. Global Warming and Mountains:** This topic is already pertinent to current studies in many disciplines (Price and Barry, 1997; Beniston, 2000). Given the proximity of altitudinal belts and different micro-climates, the steepness of ecological gradients in mountain regions will lead to much more noticeable changes in response to a given degree of global warming than in areas of less pronounced relief. Additionally, climatological changes in mountain ranges will likely have a much more readily apparent impact on the surrounding lowlands. These interactions, primarily driven by physical changes, will undoubtedly have socioeconomic and political implications. Winter recreation, availability of

water, hydroelectricity, irrigation, and the outburst of glacier lakes as glaciers continue to thin and retreat, are all potential components. It can also be hypothesized that different mountain ranges will react in different ways to global processes so that a number of 'research ranges' should be selected with this in mind.

**9. Mountain Tourism:** While it has been emphasized above (pp. 38-43) that initial expectations for tourism to bring massive benefits to poor communities have not been met, tourism, nevertheless, retains this unrealized potential. The recent upsurge in awareness through proliferation of 'appropriate' tourism offers a means for improvement. The issue of mountain tourism should be given a priority position on the 2002 agenda, especially in view of the fact that this year is shared as the International Year of Ecotourism.

**10. Comparative Advantages of Mountains:** This topic has been explored by Jodha (1997, 2000) and discussed extensively during electronic exchanges via the Mountain Forum. In many instances mountains do possess comparative advantages which are being utilized effectively. Jodha (1997) discusses these advantages within the context of diversity, mountain niche, and human adaptation mechanisms, as positive aspects to help counterbalance mountain marginality, fragility, and limited accessibility. The enormous asset of the world's mountain regions, of course, is water. What is needed is a much more open approach to reciprocity such that major resource development

projects ensure that benefits accrue to local populations. This, of course, should relate to all development, not only water.

## **Conclusion**

It is contended that the significant increase in general awareness of the mountain theme and recognition of the importance of highland – lowland interactions since the Rio de Janeiro Earth Summit (UNCED) provide grounds for optimism that the year 2002 will address many of the issues introduced into this report.

Increased awareness, together with political advocacy, however, must be pursued further. This goal is being made much more readily attainable through the work of the Mountain Forum and its electronic conferencing. It has already served to take the first steps in breaking the isolation that has contributed to the intractable nature of so many of the highland – lowland problems. The International Year of Mountains should provide means of moving forward to a degree that could hardly have been anticipated ten years ago.

## APPENDIX I

### DEFINITIONS

'Highland-lowland interaction' is a term, or concept, designed to cover a broad range of processes and effects such that any definition must remain flexible. While this monograph is intended to analyze the economic, social, and political relationships between highlands and lowlands, a firm physical basis is necessary. Thus, the approach to a definition will be strongly influenced by the way the term 'highlands' is used.

The term 'highlands' will be used as synonymous with 'mountains'. In the strictly physical sense, therefore, 'lowlands' become those areas beyond and beneath the mountains that are influenced by physical processes emanating from the mountains: the area onto which, and across which, rivers, with their headwaters in the mountains, transfer both water and sediments. In some instances, river sediments can be traced for hundreds of kilometres into the neighbouring seas and oceans; in others, and especially in arid continental interior mountain ranges, the lowland component will be quite narrow.

When attention is turned to economic and/or political interactions, however, and especially when the growing impacts of the global market on hitherto very remote regions is considered, then 'lowland' cannot be conceived as a concrete physical entity. In this case the issue becomes 'mainstream political and economic power bases' and their impacts on remote mountain areas and communities. Nor should it be overlooked that this entails not only a unidirectional process from the 'lowlands' to the mountains: it is dramatically apparent that mountain communities are having enormous impacts on the power bases of far distant lowlands ( e.g.s, Caucasus and 'Kurdistan').

Furthermore, there is no universally accepted definition of 'mountain'. This problem is explored here to illustrate why it is necessary to retain a flexible approach to the content of this monograph.

The inability of mountain scholars to agree upon a rigorous definition that has universal application and acceptance has frequently led to time-consuming discussion with no satisfactory result. Ives *et al.* (1997) have relied upon the simple combination of 'steep slopes' and 'altitude', facets of mountain landscapes that, individually and together, lead to marginality and relative isolation in the context of human utilization and adaptation.

Steep slopes imply geomorphologically high-energy environments where atmospheric weathering processes combine with gravity to induce large mass transfers downslope and, hence, inhibit the development of mature soil profiles. Together with slope instability, this restricts biomass productivity and increases vulnerability to human intervention. Frequently, when the downslope mass movements occur suddenly and entail large volumes of material (rockfalls, landslides, avalanches, outbreaks of naturally-dammed lakes, and flood waves), they can be catastrophic to human life and property. They thus magnify the prevailing degree of inaccessibility or, alternatively, augment the maintenance costs of infrastructure extended into mountain regions as efforts to improve accessibility. This, in turn, causes high transport costs for goods imported by mountain communities and for products exported by them to potential lowland markets.

High altitude, in extreme cases, is also invariably associated with steep slopes. But there are many regions of the world that lie between about 3,500 and 5,000 metres asl that are not steeply sloping and, therefore, are not high-energy environments (in a narrow sense, these plateaus would not fall into the 'mountain' category). These include the Altiplano of the Central Andes, parts of the Ethiopian Highlands, much of the Tibetan Plateau, and the Eastern Pamir. In these instances, however, biomass productivity is constrained by reduced temperatures and, depending on the climate zone, where access to irrigation water is restricted, by aridity. It has become traditional, therefore, to combine high altitude and steep slopes as essential components of mountain, or highland, landscapes, separately or in combination. In this way the extreme high plateaus are included.

In terms of latitudinal variations, it should also be pointed out that ambient air temperature is not only influenced by increasing altitude (adiabatic lapse rate), but also by latitude. This is reflected in the worldwide trend of upper timberlines and regional snowlines which are best described as high altitude-low latitude to low altitude-high latitude continua of available energy. It follows, therefore, that as timberlines approach sea level between 56° and 72° N latitude in the Northern Hemisphere, actual northing will depend upon longitude and degree of continentality. According to this approach, the Lofoten Islands in northern Norway, the Torngat Mountains in eastern Canada, and the mountains of southern Greenland, as examples of formerly or presently glaciated areas of high-energy relief, are approximate equivalents of the Alps, but cut off at timberline and reduced to sea level. More problematic for an acceptable and universal definition are the Hercynian massifs of Europe - the Schwarzwald, the Vosges, and the Scandinavian Calidonides. The Scottish Cairngorms, and large sections of the mountains of Norway and Sweden, at least rise well above

climatic and anthropomorphic timberlines; the *Mittelgebirge* (Middle Mountains) of Central Europe rarely do. Yet they all must be included as mountains.

Any exhaustive attempt to define 'mountain' should include illustrations of how the terms 'alpine', *Hochgebirge* (High Mountains), *Mittelgebirge* (Middle Mountains) are used and should introduce the terms *Almwirtschaft*, 'transhumance', and 'nomadism'. This leads to the consideration of geographical, especially latitudinal, position of individual mountain ranges in terms of human adaptations. Thus, within the tropical and subtropical zones, throughout human history mountains frequently have provided much more favourable human habitats than their surrounding lowlands. In this context the famous German mountain geographer, Carl Troll, made the remark that much of the high land near the equator could be described as "high mountains without a high-mountain landscape". With increasing latitude, this environmental advantage diminishes and is eventually reversed with mountains in higher mid-latitudes and subarctic zones being highly inimical to human habitation and resource exploitation, excepting such special cases as the location of high value mineral wealth.

From the foregoing, albeit truncated, discussion, it is apparent that the world's mountains do not lend themselves to any unifying definition or classification. For the present purpose, therefore, there will be reliance on the simple combination of steepness of slope and altitude with the stricture that mountain landscapes exist from sea level to 8,000 metres, the highest places on earth. It also follows that the concept 'upstream - downstream' represents a subset of processes *within* the mountain zone. Also, the 'watershed', frequently but by no means invariably, will prove an invaluable landscape category for study as well as for the intervention of 'development' policy.

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