Farming flexibility and food security under climatic uncertainty: Manang, Nepal Himalaya

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Climate change is predicted to cause a substantial decrease in food production in poor regions during this century. But since reliable models of future climates have not been produced at local level as yet, this article focuses on the flexibility of farming systems in terms of adaptability to changing conditions of production, whatever those changes may turn out to be. Defining flexibility as ‘uncommitted potentiality for change’ Bateson 1972, the aim of the article is to identify such potentialities among subsistence farmers in a remote part of the Himalayas. Our analysis reveals four ‘uncommitted potentialities’ for adaptation to a future situation that will be climatologically different from the present. In order to maintain local food security under changing climate conditions, farmers in the study valley of Manang can reclaim abandoned land, they can depend more on barley, they may reduce the conspicuous exhibition of horses, and relocate farming from the slope to the valley bottom. The inherent flexibility in their farming system renders Mananges quite robust in facing future uncertainties. Thus, Manang is more appropriately labelled ‘dynamic’ than ‘fragile’, which is a term often ascribed to high Himalayan communities and environments.

Key words: agro-pastoral cultivation, climate, glacier, interdisciplinary, trans Himalaya, wheat

Introduction

A recently published estimate predicts a decline in total global agricultural productivity of between 3 and 16 per cent by 2080 due to global warming (Cline 2008). However, the total decline is expected to be geographically differentiated. Northern Europe is predicted to increase its agricultural yields by 8–25 per cent by 2050 (Parry et al. 2007). India, on the other hand, is facing agricultural output losses of 30 per cent by 2080 (Cline 2008), and sub-Saharan Africa will experience a decrease in food production of between 30 and 50 per cent if temperatures increase by 2°C (IPPC 2007). Poor countries in the South are generally assumed to fare worse in the era of climate change than temperate countries in the northern hemisphere.

If our purpose is to envisage the future of individual farmers, however, predictions like those cited above are of limited value. Regional estimates cover up vast climatic variations, and reliable models for local climate still have to be developed. Since food production is carried out in localities rather than in regions as such, it follows that the situation for individual farming communities is best described as one of uncertainty. We are not thinking about the kind of uncertainty identified by Thompson et al. (1987), which is produced by diverging and contradictory epistemologies forwarded by various stakeholder institutions. Assuming that some kind of climatic change is actually taking place in the Himalayas, the uncertainty we refer to is ‘inherent in the bio-physical properties of the system’ (Thompson et al. 1987), that is, in the climate system.
But since we do not know the local manifestations of those changes, we do not know which challenges farmers will have to face. The magnitude of temperature change is uncertain, and the change in precipitation and the monsoon system are even more uncertain. Lacking reliable models of future climates at local level, the best we can do is to focus on the flexibility of local farming systems in terms of adaptability to changing conditions of production, whatever those changes may turn out to be. Borrowing from ecology, Bateson (1972) defines 'flexibility' as upper and lower thresholds of variables which together make up a system. When a variable takes on a value close to its upper or lower limit or tolerance, flexibility is lost. In a farming systems approach, the 'variables' translate into units that constitute the system, such as labour, cultivated fields, domesticated animals, pastures, etc. If one of the units is exploited to its limits, flexibility is lost. Flexibility is, accordingly, a system's space of manoeuvre when it is faced with internal or external challenges. Defining flexibility as 'uncommitted potentiality for change' (Bateson 1972, 505), the aim of this article is to identify such potentialities among subsistence farmers in a remote part of the Himalayas.

Estimates of agricultural output have not been made for the Himalaya region, where the primary concern of researchers and politicians is with retreating glaciers, since the mountains constitute the 'water tower' of 1.3 billion people in Asia. The fact that global warming is positively correlated with altitude, in that one degree rise in temperature at sea level corresponds to a rise of two degrees in the world's highest mountains (Holland and Bitz 2003; Shrestha et al. 1999), suggests quite gloomy prospects for the Himalayan glaciers. In Manang valley in Nepal (Figure 1), the results of global warming are already becoming quite conspicuous (Figure 2) and they will probably become even more dramatic in the near future. A rise in temperature of 5–6°C, which is predicted to take place in the course of the twenty-first century (Salick and Byg 2007), will have two serious environmental effects in the Himalayan region. First, plant species may have to migrate north by some 500 kilometres or upwards by 500 metres in order to find a suitable biotope (Thuiller 2007). Secondly, the line of snow accumulation will rise from its current 5700 metres above sea level (masl) to 6300 masl, which implies that two-thirds of the glaciated area of the Himalaya will vanish. The immediate hydrological implication is that river discharges will increase as long as glacial melting is taking place. The winter stream flow of the Baspa glacier basin in India, for example, increased by 75 per cent between 1966 and 1999 (Geological Survey of India 1999). From a long-term perspective, when low-lying glaciers have disappeared, river discharge will fall dramatically. The dramatic climatic and environmental changes that are taking place in the Himalaya will of course change the conditions for food production. The
The question is whether and how local farmers will be able to adapt to those changes.

Many studies of the Himalaya tend to describe the mountain environment and livelihoods in terms of ‘fragility’ and ‘crisis’ (FAO 1997; Adhikari and Bohle 1998; Blaikie et al. 2001; Jodha 2005). Since the concepts we apply to things and places shape the way in which we think about them, it is to be expected that a gloomy future is anticipated for the Himalaya in the present era of global warming. Fragile objects do not tolerate much change. In line with this thinking it is tempting to assume that the dramatic environmental changes that are presently taking place will have devastating effects on communities and traditional farming systems.

However, other writers strongly oppose this way of conceptualising the Himalayas (Thompson and Warburton 1985; Ives and Messerly 1989; Ives 2004; Vetaas and Knudsen 2004). One of them is the late Dr Harka Gurung, who was born and spent most of his life in the Middle Hills of Nepal. He argued that the term ‘fragile mountains’ is a conceptual fallacy that for some reason has stuck to the Himalayas since the 1970s: ‘It would be more realistic to consider mountains as dynamic, certainly not fragile’, he wrote in one of his last publications (Gurung 2004, 16). Implicit in Gurung’s labelling is an invitation to explore whether, and to what degree, the dynamism of Himalayan communities is capable of adapting local food production to the climatic changes that will most certainly take place. This implied invitation is taken up in the present article.

At the outset, our prime objective was to investigate how global processes affect remote places of the world, and for that purpose the Upper Manang valley was chosen due to its peripheral location. The valley is located on the northern side of the Annapurna Massif in the border region between Nepal and Tibet, 6 days’ walk from the nearest road. The climate is semiarid and temperate, which allows for summer cultivation only. Seven villages are situated at altitudes between 3200 and 3800 masl, with the cultivated area ranging between 3000 and 4200 masl. The ethnic group of Mananges totals approximately 10 000 people. They are of Tibetan stock and confess to Buddhism. Data were collected through interviews with farmers, hourly temperature measurements for 3 years at six locations, calculations of agricultural productivity on 40 trial plots (wheat), surveys of active agricultural acreage and observations of farming activities throughout the agricultural year.

The present farming system of Manang

Manang is a U-shaped valley that runs northwest–southeast, which means that exposure to the sun determines its natural vegetation. The cool north-facing slope is densely forested with pine, fir and birch, while only juniper, brush and some grasses thrive on the south-facing slope, due to higher evaporation rates there (Figure 3). The farming system is a typical Himalayan combination of valley cultivation and animal husbandry. Wheat, barley, buckwheat, potatoes and some vegetables are grown during the summer on flat land in the valley bottom and on terraces on the south-facing slopes. The north-facing slope is too cold for cultivation (Baniya et al. 2008). Since the sun-exposed side is dry, farming is dependent on irrigation channels.

Figure 2 Retreat of Gangapurna glacier, Manang Valley, Nepal. Left (1850): reconstruction on basis of terminal glacier; middle (1952): reconstruction after photo by Toni Hagen; right: picture from 2005
that draw their water from streams which are fed by glaciers and by snowmelt. Previously, yak and sheep were kept in large numbers, but due to a lack of local herdsmen only immigrants from Tibet and those from some remote villages keep yak nowadays. Manang farmers have largely replaced yak and sheep with cows, yak and cow hybrids (jyupa) and goats.

In the summer, animals are taken to high mountain pastures where they are allowed to graze on village commons. Every spring, two young men from each village are selected by lot to herd the animals throughout the summer. Stone fences that surround the villages prevent animals from reaching the cultivated fields during the crop-growing season. As harvest-time approaches, the animals are attracted by the smell of ripe crops and gather outside the fences. During this period it is important that the fences are kept well maintained, otherwise crops will be destroyed by roaming cattle and goats.

From November to February the valley is covered in snow and livestock has to be fed in the stable. The supply of winter fodder is a bottleneck in the farming system. One kind of fodder is supplied by crop residues, which are dried and stored for use in winter. Various herbs and grass species, including wild oats (Avena spp.) are also collected from common village land along footpaths, on uncultivated land in the valley bottom and from the forest on the north-facing slope.

The problem of maintaining soil fertility is solved by the use of manure. Since it takes 6 days to reach the nearest road on foot, chemical fertiliser is not an option. Animal husbandry is thus an integral part of the farming system; nothing can be cultivated without manure. Manure is so valuable that it is collected from the summer pasture and carried in baskets down to the farmsteads 500 metres below. In winter, pine needles and juniper branches are collected from the forest on the north-facing slope and used for animal bedding. After two months the bedding, which is now mixed with dung and urine, is added to the manure heap. This acidic bedding manure is particularly suitable for fertilizing the alkaline soils of Manang. The agro-pastoral system means that the more animals a household can
manage to keep, the more fertiliser it has available and the more crops can be grown. Thus, there is a balance between the size of animal herds and acreage under cultivation. A prosperous cultivator will also have many animals.

Three categories of land are vital for the system: irrigated terraces for cultivation in the valley, alpine summer pastures and forest from which manure bedding and winter fodder can be collected. Of these, the cultivated terraces are the most sensitive to climatic change. If temperature increases by the predicted 5–6°C, the ablation line will rise beyond the mountains on the south-facing slope, with the result that glaciers on that side will completely disappear. Since those glaciers are vital to feed irrigation channels during summer, the consequences could be devastating. On the other hand, farmers claim that snowmelt is more important than glaciers, and we do not know yet what will happen to the amount of precipitation in the future. Given this uncertainty, the future viability of the agro-pastoral system will depend on its ability to adapt to various trajectories of climatic change. Our analyses conclude that the Manang farming system does include such flexibility. We can identify at least four options for adaptation to changing conditions of production that could be followed without transforming the system itself.

First flexibility: reclamation of abandoned land

Historically, food production in Manang could probably sustain its population for eight months of the year only (van Spengen 1987). The problem of subsistence during winter was partly solved by moving down to the Middle Hills where casual work could be found in villages and towns. But the strategy that came to leave a lasting imprint on Manang society was involvement in trade.

Many people who lived in the border regions had great success in the historical salt trade between British India and Tibet. But since Manang is unfortunately located outside the main trade routes, Mananges took up trade in locally produced goods in the eighteenth century. Woollen blankets, scent glands from musk deer, snow leopard furs and medicinal plants were sold in India, and rice, tea and sugar were brought back to the valley. Mananges proved to be good businessmen, probably due to the fact that, among other qualities, they were free from caste considerations in finding trade partners in the lowlands (von Fürer-Haimendorf 1975). By the early twentieth century, trade had become disassociated from local resources in Manang. Instead of bringing medicinal plants and handicrafts from the home valley, traders learned to exploit price differences between Asian countries. Gemstones were bought cheaply in Kashmir and sold at a profit in Thailand, from where silk was brought to India, and so forth. (For a detailed account of the trading history of Manang, see van Spengen (1987) and Rogers [2004].)

During the time of India’s import substitution policy, Mananges found a profitable market there for smuggled goods from Hong Kong and Singapore. But when Rajiv Gandhi liberalised the Indian economy after 1984, the Indian market evaporated. By then, however, a new niche had emerged in Kathmandu. The rising stream of western tourists to Nepal created a market for hotels, restaurants and souvenir shops in the capital, which Mananges were quick to seize hold of. During the years of international trade they had accumulated substantial fortunes, which could now be invested in the tourist industry. But unlike their earlier trading activities, running a business in Kathmandu demanded a continuous presence in the city. Since 1970, some 5000 Mananges have settled in the capital, while only 4000 remain permanently in their valley of origin. An estimated 1000 live in other Nepalese cities, Southeast Asia and other parts of the world.

The Manang history of migration has always been intimately related to trade and business. Mananges were never part of the comprehensive South Asian migration streams of wage labourers who sought out urban destinations on the subcontinent (labelled ‘labories’ elsewhere in Nepal, since it started with labour migration to Lahore), and later in the Gulf states and in Europe and North America. Today, Mananges form a wealthy and well-established community in the capital.

The massive exodus of people has left its toll on the valley. The most immediate repercussion is a high proportion of abandoned agricultural land. Today, an estimated 60 per cent of the land that was cultivated around 1970 lies abandoned (Figure 4). Beautifully terraced fields, with stone risers up to three metres high, which must have taken years to construct, are now left unused. Total agricultural production has of course decreased accordingly, by around 60 per cent in the course of the past 40 years.

This situation is not unique to Manang. A recent study of two villages on the south side of Annapurna found the rate of land abandonment to be 46 per cent. The authors ascribe the high rate of abandonment to a
combination of emigration and national land policy. The Land Reform Act of 1997 established the right of sharecroppers to claim ownership to half the land they cultivate if they have paid 50 per cent of the crops to the landowner for a certain period of time. The noble intention of this land redistribution was to enhance productivity and alleviate poverty, but the actual result was reluctance on part of landowners to lease out their land. Since land taxes are negligible in Nepal, emigrant landowners keep their land empty instead of selling it or leasing it out to sharecroppers and risking losing half of it (Khanal and Watanabe 2006).

This situation also exists in Manang, but in addition, Mananges hold exclusive rights to all land in the valley. Farmers have individual land rights that are transferred to their children, but they are not allowed to sell it to non-Mananges. Individual farmers thus have entitlement to land while endowments remain with the ethnic community. Even if this practice is not in accordance with Nepalese law, it is consistently enforced by the village councils. No land has ever been sold to non-Mananges. If an emigrant wishes to sell his land he is not allowed to do so. There are plenty of land-hungry peasants in the less fortunate neighbouring valleys of Gorkha and Dolpa who cannot boast of a past of successful trade. Migrants from those districts work as land labourers in Manang during the summer. Some are also allowed to sharecrop fields for Manange owners who live in Kathmandu. If they were allowed to buy the land of Mananges who have emigrated, the whole valley could be cultivated as it used to be 40 years ago.

The combined outcome of international trade, resettlement in Kathmandu and the ethnic monopoly of land is that more than 60 per cent of all farmland in Manang is now permanently out of production, a paradoxical situation in a country that has recently become an occasional net importer of food. Herein lies the first flexibility of Manang farming. If food prices increase dramatically in Nepal due to global or national food deficiency, it would be possible to increase production in the valley by 150 per cent by reclaiming currently abandoned fields. But that ‘potentiality’ is conditioned by a sufficient supply of irrigation water. As pointed out above, the water supply on the south-facing slope is highly uncertain. Shrinking glaciers may be substituted by more abundant precipitation, but the present tendency seems to be the opposite. Farmers complain that snowfall is more scant than it used to be, which seems to be a widespread perception in the region (Rai and Gurung 2005). Thus, other options are needed. One possibility is to change the cropping pattern and the genetic diversity of the crops.

Second flexibility: substituting wheat for barley

The traditional staple crop of Manang has been barley,\(^2\) as it still is throughout Tibet. Barley is used in the old Tibetan dish tsampa (sweet tea mixed with barley flour) and for making liquor (raksi). It has been cultivated in the valley ‘always’, so people say. Two indigenous types of barley are grown: the spring (summer) barley grown at high altitudes in the upper parts, and winter
barley at lower altitudes (Chaudhary et al. 2007). Barley can grow under a wide range of climatic conditions and is particularly well adapted to a mountain environment. The crop is more tolerant to soil salinity than wheat, and it can thrive in conditions that are too cold even for rye.

Wheat is of more recent origin, although no one can remember a time without wheat production. Three landraces of wheat with somewhat different qualities are sown separately or in mixed fields (Chaudhary et al. 2007). In recent years, wheat cultivation has been increasing steadily while barley is decreasing. Today, an estimated 38 per cent of all cultivated land is sown to wheat, the remainder being used for buckwheat, potato, vegetables and barley. Initially, we related this change in crop composition to the combined factors of climate and demand.

It seems reasonable to ascribe the increasing wheat production to a change in demand generated by tourists who started coming to the valley in the 1980s. After a long day’s trek hungry tourists are not content with barley tsampa and buckwheat bread; they want white bread, naan and pizza. Several ‘German Bakeries’ have popped up in the valley to meet the demand, and all the hotels serve home-made pizza, pasta and naan. For these they need wheat. Since wheat is more heat-loving than barley, it was reasonable to hypothesise that climate change would make it possible to meet the new demand for wheat locally. But a closer look at things proved the hypothesis to be wrong.

First, villagers claim to have cultivated wheat on their highest fields at more than 4000 masl for as long as they can remember, and long before the first tourist showed up in Manang. Secondly, the demand from tourists is not met by local wheat. The locally grown wheat is not suitable for leavened dough, and in addition, the valley does not have mills capable of grinding the flour to the quality required. So, the wheat offered to tourists is imported from the plains. It is carried for six days from the road by porters, while the local wheat is used for other purposes. But the question of wheat cultivation remains. Why change to wheat at all when it is not used for ‘modern’ tourist food?

During the summer, the men of the valley migrate in large numbers to do business in Kathmandu or in Southeast Asia, leaving farming mostly in the hands of women. In one village, two-thirds of the 2003 summer population were women. Gender roles are far more relaxed in mountain communities than they tend to be on the plains (Guillet 1983; von Furer-Haimendorf 1975), and especially so in Manang, which ranks first among the 75 Districts of Nepal on gender equality (ICIMOD 2003). Manage women can perform the same agricultural tasks as men, except summer herding of livestock in the high mountains. But even if there are few cultural barriers to women farming, there is a physical one. Barley grains are more firmly attached to the straw than wheat, which means that it takes more strength to thresh barley than wheat. When farming is left to women, therefore, they prefer to cultivate wheat.

The increasing cultivation of wheat can be related to global processes, but not to the combination of rising temperatures and international tourism that we initially assumed. Rather, it is explained by different gender roles in international migration and gendered preferences for different crops in local agriculture.

Here, then, is another flexibility of the farming system. Wheat needs more water than barley, and in semi-arid Manang that means artificial irrigation. In one village, Ghyaru, the landscape is too steep for irrigation, and there only barley is grown. Threshing is performed by the men who stay at home and by hired labourers. If the time comes when water discharge in streams and creeks drops because of disappearing glaciers on the south-facing slope (Figure 3) from which irrigation water is taken, or if winter snow cover melts earlier than it does today, it will be possible to resume barley cultivation. Although it is feasible in environmental terms, such a change will still involve a rearrangement of labour. Barley requires more active men during the harvest, whether they are Mananges or hired labourers from outside the valley.

**Third flexibility: reduction of conspicuous consumption**

In every society there are ways of showing success through exposure of certain material items that take on symbolic value. This exhibition has been labelled ‘the consumption of conspicuous items’. The consumption of conspicuous items is a way of improving one’s social position:

> Since the consumption of these more excellent goods is an evidence of wealth, it becomes honorific; and conversely, the failure to consume in due quantity and quality becomes a mark of inferiority and demerit. (Veblen 1899, 64)

The traditional items of conspicuous consumption in Manang are indices of success in local adaptation, and some of them have repercussions for food production.

Any traveller in Manang is struck by the huge piles of firewood that are placed on roofs or in other places that are easily visible from the trail. To a European the
piles look messy, but to a Manange they convey the message that the owners of the wood will enjoy a pleasantly warm winter. It also communicates that the families are so well-adapted demographically that they can allocate man- and woman-power to collecting firewood in nearby forests, and that it has entitlements to do so. A big pile of firewood tells passers-by that this house is inhabited by people who can enjoy comfortable lives.

Likewise, dungheaps are situated where people can easily see them, often just outside dwellings. Natural manure is produced by mixing animal droppings with conifer needles that have been used for livestock bedding, and the heaps may become quite voluminous. There is no chemical fertiliser in Manang due to its remote location, so cultivation is wholly dependent upon manure. Large dungheaps reach a higher internal temperature and therefore decompose more rapidly than smaller ones. But in addition to its functionality, the size of the dung heap is an index of the number of animals a household is able to keep, and that in turn reveals how many fields the household is able to cultivate. In other words, the size of the dung heap is an indicator of success in the traditional agro-pastoral economy; the bigger the heap, the more wealthy the farmer.

A third item of conspicuous consumption is the horse (Aase and Chaudhary 2007). It is quite obvious that horses are not primarily held for their use-value in Manang. They are not used for ploughing as they used to be in Europe, nor for carrying crops from the fields to the village, as is common in other parts of South Asia. To an outsider, it is a paradox to see men, women and children toiling from early morning until late evening with heavy burdens of straw and cereals on their backs during the hectic harvest season, while horses are grazing leisurely alongside them.

A small survey reveals that horses are used for travel and transport of goods and tours as well as other purposes (Table 1). Since there are no roads in Manang, the horse is a cherished means of travelling. All horse-owners use them for that purpose. Some use their horses to porter rucksacks for tourists on their way to the Thorong La pass, but less than half use them to transport goods. No one use horses for transporting crops to the village during harvest; that is the cumbersome work of people. Asking farmers about their most frequent use of horses, 88 per cent answered travelling. Only two out of 26 listed tourism as their most frequent use of horses, and one kept horses mainly for breeding and selling. No one replied that goods transport was their most frequent use of the horse. This is quite significant, since all the households in our sample kept horses. The average number of horses per household is 2.7, ranging from 1 to 5. Since goods transport is mainly done by porters, horses are left idle most of the time (Table 1). Even if horses play a rather marginal role in the daily work of farmer households, they nevertheless consume a substantial part of the local produce. In the sample, 38 per cent of all cultivated fields are allotted to wheat. Asking farmers about the use of wheat, it emerges that the largest share goes to horse fodder (Table 2).

If we compare the proportion of wheat used for horse fodder (43.6%) with the share of total cultivated land allotted to wheat (38%), we find that 16 per cent of all cultivated land is allotted to wheat for horse fodder. Generalising about Manang at large, it means that horses consume the produce of 16 per cent of all cultivated land in the valley!

Conspicuous consumption of certain items for the sake of merit is a universal phenomenon. But the kind of items that yield merit is not fixed. In the neighbouring Mustang District, modern commodities like DVD players and TVs have become markers of wealth and rank in partial substitution for old ones (Poudel 2008). This could be a third flexibility of food production in Manang: if people were to develop other ways of claiming respect and admiration than by keeping

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<tr>
<th>Purpose</th>
<th>% of horse owners</th>
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<tbody>
<tr>
<td>Travel</td>
<td>100</td>
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<tr>
<td>Racing and festivals</td>
<td>60</td>
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<tr>
<td>Tourist transport</td>
<td>56</td>
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<td>Goods transport</td>
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<td>Breeding</td>
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<table>
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<tr>
<th>Purpose</th>
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<tr>
<td>Horse fodder</td>
<td>43.6</td>
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<td>Food</td>
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<tr>
<td>Liquor (raksi)</td>
<td>16.0</td>
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<td>Cattle fodder</td>
<td>5.8</td>
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<td>Other</td>
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**Table 2 Use of wheat for different purposes in the Mang Valley**

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<th>Purpose</th>
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<tr>
<td>Horse fodder</td>
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<td>Other</td>
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<td>Total</td>
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horses for conspicuous exhibition, more crops could be allotted to human consumption. In comparison, people of the semi-arid Hunza valley in the Karakorum Mountains no longer keep horses at all, and even dogs have become extinct in an effort to raise the level of local subsistence (Aase 1992; Lorimer 1939). If the need should arise, Mananges have an ‘uncommitted potentiality’ to do likewise.

Fourth flexibility: spatial relocation of cultivation

The most recent chapter in the economic history of Manang started in 1977. During the 1960s, Manang was one of the bases for resistance against the Chinese occupation of Tibet. Tibetan freedom fighters (khampas) had camps in the valley, from where they carried out operations within their homeland. Out of respect to (and probably fear of) its powerful neighbour to the north, Nepal was one of the first countries to recognise China’s annexation of Tibet. Part of the endeavour to stay on good terms with China was to end hostile operations from Nepalese territory. The government persuaded Mananges to disarm, in return for which the valley would be opened up for tourism. Guns were handed over to the Army, and in 1977 the first tourists were allowed to enter the valley. Having suffered from its unfavourable location in the old salt trade, Manang was now lucky enough to be located on the Annapurna Circuit Trail that takes trekkers around the Annapurna Massif in three weeks. It soon became one of the most popular tourist destinations in Nepal. The annual number of tourists passing through Manang increased from 1000 in the initial year of 1977 to more than 14,000 in the record year of 2001. During the last six years, an average of 11,300 tourists have passed through the valley every year.

Overnight, a market for new business had emerged in Manang. Trekkers spend an average of three nights in Manang, resting and acclimatising before ascending the high Thorong La Pass on the way around Annapurna. The market provides a demand for 35,000 bed-nights a year, a lot of food to hungry trekkers and some local mementoes to take home. Of course, such a considerable market can be expected to draw attention from investors from far beyond Manang Valley itself.

It is quite common for new tourist destinations and market towns to be dominated by outside capital. Manang’s neighbouring district to the west, Upper Mustang, was opened to tourists in 1992, 15 years later than Manang. There, tourist operators based in Kathmandu have managed to monopolise the operation of hotels and tea-houses, to the great resentment of local people whose only blessing from the new activity is a 300 per cent rise in the prices of imported goods such as rice, tea and lentils (Ives 2004).

A similar outcome of tourism, but one that was far more serious, occurred in the Pakistani town of Gilgit in the Karakorum Mountains. When the Karakorum Highway linking the plains of Pakistan with Xinjiang in China was opened in the late 1970s, powerful business houses in Peshawar and Nowshera were quick to seize the opportunity and established hotels, shops and restaurants in the town. The local Shia Muslim population, who had neither the means nor the knowledge to take advantage of the new market opportunities, was marginalised by the Sunni traders from the south. In 1988 Gilgit exploded into a full civil war that killed several hundred people during a few days of intense fighting. The town has been troubled by continuous tension and occasional fighting ever since, and by ethnic cleansing of Shias from areas south of the town (Aase 1999).

In contrast, the ethnic monopoly of land in Manang has kept non-local investors out. Since 1977 a number of hotels, cafes and shops have been opened along the trail. Without exception, they are owned by Mananges. Since outsiders are not allowed to buy land, they are ruled out as competitors in the tourist market. A number of families have now returned to Manang, leaving their Kathmandu businesses in charge of relatives or partners. The ethnic monopoly of land thus has positive as well as negative effects. It has left more than half the farmland in the valley empty, but on the other hand it has effectively enabled local people to reap the benefits of the new tourism business. Nor has the boom been confined to only a few wealthy families. About 50 hotels owned by different families have opened since the first tourists appeared in 1977, as well as an even larger number of cafés and shops. In 1975 there was not a single shop or lodge in the whole valley.

In addition to generating an economic boom, tourism is also changing the settlement pattern of the valley. Six of the seven villages are located on the south-facing slope, several hundred metres above the valley bottom. This location was obviously chosen with the local climate in mind. Our temperature measurements show that the frost-free period is longer on the slope than in the valley bottom, thus making valley bottom agriculture more prone to frost during the vital periods of germination and harvesting. Since both settlements and farmland were located on the slope,
the main trail through the valley also went on the slope. Tourists, however, are not interested in climbing the slope. They prefer to walk the easy way along the valley bottom, and that is where most of the hotels have opened. New settlements have sprung up around the hotels, and so has farming. Three villages are now divided into two parts; the old upper settlement and the new lower settlement.

Settlements as well as farming are relocating from the slope to the valley bottom. The immediate reason for this change is tourism. But it is tempting to assume that the recent temperature increase has improved conditions for farming in the valley bottom by reducing the incidence of frosts in spring and autumn. If this is correct, huge areas of the valley bottom will be cultivable in a warmer future. Water is not a bottleneck there as it is on the south-facing slope (Figure 3). The Marshyangdi River that drains the valley is fed by glaciers in the Annapurna range that rises to 8000 masl, and these are unlikely to disappear in the foreseeable future. If global warming causes water scarcity due to vanishing glaciers or less winter snow in the old settlements, a warmer climate may on the other hand facilitate farming in the valley bottom. Thus, climate change may relocate farms rather than altering or preventing current agricultural practices.

Conclusions
The case of Manang supports those who ascribe the label ‘dynamic’ rather than ‘fragile’ to Himalayan communities. The history of Manang is a tale of dynamic adaptations to a changing world. For 200 years, Mananges have managed to develop from being one of the most miserable peoples of Nepal, suffering extreme poverty and regular famines, into one of the wealthiest and most sophisticated and internationally oriented communities in the country. Their success has been achieved by a willingness and ability to be flexible in establishing active links with global processes of trade and tourism and exploiting them to their own advantage. Bateson maintains that social flexibility – in the sense of uncommitted potentialities – ‘is a resource as precious as oil or titanium and must be budgeted in appropriate ways, to be spent (like fat) upon needed change’ (1972, 505). So far, the Mananges have budgeted their flexibility in a solid manner. Looking ahead, our analysis reveals four ‘uncommitted potentialities’ for adaptation to a future situation that will be climatologically different from the present. In order to maintain local food security under changing climate conditions, Mananges can reclaim abandoned land, they can deforest more on barley, they may reduce the conspicuous exhibition of horses, and relocate farming from the slope to the valley bottom. The vital ‘variables’ (Bateson 1972), so-called vital units of the Manang farming system, have not yet been exploited to their limits. Thus, the inherent flexibility in their farming renders Mananges quite robust in facing future uncertainties.

We should be more worried about the millions of farmers on the plains of India, Nepal and Bangladesh if glacial melting reduces water discharge rates in the major rivers. There, ‘the likelihood of food shortage is currently viewed as a small, dark cloud on the horizon’ (Baker and Jewitt 2007, 331). The Green Revolution that was introduced in South Asia in the 1970s greatly enhanced farm productivity, but the new technology is heavily dependent on an abundant supply of water. Since individual farms are smaller today than they were before the ‘revolution’ (Lipton 2008), a future with less water may very well turn the dark clouds into a heavily overcast sky.

Notes
1 Local climate models will probably be developed within a few years, according to Director Dr Eystein Jansen at Bjerknes Centre for Climate Research, University of Bergen.
2 The barley of Manang is labelled karu in vernacular language. It has short spikes and may wrongly be taken for wheat at first sight. In official statistics, it has occasionally been mistakenly translated as oats (oah in Nepali).
3 Expansion of wheat cultivation accompanied by reduction in growing barley may lead to loss of indigenous barley landraces, including ‘Nepal barley’ (as named by Nakao 1956), which is occurring in the Marshyangdi River basin, in Manang and Pisang villages.

References
Aase T H 1992 Electrification and water management in the northern areas of Pakistan Norwegian Agency for Development Cooperation (NORAD), Oslo
Aase T H 1999 The theological construction of conflict: Gilgit, Northern Pakistan in Manger L ed Muslim diversity. Local Islam in global context Curzon Press, Richmond VA
Adhikari J and Bohle H G 1998 Rural livelihoods at risk: how Nepalese farmers cope with food insecurity Mountain Research and Development 18 321–32


Bateson G 1972 Steps to an ecology of mind University of Chicago Press, Chicago IL


Cline W R 2008 Global warming and agriculture. Impact estimates by country Peterson Institute for International Economics, Washington DC


Geological Survey of India 1999 Inventory of the Himalayan glaciers: a contribution to the International Hydrological Programme Special Publication no 34, New Delhi

Guillet D 1983 Toward a cultural ecology of mountains: the Central Andes and the Himalayas compared Current Anthropology 24 561–74

Gurung H 2004 Mountain reflections Mandala Book Point, Kathmandu

Holland M M and Bitz C M 2003 Polar amplification of climate change in the coupled model intercomparison project Climate Dynamics 21 221–32

ICIMOD 2003 Districts of Nepal. Indicators of development 2001 International Centre for Integrated Mountain Development (ICIMOD), Kathmandu

Ives J D 2004 Himalayan perceptions. Environmental change and the well-being of mountain peoples Routledge, Abingdon


Khanal N R and Watanabe T 2006 Abandonment of land and its consequences Mountain Research and Development 26 32–40


Lorimer E O 1939 Language hunting in the Karakorum George Allen and Unwin, London

Nakao S 1956 Barley in Kihara H ed Land and crops of Nepal Himalaya vol II Fauna and Flora Research Society, Kyoto University, Japan 313–44


Rogers C 2004 Secrets of Manang. The story behind the phenomenal rise of Nepal’s famed business community Mandala Book Point, Kathmandu

Salick J and Byg A 2007 Indigenous peoples and climate change A Tyndall Centre Publication, Oxford


Thompson M and Warburton M 1985 Uncertainty on a Himalayan scale Mountain Research and Development 5 115–35


Thuiller W 2007 Climate change and the ecologists Nature 448 550–52

