Farming Flexibility in Mustang, Nepal

Potentialities and constraints under conditions of climate change

By Nina Holmelin

Master Thesis in Human Geography
Department of Geography
University of Bergen
May 2010



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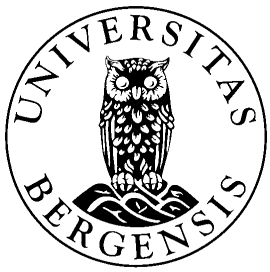

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ACKNOWLEDGEMENTS

This Master thesis is part of a research programme on 'Farming Flexibility under Conditions of Climatic- and Market Uncertainty', led by Professor Tor Halfdan Aase at the Department of Geography, University of Bergen. Taking part in a research group has been a pleasure and in this final stage of writing, I am most grateful for all help and support I have received while working on this thesis. In particular I want to thank:

Professor and supervisor Tor Halfdan Aase for great inspiration, guidance and the many advices I got during fieldwork and writing process; Keshav Prasad Paudel for help with the map; the Faculty of Social Sciences, University of Bergen, for economic support for fieldwork; Nordic Institute of Asian Studies (NIAS) in Copenhagen for the SUPRA Scholarship, for letting me use their facilities and for their warm welcome; all my friends and informants in Mustang for their great hospitality and patience with all my strange questions; Gabi and the children in Muktinath Tibetan Traditional Medical Centre ("the *gompa*") for letting me teach there and for including me in the daily life in the village.

I would also like to thank my friends at the Department of Geography and particularly Signe Vinje and Bjørn Erik Løken who have stayed by my side sharing joys and frustrations since our very first day of University studies; my parents and my sister for all their support and for visiting me in Nepal after completed fieldwork; and lastly, I send my greatest thanks to Carl-Fritjof, who brightens my days and brings me back to reality when I happen to get lost in thoughts and work.

I appreciate all help I have received, although I alone am responsible for any mistake this thesis might include.

Bergen, May 2010,

Nina Holmelin

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CHAPTER 1: INTRODUCTION

Mountain farming systems are often characterised by diversified practices, a feature which distinguishes them from the standardised and often highly specialised practice of modern agriculture. From a western perspective, small scale peasants in mountain regions are therefore often viewed as traditional, irrational and resistant to change (MacDonald 1998). However, several voices have been raised to counter this view. Instead they argue that diversification is a rational strategy for risk reduction (MacDonald 1998, Mishra et al. 2003), and that many mountain farming systems are highly flexible in response to environmental as well as socio-economic changes (Bishop 1998, Mishra et al. 2003, Aase et al. 2010). This thesis supports the latter view, that mountain farming systems are indeed highly flexible, although there may be constraints to flexibility.

In a paper from a recent research project in Manang, Aase (2008) argues that despite their location in a remote mountain district of Nepal, the people of Manang are integrated in large scale processes such as international trade and migration, tourism and climate change. Generally speaking, international food markets and new communication technology could probably be added to the list of large scale processes affecting mountain communities. These processes must be considered in order to understand local primary production even in remote locations such as Trans-Himalayan valleys.

1.1 The challenge of climate change to food production

Global climate change is currently an issue of great concern for researchers, political leaders and the general public alike. The reports of the Intergovernmental Panel on Climate Change (IPCC) project comprehensive changes in global climate systems throughout this century. Far-reaching impacts on society and environment are expected unless greenhouse gas emissions are rapidly and drastically reduced at a global scale (IPCC 2007). The prospects for achievement in this matter are not promising, however, and even the goal of limiting the average temperature increase to two degrees Celsius now seems out of reach. The concentration of greenhouse gases (both CO_2 and non-CO_2) in the atmosphere is already exceeding the critical level of 450 parts per million CO_2-equivalents (Richardson et al. 2009). In order to stabilize concentrations at this level, which would probably limit global warming

to between 2.0 and 2.4^{o}C, an immediate 60 – 80% reduction in greenhouse gas emissions is required (ibid.). Judging from the meagre results of the last UN Climate Change Conference (COP15) in Copenhagen in December 2009, achievement of this goal seems politically unrealistic at the moment. By climate change, the IPCC (2007: 6) means "any change in climate over time, whether due to natural variability or as a result of human activity". The confluence of natural variability and effects of anthropogenic greenhouse gas emissions is expected to have significant impact on ecological systems at a global scale, although the impacts at the local scale will vary significantly.

In many Asian countries, rising temperatures and extreme weather events have already contributed to declining crop yields, a trend which is expected to be reinforced throughout this century (IPCC 2007: 479). Likewise, the great glaciers of the Himalaya which feed seven of the largest rivers of Asia are currently melting at a accelerating rate[1] (Rai and Gurung 2005, IPCC 2007, Zemp and Haeberli 2007, Kehrwald et al. 2008). The melting of glaciers not only puts the people who live along these rivers at potential risk of glacier lake outburst floods and landslides, it also changes the seasonality of river runoff. With higher temperatures the runoff peak will shift to winter and early spring, away from summer and autumn when the demand is greatest (Barnett et al. 2005). Ganges, for instance, is expected to reduce July – September flows by two thirds due to reduced glacier meltwater, a change which could cause seasonal water shortage for 500 million people and 37% of India's irrigated land (Rai and Gurung 2005).

The future prospects are not any better when it comes to food production and food prices. The sharp rise and volatility in food prices the recent years has caused hardships especially for the poorest part of the world's population (Cord et al. 2008). Increased demand for animal feed for meat production, crops used for biofuel and disruptions in agricultural supplies in important export countries like India and Argentina in this period, led to chaos in the international food markets in the 2006 – 2008 period (Battisti and Naylor 2009). Without immediately blaming climate change for the recent rise in food prices, we must still be prepared to meet severe challenges in food production systems in near future, as price

[1] Early in 2010 the IPCC admitted that a statement in the report of Working Group 2 was based a non-scientific source and should not have been included in the report. The statement claimed that 80% of Himalayan glacier area would very likely melt away by 2035. However, this does not raise doubts concerning the rest of the report or the assessments of Working Group 1, which has thorough and broad scientific foundation for their prediction of extensive glacier melting as a consequence of raising global mean temperatures.

increases and fluctuations will probably be further spurred by climate change impacts (Cord et al. 2008). According to the IPCC (2007: 479), crop yields in Central and South Asia may decrease up to 30% by 2050 and with more frequent droughts and extreme weather events, crop failures must also be expected to occur more frequently. It is projected that global cereal prices may rise more than 300% by 2080 as a consequence of climate change related decline in productivity (Parry et al. 2004). Naturally, the food security of the world's poor, who already spend a large share of their income on food, will be severely threatened under such a scenario. Hence, it is likely that local small scale food production will become increasingly important throughout this century, particularly in rural areas.

Although the above mentioned regional climate predictions are quite clear, spatial variations between specific localities make local prospects more uncertain. Especially in the rugged Himalayan mountain region, there are great differences in micro climate conditions (Price 1995). In such a diverse and complex environment, regional climate predictions are of limited value for the specific local communities trying to adapt (Aase et al. 2010). Some farming systems will probably benefit from improved growing conditions as a consequence of a warmer climate as long as their water supply is sustained at an acceptable level. Others will inevitably be less fortunate, being exposed to seasonal floods, droughts or landslides, events which will represent great challenges to the adaptive capacity of local farming systems. Since people live in localities and not regions as such, uncertainty is the best characteristic of future climate conditions at the local scale. When uncertain long-term changes add to natural variability in temperature and water availability, the local climatic conditions for food production will be altered in many Himalayan farming systems. A central question, then, is whether and how these farming systems may successfully adapt to maintain agricultural production under conditions of climatic uncertainty. One way to approach this question is to focus on the general flexibility of farming systems.

1.2 Flexibility in farming systems

Gregory Bateson defines flexibility as '*uncommitted potentialities for change*' (2000 [1972]: 505, emphasis in original), a concept which is applicable to a range of systems at various levels of abstraction. When applied to small scale Himalayan farming systems, the peasants become managers of flexibility in the system. In this case flexibility refers to the adaptive capacity of the farming system, meaning its ability of rapid adjustment and active response in

order to cope with changes, which also includes introduction of new practices. For instance, flexibility may imply to make use of a wider range of local resources to enable alternation between different strategies in the face of uncertain and variable climatic conditions. Furthermore, flexibility means to identify uncommitted potentialities for change in the farming system, that is, opportunities and strategies ready to be implemented and the ability to do so in times of need. However, in a highly diverse environment such as the Himalaya, contextualised analyses of specific cases are required. This thesis presents one such case study from the village Jharkot in Mustang, Nepal Himalaya. The case of Jharkot will inform a discussion of whether the concept of flexibility is a useful analytic tool to study the adaptive capacity of a farming system under uncertain climatic conditions and, if so is the case, how it may be done.

To study farming systems in terms of flexibility opens the door for analyses of new opportunities which are not yet explored. Such an approach is particularly interesting when it comes to the Himalayan region. A common perception of Himalaya was from the 1970s and onwards dominated by various characteristics of anthropogenic crisis and degradation in highly fragile ecological systems. These descriptions were rooted in what Ives (1987) later referred to as the Theory of Himalayan Environmental Degradation, an assertion of massive deforestation in Nepal which for decades has been widely criticised both on its assumptions and on the alleged causal connections. However, the perception of the Himalayan environment as vulnerable and fragile is still remarkably persistent (Guthman 1997, Rai and Gurung 2005, Ives 2006). Several voices have been raised, however, in favour of seeing the Himalayan region as highly dynamic, rather than fragile (Gurung 2004 [1987], Chapman and Thompson 1995, Mishra et al. 2003, Subedi 2007). Dynamism is closely related to flexibility as both concepts refer to proactive and constant change. For local farming systems facing a climatically uncertain future, ability to rapid change is most likely of vital importance for successful adaptation.

1.3 Research questions

The main topic of this study is the flexibility of the farming system of Jharkot in Mustang, Nepal, under conditions of uncertain local effects of global climate change. More specifically, my intention is to:

1. Identify and describe the internal dynamics and current practice in the farming system of Jharkot,
2. Analyse some aspects of flexibility in the farming system and assess the most important constraints to this flexibility, and
3. Discuss whether and how flexibility in the farming system may enable the system to maintain or even increase agricultural production under various trajectories of change in temperature and water availability at the local scale.

To complete this task requires an analytical approach to flexibility. Bateson (2000 [1972]) applies his notion of flexibility in a theoretical analysis of an ecological system which comprises the whole of human civilization. However, it is relevant to ask whether this concept could also be useful in more empirically based analyses of agricultural systems. Hence, I phrase a fourth, theoretical research question:

4. Is Bateson's conception of 'flexibility' a useful tool in analyses of farming systems' adaptive capacity under conditions of climatic uncertainty?

1.4 Structure of the thesis

Chapter 2 gives a general introduction to the study area, its historical background and some recent changes of relevance for the case.

Chapter 3 discusses the methodological approach of this thesis and the methods applied for production of primary data during fieldwork. Methodological issues concerning data analysis are also discussed.

Chapter 4 concerns the farming system approach and its precedents. This is primarily a theoretical chapter, although I have chosen to include references to the empirical case to

demonstrate the relevance of the theoretical framework for the case. In the last part of the chapter I address some basic assumptions in system analysis.

Instead of strictly separating theory and analysis in different chapters, I have chosen to let my first three research questions structure the analytical chapters, dedicating one chapter to each question. Relevant theories are therefore presented along the way as they are required for the analysis. Although it is not the intention of this thesis to provide a comparative study, in certain places parallels are drawn to farming systems elsewhere. The comparisons do not, however, imply any attempt to generalise my empirical findings. Instead, this thesis is an example of an idiographic analysis, which is required for recognition of the diversity of empirical realities as well as the diversity of worldviews and perspectives (Tucker 1999).

Chapter 5 addresses my first research question and describes current practice in the farming system of Jharkot. By applying the farming system approach presented in chapter 4, I attempt to demonstrate the interrelatedness of the system.

Chapter 6 is dedicated to flexibility. The concept of flexibility is theoretically discussed and I suggest an analytical approach to the study of flexibility in farming systems. Answering my second research question, this approach is applied on the farming system of Jharkot, analysing some aspects of flexibility in the system under varying climatic conditions. Factors that constrain this flexibility are also discussed. Lastly, the chapter discusses my theoretical research question.

Chapter 7 introduces the challenge which climate change poses to agricultural production in Jharkot. After a short review of climate change projections for the Himalaya, I clarify the relation between flexibility and adaptive capacity. Addressing my third research question I next discuss whether and how flexibility in the farming system may enable maintained or even increased agricultural production under uncertain local conditions in temperature and water availability.

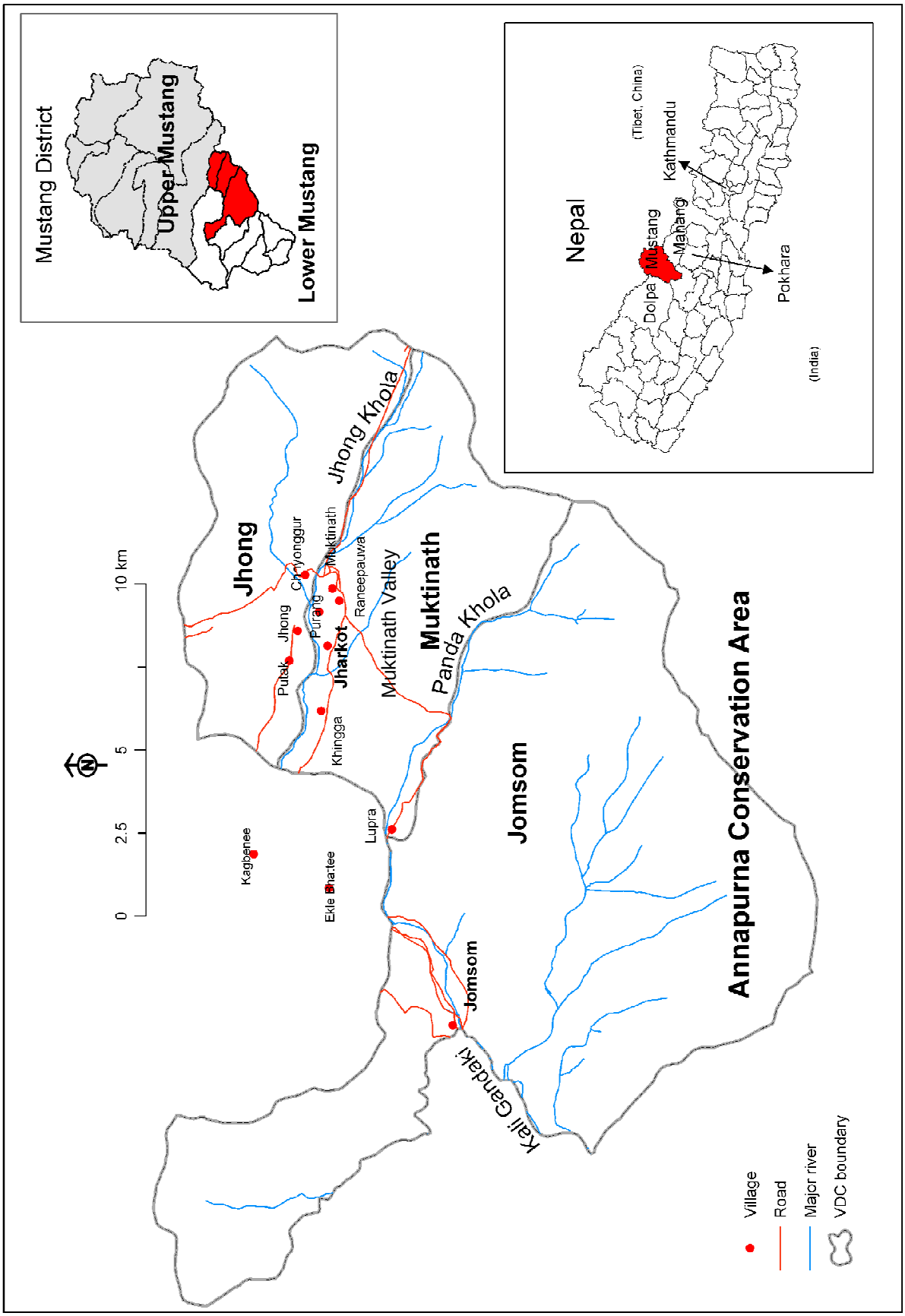
The final chapter summarises the thesis and draws conclusions with reference to the research questions. Questions for further research which have emerged as a result of the analysis are also formulated.

CHAPTER 2: JHARKOT IN CONTEXT

Picture 1: The village Jharkot surrounded by snow-covered mountains

Ranges of snow-covered mountain peaks gave the 'Himalaya' its Sanskrit name, the 'abode of snow' (Gurung 2004). The geographical area conventionally referred to as Himalaya is the mountain range stretching more than 2,400 km from the gorge of the Indus below Nanga Parbat (8,126 metres above sea level) to the gorge of Dihang by Namcha Barwa (7,755 m.a.s.l.) (Ives and Messerli 1989, Gurung 2004). Being the youngest mountain system of the world, the Himalaya is still tectonically active and exposed to high rates of natural erosion. Due to high altitude, high relative relief and a harsh natural environment, many areas of the Himalaya are scarcely populated compared to the lower lying hills and plains. Still, the water resources of the Himalaya are of crucial importance far beyond the mountain areas. The snow and ice covered areas of the Himalaya serve as the water towers of Asia, the source of several great river systems which together provide 1.3 billion people with water.

This chapter introduces the field area and its context, both geographically and historically. After a short introduction to Nepal Himalaya, I will introduce the district of Mustang, the Muktinath Valley and the farming system of the village Jharkot where my fieldwork was carried out. A brief review of selected historic events of the Mustang District and some important recent changes are also included.



Map 1: Jhong, Muktinath and Jomsom VDCs in Mustang District, Nepal

(Source: Elaborated by Keshav Prasad Paudel 2010, modified by the author)

2.1 Geographic setting

2.1.1 Nepal

Being located in central Himalaya, Nepal is perhaps best known for its high mountains. For centuries, Nepal Himalaya was perceived by Westerns as a mythical place, little known to western travellers and researchers before the 1950s (Führer-Haimendorf 1975). Even today the mythical history and the impressive mountains attract trekkers and tourists from all over the world. For thousands of years this area has been the home of a variety of populations of diverse origins (English 1985), among them transmigrants of Tibetan origin. The study area of this thesis is located in one of the Tibetan speaking areas of Northern Nepal: the village Jharkot in Muktinath Valley (Map 1, p. 8), which is situated in Mustang District in the northern part of Annapurna Conservation Area (ACA).

Nepal has currently a population of 28.5 million, of which more than 80% live in rural areas where they are employed predominantly in the agricultural sector (CIA 2009). The country is quite impoverished with 42% of its population living under conditions of absolute poverty (World Bank 2002, in Gill et al. 2003). This has serious consequences for the food security and health situation of the people, particularly for children. More than half of the children below the age of five suffer from stunting and as much as ten percent of the living infants die before their 5th birthday (ibid.). Nepal is thus ranked as number 144th (out of 182) in the Human Development Index for 2007 (UNDP 2009). However, there were some improvements in the poverty and health situation from 1980 to 2000. While the population of Nepal increased from 14.6 to 22.5 million, the absolute number of undernourished persons fell from 7 to just above 4 millions. The proportion of the population suffering from undernourishment was more than halved during the 80s and it was kept stable during the 90s at about 19% (FAO 2002, in Gill et al. 2003). While these aggregated numbers account for the food security situation in Nepal in general, regional differences are quite pronounced. Poverty and food insecurity are closely related in Nepal and poverty is more widespread and intense in rural areas, particularly in mountain areas. Short growing season and small potentials for income outside agriculture are contributing factors, in addition to lack of roads so that even if people can afford to spend more on food, they cannot access it (FAO 2004). However, the districts of Mustang and Manang are somewhat better off compared to other mountain districts in Nepal such as Dolpa. A history of transnational trade and successful

tourism development the last thirty years contributed to the socio-economic improvements in Manang (Aase 2007) and to some extent, in Mustang.

2.1.2 Mustang District

Mustang is located in north-west of Nepal and shares border with the Tibet Autonomous Region in China. The district of Mustang spans from 83°28' to 84°8' east and from 28°33' to 29°19' north and covers an area of 3,176 sq km. The landscape is mountainous with steep relief and the river Kali Gandaki runs in a gorge from north to south through Mustang. Kali Gandaki is also one of the feeders of Ganges which is a sacred river for Hindu devotees. Most of the villages of this district are located close by the river bed of Kali Gandaki or by its tributaries. The villages are settled by several ethnic groups of Tibetan origin and Buddhist faith. The Thakalis, however, who inhabit large parts of the Kali Gandaki area south of Kagbeni are actually not Tibetan decendants but were drawn into the Tibetan cultural orbit at some time in history (Führer-Haimendorf 1975), and thus have a distinct dialect. Nevertheless, the inhabitants of the Muktinath Valley, which is the focus of this thesis, are culturally and linguistically Tibetan. These communities are often referred to as Bhotias and the people here claim to belong to the ethnic groups Gurung and Thakuri[2]. Their traditional way of living is a combination of irrigated terrace cultivation and livestock rearing in an agro-pastoral farming system. In this semi-arid high mountain environment with short growing season, subsistence production has historically been complemented by seasonal migration and trans-Himalayan trade (Pyers 1985). Since the opening of the district for tourism in 1977 with the establishment of a trekking route around the Annapurna Conservation Area, many have also found a living in hosting lodges and tea houses, and as porters and guides. However, the central government initially allowed tourism development only in Lower Mustang, not in Upper Mustang (the area historically known as Lo). Upper Mustang is not included as a field area for this thesis. The border between Upper and Lower Mustang is drawn just north of the village Kagbeni (Map 1, p. 8).

[2] Thakuri is actually a title which some powerful families took in the 16th century. Here, the Thakuris are described as an ethnic group since the title is held by a kin-based group related to the King of Mustang, and because in this mountain area, economic and political divisions are more prominent than caste divisions (see Bista, D. B., 1991. *Fatalism and Development. Nepal's Struggle for Modernization.* Kolkata: Orient Longman Private Limited.).

2.1.3 Muktinath and Jharkot

Muktinath Valley is located in Lower Mustang at 83°35' east, 28°49' north, to the north-east of the great Annapurna Massif. From the snow and glacier covered mountains, streams of meltwater find their way down the mountain sides. One of these streams is Jhong Khola which crosscuts the Muktinath Valley and makes up the border between the administrative units of Muktinath and Jhong. Jhong Khola runs from east to west, where it eventually joins the Kali Gandaki River by the village Kagbeni (Map 1, p. 8). Over the years these rivers and streams have dug into the landscape, contributing to the already impressive steepness so characteristic for the Himalaya. The streams of meltwater constitute the basis for the agro-pastoral farming system practiced by the inhabitants of this area. Located in the rain shadow of Annapurna, the area is semi-arid and cultivation is fully dependent on irrigation. Climate conditions of strong winds and intense sunlight causes high evaporation and contribute to the semi-arid conditions (NTNC 2008)[3]. Exact and recent figures of precipitation are scarce, but Fort (1987) reports that annual precipitation is approximately 352 mm (ten year average). In Muktinath Valley, most of the precipitation falls in July and August while only little falls as snow during the winter months. This probably indicate the influence of the monsoon and contrast the climate of Muktinath Valley from that of the Western Himalaya (Fort 1987).

Muktinath Valley is surrounded by snow covered mountains, some of them rising more than 6,000 m.a.s.l.. The wildlife here includes snow leopard (*Panthera unica*), lynx (*Lynx lynx*), blue sheep (*Pseudois nayaur*) and Tibetan wolf (*Canis lupus chanco*), while great vultures (*Gypus himalayensis*) frequently circle over the valley. In Muktinath Valley, six villages are situated at altitudes between 3,200 and 3,800 m.a.s.l., three villages on each side of Jhong Khola. The villages to the north of the stream are part of Jhong Village Development Committee (VDC, an administrative unit), while those to the south are part of Muktinath VDC. Jharkot village (3,550 m.a.s.l.) belongs to Muktinath VDC, together with the twin village Purang/Ranipauwa, Khinga and the village Lupra in the neighbouring Panda Valley. Jharkot consists of 62 households, of which the majority is peasants.

The farming system of Jharkot is to a large extent subsistence based. Barley, wheat, buckwheat and some vegetables are cultivated in terraced fields. Fruit trees are also grown in orchards, while planted trees grow at the field edges. Since precipitation alone is not sufficient

[3] National Trust for Nature Conservation (NTNC)

for cultivation, water is led to the fields through a complex system of irrigation channels. Manure to fertilize the fields is provided for by animal husbandry. Cattle and goats are kept in large numbers, providing milk and meat in addition to manure. Smaller numbers of sheep and poultry give wool and eggs, horses and mules are used for travel and transport, while *jhopas* (yak – cow hybrids) are used as draught animals. Small numbers of yaks are kept for the purpose of meat, which is highly appreciated locally. Most animals are daily taken out to the community pastures, except in winter time when they are stall-fed with dry leaves and crop residuals. Fuelwood and construction materials are either collected from the community forest some four hours away by foot, or obtained by lopping the planted trees closer to the village. In lean agricultural periods people gather berries, herbs and medicinal plants from the common land, some of which they can sell.

The farming system is supplemented by additional livelihood strategies. Home weaving is widespread, both for sale and for private use. The colourful textiles are part of the traditional Tibetan dress which all married women wear at a daily basis. In addition, many add monetary income to the household's subsistence production through engagement in tourism, transport, seasonal migration and through remittances from relatives working in the cities or abroad.

2.2 Historic context: A Tibetan Kingdom

Muktinath Valley has been populated in several periods throughout history, the earliest signs of human activity is found to be about 3,500 years old (Simons 2002, in Kriechbaum 2002). In the earliest centuries A.D. the area around Muktinath Valley (historically known as Baragaon, "Twelve villages") was part of an independent state called Se-rib, but during the Tibetan expansion in the 7th century the state was brought under Tibetan rule. The Tibetan expansion also included Se-rib's northern neighbour state, Lo (in today's Upper Mustang), but not the Thakali area further south along the Kali Gandaki river (Jackson 1978, Messerschmidt 1982). From the 12th century Se-rib was under shifting political dominance by a range of rivalling kingdoms, before the entire Kali Gandaki region came under the control of the King of Lo (Mustang) in the middle of the 18th century. This was the time when the House of Gorkha, seated in Kathmandu, gained control over an area that in 1786 came to be the state of Nepal (Messerschmidt 1982). By submitting willingly to the Gorkhas without fighting, the King of Lo was in return granted control over his area and became a tributary monarch to the central power (Vinding 1998). Later Lo and Se-rib were defined as

the administrative district of Mustang, in accordance with modern principles of Nepali state organisation.

Traditionally, most villages were built as forts on hilltops where they were easily defended. In the heart of Jharkot there are still ruins of a fort built by a noble family in the 15th century (Ehrhard 1993). Though Jharkot is still situated in its original location, with the political consolidation of a Nepali state, many inhabitants of Mustang chose to resettle closer to the fields, the water sources and the trade route in the flat Kali Gandaki river bed (Vinding 1998). This trade was soon to become a great source of revenues for successful merchants.

2.2.1 Trans-Himalayan salt trade

For centuries, caravans of traders walked over high passes, in deep gorges and along the alluvial plains from Tibet to India (Pyers 1985). They brought with them large herds of animals, and not only mules and donkeys but also goats and sheep were loaded with heavy burdens and used as pack animals (Führer-Haimendorf 1975). The bags were often filled with wool and Tibetan salt, the latter a highly valued commodity in India. Until the middle of the 20th century the Terai (plains) of Nepal was infected by malaria and therefore largely uninhabited, so the demand was to be found either across the Indian border or in the western hills of Nepal. The Kali Gandaki river bed was one of the principal routes between these markets and Tibet (Jackson 1978), due to its relatively easy access to Tibet (Führer-Haimendorf 1975). Through a complex system of contractors, transporters and fixed points of exchange, the salt was traded several times before it eventually reached India. In return, rice and other food grains were brought back to Mustang along the same trading route, where they were necessary food supplements in an environment which does not permit farming as the sole source of subsistence (Führer-Haimendorf 1975). The trade flourished from the 15th century and especially throughout the 19th century (Vinding 1998) before it declined with the Chinese occupation of Tibet in 1959.

While the mountainous northern part of the trade route was easiest to travel during the summer, traders from the south tried to avoid the monsoon and preferred to go in wintertime. In addition, different types of pack animals were suitable at lower altitudes than higher ones. Therefore the distance from Tibet to India was divided in stages along the route (Führer-Haimendorf 1975). Commodity exchange took place in certain villages where Thakali

middlemen stored and traded the goods, making considerable profit (Rogers 2004). Thus the petty traders of Mustang who went to Tibet to barter barley for salt only transported the salt part of the trade route before they sold their salt and turned back home. In terms of prices, the salt to grain ratio was highly dependent on the distance travelled (Führer-Haimendorf 1975). Close to Tibet salt was far cheaper than barley, while the opposite was the case further south so even a small scale trader could contribute considerably to his household's economy by exploiting the price differences.

An interesting question arises from the story of salt trade: Why did the people of Mustang experience such success in the salt trade while people in neighbouring, similar districts did not? Führer-Haimendorf (1975) finds that the most important factor behind the trade success in Mustang was a favourable geographical position with relatively easy access to Tibet, an explanation to which there is general consent (Jackson 1978, Messerschmidt 1982, Vinding 1998, Manzardo 1977, in Rogers 2004). A government sanctioned monopoly of trade in salt that was granted to the Thakalis in 1860 did also contribute to economic prosperity along the Kali Gandaki. However, Führer-Haimendorf (1975) argues that the trading community would probably have risen even without the Thakali monopoly, though he finds that it certainly did contribute positively. Due to this arrangement the petty traders going to Tibet for barter trade were obliged to sell their salt at fixed trade stations where the owner paid annual royalties to the government. When the salt monopoly was abolished in 1928, the revenues were spread among a larger number of traders and the trade thus became a widespread activity.

From here the explanations diverge, however. In addition to the above mentioned factors, Führer-Haimendorf emphasizes certain cultural characteristics as contributing to economic success in trade. Relative to the lowland Hindus, the highland Buddhists were to a large extent free from social hierarchy and social restrictions, and thus free agents who could do business with a greater range of trading partners across for instance caste divisions. Manzardo (1977, in Rogers 2004), however, challenge the latter cultural explanation and rather emphasizes the ecological advantage of having access to large pastures and thus the opportunity to raise large herds of pack animals. Jackson's (1978) explanation is less functionalistic, though, rather emphasizing religious and cultural boundaries as reasons for why Mustang was a natural meeting point for trade:

> "It was the highest point that traders from the lowlands were likely to visit; for traders from Tibet and the high borderlands it was the end of their world: the bottom. (…) There is a temple in that area, aptly named in Tibetan "Temple of the Bottom" (…) which Tibetan Buddhists still consider the boundary of their own religion and culture." (Jackson 1978: 217).

Leaving to the historians to conclude in this matter, there is nonetheless little doubt that the salt trade became an important source of income for many peasants in Mustang. The salt trade flourished until 1959, when the Chinese closed the borders of Tibet and made transmigration more cumbersome. In addition, cheap sea salt from India started to challenge the position of the Tibetan salt traders (Führer-Haimendorf 1975). According to my informants, however, small scale salt trade was done until only twenty years ago. Still, even though the salt trade was declining, the long tradition of seasonal migration (see Schuler 1977, in Messerschmidt 1989) is kept alive even today. Nowadays people go down to the hills and plains of Nepal and to the northern parts of India for small scale business and trade during the winter months. In addition, many go to the Tibetan border to buy carpets and souvenirs which they sell to trekkers passing by their village.

2.2.2 Trekking in the mountains

The long history of trade and business in Mustang did not only mitigate poverty. The building up of experience and capital was also an advantage when the area was opened for tourism in 1977. A trekking route was established around Annapurna Conservation Area (ACA), going up Manang district to the east of Mustang, passing through Muktinath Valley and going down along the Kali Gandaki in Lower Mustang. Rapidly ACA became among the most popular trekking destinations in Nepal (Nepal 2003). In Mustang alone the average annual number of foreign visitors the last eight years has been 19,300, peaking in 2008 with 27,800 foreign visitors (NTNC-ACAP 2009). Even though the tourists offer great opportunities for non-farm income, the revenues from tourism is unevenly distributed among villages, households and seasons of the year. Only 5% of the households of Mustang run lodges and camp sites (NTNC 2008). Thus for the majority of households income opportunities from tourism are limited to sale of vegetables, fruit juice and liquer to the lodges, or to what they can get from the tourists for their woven carpets, Tibetan souvenirs and black ammonite fossils found in the watersheds. However, contrary to Upper Mustang where tourism is dominated by non-local capital (Ives 2006), the lodges are locally run and owned in Muktinath Valley. A favourably situated lodge or shop is a potential source of significant income for the owners. The most

attractive locations are to be found along the trekking path going down from a high mountain pass separating Mustang District from Manang. In the opposite direction this path is also walked by many religious pilgrims seeking their destination: The Muktinath Temple.

2.2.3 A sacred place: The Muktinath temple

Muktinath temple is an enclosed area in the mountain side far east in Muktinath Valley. The temple complex consists of several natural phenomena and human created temples which are considered sacred in no less than three religions. Höivik (2004: 81) summarises the profound and multiple religious significance of the Muktinath temple: "Muktinath is trice-sacred, and in two respects. First, it is holy to the three faiths: to Hindus, to Buddhists (…) and to adherents of Bon. Secondly, it has three especially holy features: *sacred waters, sacred flames, sacred saligrams."* The sacred waters refer to 108 waterspouts shaped in stone as boars' heads, which are the main destination for Hindu devotees. In a separate temple two flames are burning from natural gas over earth and water, and the saligrams refer to spiral fossils which can be found in the whole Kali Gandaki area. Being about 265 million years old, the black fossils are the remains of ammonite shellfish living in the Thetys Sea, before the tectonic collision which caused the Himalayan mountain range to rise (Höivik 2004). It is not only the fascination of age and distant location from the ocean that make the fossils sacred, however, but also their spiral shape which is worshiped by Hindus as a symbol of Vishnu (Messerschmidt 1989).

The place with its fossils, flames, waterspouts and temples are also sacred to Tibetan Buddhists, who interpret the signs according to their own religious traditions. To Buddhists the spiral shaped fossils represent both *Gawo Jogpa*, the Tibetan serpent deity (Messerschmidt 1989), and the Wheel of Dharma (teachings), which the historic Buddha turned three times (Höivik 2004). In addition, the lama who first introduced Buddhism to Tibet visited Muktinath in the 8th century A.D. (Messerschmidt 1989). An abundance of Buddhist prayer flags and praying wheels decorate the place, which is guarded by Buddhist monks and nuns living in a monastery (*gompa*) close by. People in the valley worship their sacred site and there is a tradition for sending their second son or second daughter – if three or more siblings are of the same sex – as a monk or nun to the *gompa* in Muktinath. However, this tradition has recently been challenged as more and more parents choose to send their children southbound for education in the cities.

The lesser known, pre-Buddhist religion of Bon is also practiced in Mustang (Höivik 2004). Bon is the ancient belief system of Greater Tibet and belongs to a family of animistic and shamanistic traditions that stretches through Tibet and Mongolia, through Siberia and westward to the Saami of Northern Scandinavia (Höivik, 2004). In the outskirts of Jharkot there is an abandoned Bon *gompa* (monastery), but in Lupra village Bon is still practiced.

2.3 Recent changes in Mustang

'Change' is far from a strange word to the people of Mustang. Not only has the district historically been subject to frequent shifts of political and religious dominance (Messerschmidt 1982), emerging opportunities through trade and tourism have also had significant impact on the economic structure of the area. These multiple processes of change justify the description of Mustang as highly dynamic, in accordance with Gurung's (2004) characterization of Himalaya. Still, it should not be assumed that the people of Mustang are in a process of radical cultural change. Messerschmidt (1982) instead argues that they meet changes with a basic underlying adaptive continuity. He highlights the people of Mustang's "uncanny and innovative ability as a people to adapt to new and unpredictable circumstances. Change, in this sense, is no more than another step in a continuous process of adjustment to changing circumstances" (Messerschmidt 1982: 276). Change is the natural condition, so to speak, and not a threat to cultural continuity. Keeping this perspective in mind, I shall now explore some of the current processes of change influencing Mustang, in particular education, seasonal migration and infrastructure development.

2.3.1 Education

Literacy rates have lately been rising in Mustang. In 2001, the literacy rate for children aged 10 to 14 had reached 81% (ICIMOD and CBS 2003a), compared to an adult literacy rate (age 15 and above) at only 48% (ICIMOD and CBS 2003b). Though adult women were less frequently educated (34% literate) than adult males (59%), every second child enrolled in schools was a girl, also at higher education levels (ibid.). Mustang was recently rated as number two – only surpassed by Manang – in a national Gender Discrimination Index covering the 75 Districts of Nepal, where gender imbalance in literacy status is one of the indicators (ICIMOD and CBS 2003a).

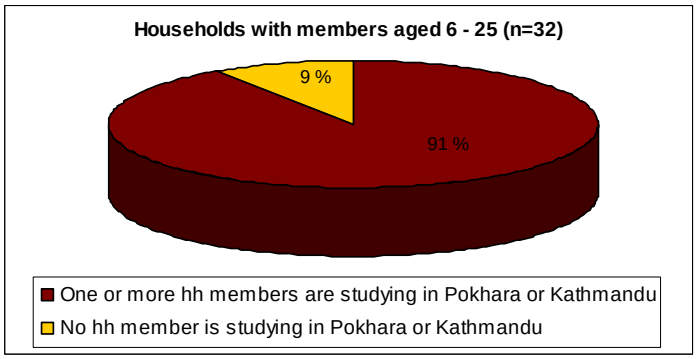


Figure 1: Out-migration from Muktinath VDC for education purposes (own survey).

There is a primary school in Jharkot and a secondary school in the district capital Jomsom, but youths must migrate to large cities such as Kathmandu or Pokhara for higher level education. According to a survey I conducted during fieldwork (Figure 1), out of 32 households having members in the age group 6 to 25, a majority of 91% choose to send at least one of their household members to the cities for education purposes. Many parents choose to send their children to boarding schools in Kathmandu and Pokhara already from first grade, either to NGO-sponsored and public schools or by own means to private schools. Some live with relatives in the cities during the years of education. In Mustang, ten percent of the children under the age of 16 live with relatives other than their parents, the highest figure in Nepal (ICIMOD and CBS 2003b). The children spend most of the year in the cities and visit their parents only during longer school holidays. This pronounced trend of educational migration reflects a more general pattern of seasonal and semi-permanent migration in Mustang.

2.3.2 A mobile population

During winter time from November to February there is little productive work to find in the village. When the fields are covered with snow and the tourist season is over, the principal tasks that have to be conducted are to feed the animals and occationally to sweep the roof for snow. In order to save the winter supplies of food and fuel, an age old livelihood strategy has been to keep only one or two household members in the village during the winter. The others migrate south for small scale business and trade or to take on wage work in lower-lying areas. In earlier times, people would accept food and accommodation as the only payment for their labour. They would take on causal work *"only to fill their stomach, for no extra money, to*

save what they had up here" as one of my informants put it. Nowadays in Jharkot, wages are paid to casual workers although food and housing are often included as part of the deal. Since the decline of the salt trade, the tradition of widespread seasonal migration has still prevailed. Among young men and women it is common to go to India for about two months, buying clothes directly from factories and selling them at local markets in rural areas. Others simply stay with relatives and friends in Kathmandu and Pokhara during the winter, even those who cannot find work there, in order to escape the cold and leave the winter supplies in Jharkot for those who stay behind.

Seasonal migration is not only taking place during the winter, though. Many households supply their income by remittances from relatives who have managed to acquire work abroad. Others stay in the cities when there is work to find, and turn back home when the labour market is slow. In time before the summer and the peak season in agriculture, the households summon many of their members. Both prior to and after the busy harvest period many festivals are held in the village.

The pronounced mobility and seasonal migration complicates population statistics as the number of people residing in the village vary significantly over the year. According to Nepal Population Census 2001, Mustang was then populated by 14,981 persons, compared to 14,292 ten years before (ICIMOD and CBS 2003b). These figures include people who are originally from Mustang, but residing elsewhere (NTNC 2008). The Nepal Population Census 2001 was held in the month of June, and although no comparable census has been conducted in winter time, it is reasonable to assume that the outcome would be significantly lower considering the large number of absentees during the winter. A more accurate indicator than total population is probably the number of households. In Mustang there are approximately 3,200 households, a quite stable figure throughout the 1990s (ICIMOD and CBS 2003b). Out of these, Upper Mustang had approximately 1,200 households in 1996 (Nepal 2003), leaving 2,000 households to Lower Mustang. The average household in Mustang has 5.4 members (NTNC 2008). The demographic trends vary among the villages, however. According to my informants, the number of people in Jharkot has decreased over the last twenty years. This goes for both the number of people per household and the total number of households. While there were 75 households in Jharkot 20 years ago, today there are 62. Similarly, while 216 households were registred in Muktinath VDC in 2001 (NTNC 2008), today there are only 169.

Compared to the national average, Mustang is sparsely populated with only 4.19 persons per square km (ICIMOD and CBS 2003b). However, in mountain regions the population is best compared not to total land area but rather to cultivable land (Pyers 1985, Kreutzmann 2000), which in Mustang is estimated to be 410 persons per square km land suitable for cultivation (NTNC 2008). Especially in semi-arid areas like Mustang the vast majority of villages are located close by the river bed of Kali Gandaki or by its tributaries. The river bed is also the route of both the tourist trek and a jeep road, which means that the single road actually passes by most villages, providing them with transport facilities.

2.3.3 Infrastructure

Until quite recently, riding was the fastest means of transport from the city Pokhara to Muktinath Valley and all goods had to be carried for six days by porters or pack animals. In 2006, however, the valley was connected by a jeep road to Jomsom, the district centre of Mustang, which significantly reduced the transport cost and time from Jomsom to Muktinath Valley. Jomsom has an airport and flight connection to Pokhara, although the high price for cargo by plane makes this route too expensive for common transport of goods. To the south of Jomsom there was only partial road connection passable for jeeps and trucks before full connection with Pokhara was completed in October 2008. A full road connection is a central element in the national sustainable development strategy for poverty reduction and environmental protection in Mustang (NTNC 2008). The road standard is of varying quality, though, and the road has already been blocked for several longer periods. Despite the unreliability, the inhabitants of the area still have great aspirations for this new opportunity for transport and travel. Instead of spending six days of walking or slightly shorter time by horse, the people of Muktinath Valley may now reach Pokhara in one to two days by jeep. Even though travel by plane is an option, the plane ticket represents a considerable cost for the common villager.

For transport of goods, the prices per kg cargo have been reduced from 18-20 NPR (Nepali Rupees[4]) by pack animals to only 5 NPR by jeep all the way to Pokhara. Alternatively, transport by plane costs 25 NPR per kg. The drastic reduction in transport cost and time has opened new opportunities for market production in Jharkot, as will be discussed later. Even more important is perhaps the increased accessibility and reduced prices on food and basic

[4] 100 Nepali Rupees (NPR) = 8.28 Norwegian Kroner (NOK) = 1.40 U.S. Dollar (USD).
[Exhange rate of April 21, 2010]

commodities which are imported to the village. The price of rice, for instance, declined by 32% with the completion of the road. The part of the road which is most frequently blocked is located south of Jomsom, while the jeep connection from Muktinath to Jomsom is more reliable. This part of the road has reduced the time of travel from about 5 hours by foot to one hour only by jeep between Jharkot and Jomsom. A new business opportunity in transport was also created, and a locally organized jeep cooperative is now in control of the route.

2.3.4 Level of subsistence and food security

Agricultural production in Jharkot is primarily subsistence oriented, although barter and trade are common if households are in excess of some crops while lacking others. This exchange takes place at the local market and the prices are highly volatile, most likely due to the low number of suppliers and demanders. Though peasants state that they are normally self-sufficient in barley and vegetables, this should not be interpreted as an indicator of overall self-sufficiency in the agricultural system. As one of my informants expressed: *"we buy rice from Jomsom. We eat more rice than gahun [wheat] and uwa [barley], it is not enough for us to eat just that."* (Binita, female 39). Each year 775,000 kg of food grains, mostly rice, are imported to Mustang District from lower parts of Nepal (NTNC 2008). Daily consumption of rice complicates estimation on the level of subsistence in Jharkot. According to FAO (2004), in the districts of Mustang and Manang the farming systems are capable of supporting the population for approximately six months of the year. Van Spengen (1987) estimated the level to be seven to eight months in the neighbour district, Manang. It should be noted that this naturally depends on the priorities of the peasants, where they invest their labour. As will be discussed later on, actual produced output should not be confused with the maximal potential of the farming system, as the natural resource base is not necessarily fully exploited. In both Manang (Aase et al. 2010) and Mustang, abandonment of agricultural land is widespread. Nevertheless, the short growing season justifies the conclusion that subsistence production alone cannot sustain the local population throughout the year.

Food security is not simply a matter of the total amount of food available through subsistence production and markets. Long discussions have been held on how to best define food security and arguments have repeatedly been made in favour of broadening the definition to not only include energy demands, but also nutrition status, access to food, intra-household distribution, social norms and relief from anxiety caused by uncertain and insufficient food access

(Campbell 1991, Gill et al. 2003, Pinstrup-Andersen 2009). Nevertheless, in the World Food Summit in Rome 1996, agreement was reached that food security exists "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO 1996, in Pinstrup-Andersen 2009: 5). In this definition, 'food preferences' means food items that are socially and culturally acceptable and consistent with religious and ethical values (Pinstrup-Andersen 2009).

When it comes to food security in Nepal, FAO (2004) finds the population of Mustang and Manang slightly better off than other rather impoverished mountain districts due to income opportunities from remittances, tourism and transport business. Still, far from everyone has the possibility of off-farm income and absolute poverty with related food insecurity exists also in Mustang. One study indicates that 19% of the population is food secure less than three months of the year (NTNC 2008). On the other hand, food sharing at community level is not unheard of. My informants often repeated that they shared their yields with relatives and neighbours before they sold redundant crops at the local market. This was confirmed by observations and interviews of receiving households and indicates that economically better positioned households contribute to mitigate food insecurity in poorer households, especially if they are related by kinship. Since imported food items play a prominent role in the local diet, the food security of a certain household is largely dependent on its opportunities for livelihood strategies alternative to farming. A thorough food security assessment would then require a broadening of focus from a farming system to a livelihood approach. Food security is therefore not a focus in this thesis. Quantitative assessments of the food security situation in Mustang and in Nepal are better found elsewhere (Gill et al. 2003, FAO 2004).

Picture 2: Locally grown naked barley (left) and hooded barley (right)

CHAPTER 3: METHODOLOGY

Fieldwork has a high position in the discipline of Geography as basis for production of empirical data. Following this tradition, the primary data of this thesis is the result of a fieldwork I conducted from mid April to mid June, 2009. Six weeks were spent in the village Jharkot in Mustang, Nepal, and an additional two weeks in the two cities Kathmandu and Pokhara prior to and after having stayed in the village. This chapter will initially concern general methodological issues, before turning to the methods I applied during fieldwork to produce primary data of relevance for my research question. Furthermore, it will discuss how the data are analysed in terms of theoretical concepts and analytical frameworks.

3.1 Qualitative and quantitative research methods

An important criteria for credible research is that the selected methods are appropriate to the nature of the question being asked (Silverman 2001). While social phenomena have both an extension and a nature, inherently distinct methods must be applied to produce knowledge of these two aspects (Aase and Fossåskaret 2007). Quantitative methods are appropriate for answering questions regarding the extent of a phenomenon, while the best way to obtain a deeper understanding of the character and meaning of the same phenomenon is through qualitative methods. Thus, the two methodological directions do not compete or exclude each other but are rather oriented towards different aspects of the same world of phenomena. An important point, however, is to avoid drawing conclusions regarding the extent of our findings by the means of qualitative methods or make claims about the character of a phenomenon by means of quantitative methods (ibid.). In order to answer my research question it was necessary for me to obtain a good understanding of current farming practice, including its character and dimension of meaning. The methods I chose were therefore primarily qualitatively oriented, such as participant observation, observation, field conversation and semi-structured interviews. In addition, I conducted a small quantitative household survey to assess the extent of selected features of semi-permanent migration from the village. Each of these methods will be discussed throughout this chapter.

To combine various methods of data production is a well known fieldwork strategy that is often referred to as triangulation. The idea is that by combining, for instance, observations

with interviews, a better understanding can be obtained of the various aspects of the studied phenomenon. Without adhering to the postitivist claim that an objective and absolute truth can be discovered through triangulation, a fuller account may still be given by examining the phenomenon from several positions, using different methods. There is no need for going to the other extreme of complete relativism which regards any knowledge claim as equally true and only a question of alternative interpretations. Instead, I will follow Kirk and Miller (1986) when they ontologically assume the existence of an external world of empirical reality, and epistemologically state that our perception and interpretation of this world are subjective and positioned. They share this position with critical realists which I will discuss more indepth in paragraph 4.3. At this stage the important point is that "the world does not tolerate all understandings of it equally" (Kirk and Miller 1986: 11), meaning that a person who believes that he can fly and therefore throws himself off a cliff without a parachute will probably experience the hard way that certain perceptions of the world are, in fact, in conflict with the empirical reality. This brief epistemological discussion is included here to substantiate the argument that although any knowledge production (including research) is positioned, all knowledge claims are still not equally valid. Hence, our accounts represent reality, but they do not reproduce it (Hammersley 1992, in Silverman 2001). Keeping these perspectives in mind, I will now discuss the methods for data production I applied during my fieldwork.

3.2 Fieldwork methods

In order to answer my research questions I needed to obtain understanding of local farming practices, challenges and recent changes in Jharkot and to some extent to get "backstage" (Goffman 1959, in Aase and Fossåskaret 2007). To be able to see agricultural practice in its proper context I also needed to get insight into village life in general, including social, religious and cultural dimensions.

3.2.1 Observation

By spending time in the field area the researcher is permitted to observe actual practices, both daily events such as irrigation and livestock herding and special events like funerals and festivals. Such observations may open for many new questions regarding concrete events. The benefit of observation in combination with interviews and field conversations is that the researcher may refer to a concrete practice or event, asking the informant to interpret and

explain what happens. This combination of methods may enhance the researcher's general understanding of the daily life of the informants, including dimensions of meaning previously unknown to the researcher. In addition, observations of actual practice may sometimes deviate from what informants say is taking place. Given that the researcher is confident that she has an adequate interpretation of a certain observation (e.g., excessive alcohol consumption), discrepancies between observations and interviews may indicate tabooed topics and ways of self-representation, what is openly spoken of and what is suppressed – at least to outsiders. However, the researcher must be careful not to interpret and categorise observations too quickly, but ensure that she interprets observations in terms of local categories. I will return to this point in paragraph 3.4.

Observations are not limited to visual impressions but do also include conversations (Silverman 2003, Aase and Fossåskaret 2007). Interviews and field conversations may then be called observations because the researcher observes certain aspects of the life of the informant indirectly through conversation. However, to observe is not the same as conducting *participant* observation, since the latter involves taking part in social interaction. In order to participate and be able to observe her own participation in the field, the researcher must take on a local status (Aase and Fossåskaret 2007). Then only can she in fact participate in social interaction in the field and hopefully be permitted access backstage, at least to the social arenas of greatest relevance for the research topic. But what is a status and how can the researcher negotiate a local status in the field?

3.2.2 Participant observation: Status and access

A status is a social position to which a collection of rights and duties is connected (Linton 1936: 113). Some of these are formal rights and duties (e.g., a citizen has the right to vote and the duty to pay taxes), but in addition a status is connected with a range of informal rules and norms known as role expectations. We confirm a particular status by acting according to its role expectations and by doing this we perform a role. Although there are many possible ways to perform a role, a minimum of agreement on the role expectations of different statuses is a prerequisite for social interaction. This is because without a certain degree of consensus about role expectations, our actions become unpredictable for others (Aase and Fossåskaret 2007). Social interaction can thus only take place through interaction between complementary statuses, which together make a status set (e.g., mother – child, or friend – friend). The total

range of statuses in a society is called its status inventory (ibid.). The fieldworker who tries to conduct participant observation then has to negotiate a status in the local status inventory, so that she can participate in various arenas of social interaction. Interaction through complementary statuses may or may not give access to the kind of empirical material the researcher needs. During my fieldwork I experienced how I was permitted access to different social arenas dependent on the role I performed in the particular situation. In the following I will reflect on how I managed and alternated between different statuses and how this influenced my access to empirical material.

First status: Tourist

A western, young woman like me looked exactly like the many other trekker tourists who visit the Muktinath Valley, and the very first days it is most likely that the villagers considered me as just another tourist. I was approached by western tourists and by souvenir sellers, but was otherwise of little interest to the villagers. The tourist status gave me the right to walk around the village and to stay in a local lodge and the informal "duty" (or rather, expectation) to leave some money in local shops, but the status gave me limited access to talk to people about agricultural practice or village life. This was quite as expected and I knew that I had to act counter to the role expectations of a tourist in order to take on a different status. Since I did not want to have a hidden agenda but rather wished to be open about my objectives, I told that I did research and that I would stay in the village for several weeks when people asked me. However, it is not sufficient to just claim the status of a researcher and expect that people accept it. Instead, there was a process of negotiation between me and the villagers where I could choose how to act, but not control how people perceived me. Naturally, people initially treated me as a tourist. My first concern was to get out of the tourist status, but I knew I could never become local, a villager. In anthropology it is considered an illusion that a fieldworker can "go native" (Aase and Fossåskaret 2007). Rather, my hope was to negotiate a partly local status in which I could integrate the researcher status, as suggested by Aase and Fossåskaret (2007). Luckily, such a partly local status was already available in the local status inventory.

Second status: Teacher

On my way to the village, I met a German lady who was going to Jharkot to teach in the local monastery school (the *gompa*). She had long experience as a teacher in Nepal, she spoke Nepali and had contacts in Jharkot. Since they were short in teachers in the *gompa*, she asked

me during the first week if I wanted to help her teach English. We made an agreement and in this way I became a volunteer teacher, holding classes for two hours every afternoon. I soon discovered that 'teacher' became my new status in the village. I presented myself by saying that I was doing "research and teaching", but the responses I got led me to believe that only the latter part was actually considered. When people met me on the path they repeatedly asked: *"Where are you going? To the gompa?"*, or sometimes simply: "*Gompa?*" and they expressed their satisfaction when I confirmed. A special event confirmed my impression. One night the common village phone rang, and a woman asked for *"my friend in the gompa, the teacher"*. They sent for me, trying to explain to me in poor English that I had received a phone call, until I managed to explain that it was probably the German lady the caller tried to reach. Then only did they go for her. After that incident I was assured that people in the village – at least those who knew me – ascribed me the status as a teacher. The researcher status seemed to be neglected. I interpret the reason to be that this status is normally not a part of the local status inventory and neither is the complementary status, informant. Hence, the role expectations of the researcher – informant status set was not clearly established and people did not know what kind of behaviour they were to expect of me when I presented my self as a researcher. The role expectations of a teacher, however, were known to them since teachers have a function in the village and are thus part of the local status inventory.

It surprised me, though, that people ascribed to me the status as a teacher so rapidly. Then I heard that a western young woman had stayed in the village some time before my arrival, as a volunteer teacher in the gompa. My assumption was that she had negotiated and found a place in the local status inventory as a volunteer teacher, and when I arrived, they ascribed me the same status. Since I could not escape my western background and I did not speak the local language, the volunteer teacher-status was probably only partly local. As a teacher I found the role expectations to involve the duty to teach the children every afternoon, and the right to have tea in the *gompa* kitchen, play with the children and otherwise walk around in the village. People were friendly and greeted me, but little conversation occurred. The teacher status did not give me access to ask all sorts of questions about agricultural practices, experiences and challenges, let alone conduct longer semi-structured interviews. Such activities are not part of the role expectations to a teacher. In order to get access to the type of empirical material which was necessary in order to answer my research questions, I needed to take on the status as a researcher and I needed the assistance of an interpreter.

Third status: Researcher

Adults in Jharkot generally speak little or no English, but the children and youths who have learnt English at school are often more skilled. I got in contact with a local 18 year old girl who was on vacation from her boarding school in Kathmandu and who spoke fairly good English. When we had got to know each other and I had spent considerable time at the doorstep of her family's small shop, we made an agreement with permission from her parents that she would work for me for payment. To my disappointment, however, it proved difficult to get access to people for interviews. When we walked together, I with a notebook and a pen, and she asked someone if we could interview them about agriculture, they often turned us down. Only occationally we were permitted access, but when it happened, the interviews were both informative and useful. The problem was to get access. It was disappointing to experience that people who had greeted me kindly the previous day, suddenly showed great reluctance when we asked to interview them. After some days my interpreter even avoided to ask people for interviews, saying *"they are busy, they have work"* even before we had approached them. When we sat on her doorstep, however, daily conversations with neighbour villagers occurred, and I had many informative field conversations in that setting. I suspected that the general reluctancy of the villagers had something to do with me taking on a researcher status, and when I later talked to an experienced Nepali interpreter, his view was that: *"People don't want to be interviewed. They think that these westerners are just like tourists, that they take pictures and leave and maybe sell the pictures and get money. So they don't want to be interviewed, it is much easier if you just start to talk, then they tell"*. This statement described my experience precisely. I decided to rely more on the relations I had established during my stay, as a customer in a local shop, a lodge guest and a friend. I choose to summarise all of these statuses in the term 'friend'.

Fourth status: Friend

The friendly relationships I managed to establish with people during my fieldwork turned out to be crucial for my access to empirical material. Hence, I included the researcher status into other statuses and relied on already established relationships. The fact that I had been open about my research objectives from the outset was a benefit in this situation. Some of my new friends offered to help me and set me in contact with fellow villagers. These friends became key informants and door openers to me. My access was also enchanced after I was invited to and participated in local festivals, celebrations and *pujas* (combined social events and religious services), and when I occationally participated in daily tasks such as weeding,

feeding animals, irrigating and milling grains. Participant observation is primarily a way to get *access* to data behind the public façade, to enable the researcher to produce data by means of other methods such as observation, interviews and surveys (Aase and Fossåskaret 2007). By relying on alternative statuses to 'researcher' I was permitted access and when contact and trust were established, I was enabled to apply other research methods.

Picture 3: *Puja*, walking around the village fields carrying holy books

To what extent did I manage to get backstage? On the one hand, only the people of Jharkot can anwer this question, but on the other, some specific events indicate that I was permitted backstage at least to certain arenas of village life. At one occation I was invited by a friend to come to a village meeting. On the agenda was the appointment of new village leaders (*gembas* and *rolos*). Without an invitation I would have no chance of observing this important social event, let alone understand it without my friend's explanations. At several occations I was invited to participate in *pujas* and one of these events became a breakthrough regarding contacts and trust building. One of the main activities of this *puja* was to walk in a procession around the village fields, carrying holy books on our backs. I was shown how to carry a book and taught to stop for all the people we passed, letting them touch the book with their heads. At the end of the day, after a long walk and many fulfilled rituals, I was taken into the women's room and dressed in their traditional Tibetan dress. Although verbal communication with most of the women was limited, they insisted that I joined them in the evening. Probably, my participation in this *puja* was the furthest I came in being included and I did so performing the role as a friend of one of the villagers. The *puja* was a valuable source of information in terms of observations and field conversations. By observing my own participation in the *puja*, doing my best to behave properly and according to the rituals, I increased my understanding of *pujas* as social, religious and recreational events. Through participation I became my own informant and could rely on my own experience. In this way participant observation served not only as a way to get access, but also as a means to insight in village life.

3.2.3 Field conversations and interviews

Having achieved access and permission to interview, I conducted several semi-structured interviews, most of them assisted by an interpreter. However, when the informant was able and willing to talk English, I chose to do so in order to retain greater control over how the questions were formulated. The questions, answers and relevant context of each interview were recorded through extensive note taking and supplemented with additional personal reflexions after each interview. Informed consent was requested by explaining the topic and objective for the interview, that I would anonymise all names and that the informant had the right to choose not to answer and to terminate the interview at any point. Through follow-up questions and by asking questions from many different angles I attempted to understand the meaning and content of local concepts and categories and after a while I was able to understand and use central words in the local vocabulary.

Due to the widespread reluctancy towards researchers, field conversations proved to be very useful. Field conversations are similar to everyday conversations and thus informal interviews, during which the researcher may get new information she is not qualified to ask for from the outset (Aase and Fossåskaret 2007). I found my informants to be much more comfortable during field conversations than in the more formal setting of interviews. Although I often performed other roles than 'researcher', in many situations I found it appropriate to descreetly make notes. Field conversations in combination with observations introduced me to new perspectives on farming and village life. When informed consent was not possible to obtain (e.g., when I was merely one of a group where conversations occurred), I considered my ethical responsibility to judge whether or not the shared information was too confidential to be recorded, and in certain instances the conclusion was positive.

3.2.4 Supplemental methods

Some observations of relevance to my research questions concerned the extent of phenomena and therefore demanded some use of quantitative oriented methods. During my fieldwork I conducted a small household survey (n=38) in order to quantify the extent of migration, with the following objectives: Firstly, the extent of winter migration, or more precisely, how many members of each household who spent the winter in the village. Secondly, I assessed the

extent of migration for educational purposes among children and young adults, defined as household members aged 6 to 25. To obtain this I asked the respondent where each of the household members was residing and his/her occupation during a) most of the year, b) in summer, and c) in winter. The choice to distinguish three seasonal categories was based on my preliminary impression of seasonal migration patterns and I hold that this choice increased the reliability of the data, reducing the risk of inconsistent categorisation of responses. The survey results are presented in paragraphs 2.3.1 and 5.2.

A stratified sample of the households in the Muktinath VDC was selected for the survey. The respondents were representatives from households with diverse characteristics in terms of household size and composition, ethnic groups and economic situation (income and land holdings), and all respondents were over the age of 18. The sample selection was partly dependent on my access to respondents, which did not permit me to strictly fulfil the criterias for representativity in terms of numbers and randomness of the sample. Therefore, I will not make claims about the generalisability from the sample to the total population of Muktinath VDC. Still, several key informants said that they had a clear impression of a general trend which complies with the survey results. Figures from the national census documents also report of the same trend for Mustang in general.

A selection of additional methods and techniques was also applied during fieldwork. These included the sketching of an agricultural calendar, time allocation schemes (mapping the allocation of time and labour to various activities in a household) and photo eliciting (asking key informants to identify and explain features on my photos). In addition it was useful to make simple drawings together with my informants to enhance my understanding of the meaning of local concepts. For instance, when attempting to understand the hierarchic structure of the village leaders and committee leaders, I drew a stairway and asked my informant to place the various positions accordingly. To determine which positions were open to women, I drew a man and a woman and we used the drawings in our conversation. I was constantly aware of the risk of mistranslations and by using photos and drawings I attempted to reduce that risk.

3.3 Methodological challenges and choices

3.3.1 What is 'work'? Interpretor challenges

To interview informants about their daily activities (in my case, farming) is to practice double hermeneutics, meaning that the researcher interprets the informant's interpretation of reality. Using a translator involves the risk of triple hermeneutics, however, if the translator is more interested in demonstrating his or her own views than those of the informant (Aase and Fossåskaret 2007). Being aware of this risk I explained it to my interpreter and my impression was that she translated as literal as possible, adding little herself. The challenge was rather that despite our agreement, she often said she could not come with me, but had to work. 'Work' then meant to watch the family shop in case a tourist came by (two customers would make a good day). Even though we had agreed on a daily wage in return for her assistance, her mother often told her to stay home instead. After a while I understood that to her mother, what I was doing was merely to talk to people, an activity she probably categorised as leisure. 'Work' for her meant to do something tangible like farming or housework – or the very least keep the shop open. In this situation my interpreter probably experienced a role dilemma between her mother's expectations and mine, and to solve the dilemma I decided to also rely on other people in the village who spoke English and could translate for me. Altogether it was probably beneficial that all my data were not 'filtred' by one single interpreter. For me, this strategy also resulted in new acquaintances and valuable new information.

3.3.2 "Sometimes little, sometimes much. It depends."

Responses of this kind were frequently given when I asked informants for quantitative assessments of annual yields, work load, water availability, food production etc. I take this to indicate two things: Firstly, variations are the norm in local agriculture, so my informants saw little point in giving accurate figures. Any fixed measurement of average figures could then give a false sense of accuracy and stability. Secondly, my informants did not consider it important or meaningful to quantify every aspects of agricultural production, not even the area of cultivated land. My data thus involves few numbers, though in some instances secondary data and statistics at district level are included to give the reader a general idea. Since my research objective is to reflect on the flexibility of the farming system, focus is kept on the qualitative aspect of agriculture to understand local practices and relations between

agricultural factors of production, not primarily to assess their extent. This qualitative focus is reflected in the subsequent farming system analysis (chapters 4 and 5).

3.3.3 Ethical concerns

After conducting fieldwork the researcher is indebted to her informants for their time and information. The wish to give something back is always present, but there is no simple answer to how this is best achieved. Methodologically, it would for instance be highly questionable to offer payment for interviews as this would involve a significantly increased risk that people would only tell what they thought the researcher wanted to hear. My attempt to make a slight contribution to the community – besides being a paying lodge guest – was primarily expressed by giving English lessons. During my participation in the above mentioned *puja* I also asked for permission to take portrait photos of some of the women while they were festively dressed. By means of a small photo printer I was able to give people their printed portraits, an act which caused great excitement and requests for more photos. Still, these slight attempts at repayment are minimal when compared to the valuable empirical material, the kindness and hospitality I got from people in Jharkot. Therefore, it is not only for methodological reasons that I consider it my duty to interpret and represent the empirical material as truthfully as possible and to uphold ethical standards of trust and confidentiality in my treatment of the data. Certain sensitive and personal information has been left out in consideration for the informant. This is an important point because even if my research objectives were known, field conversations do normally not open for a formal request of informed consent to use the information for research purposes. To do so would be to break with the role expectations. Methods such as observations and field conversations largely depend on the ethical judgement and sense of discretion of the researcher (Aase and Fossåskaret 2007). The context in which the information was shared was also considered critically. To further ensure confidentiality all informants are anonymised and given common Nepali names as pseudonyms in this thesis.

3.4 From observations to data

Events and expressions may be empirically observed, but they must be interpreted in order to become data. In this process of interpretation we locate our observations in cognitive categories (Aase and Fossåskaret 2007). Although the ability to categorise observations is

universal, the content of meaning and the relative emphasis put on the various categories are not universal. This is because categories have a cultural component, meaning that the same observation may be categorised differently depending on the experience and cultural background of the interpreter. When conducting fieldwork the researcher should attempt to understand the categories and concepts (i.e., category labels) used by the informants when she interprets her observations (Wadel 1991, in Aase and Fossåskaret 2007). Interpretation of empirical material in terms of informants' concepts is often referred to as the *emic* level of analysis. Subsequently, when data is produced and transcribed, the researcher must analyse and discuss her data with reference to theories and scientific concepts in order to communicate her findings to the scientific community. This is a process at the *etic* level of analysis and is the concern of paragraph 3.5. To distinguish between emic and etic level of analysis is important for the ensurance of reliability and validity of the research, to which I now turn.

3.4.1 Reliability

The concept of reliability originates from quantitative methodology, but has been transferred to qualitative research. According to Kirk and Miller (1986: 19), reliabilty refers to the accuracy of a measurement procedure when applied to a certain phenomenon, to what extent it yields the same answer however and whenever it is carried out. The objective is to avoid that accidential circumstances of the method influence the result, thereby ensuring systematic and consistent measurement procedures. In qualitative research, "measurement procedures" often involve categorisation of events and objects. Hammersley (1992: 67, in Silverman 2001) suggests that reliability demands consistency in how instances are assigned to the same category by different observers or by the same observer on different occations. However, some social scientists object to this, arguing that people do not always agree on how an event should be interpreted and categorised (Kirk and Miller 1986, Aase and Fossåskaret 2007). In a fieldwork situation, informants may disagree both among them and with the researcher on how to categorise an event: A rainy thunderstorm could be a bad omen to one person, longed-for rain to another and simply bad weather to a third person. Aase and Fossåskaret (2007) argue that it is not the task of the researcher to decide who is right, but rather to document and attempt to understand diverging categorisation of objects and events. However, there must be consensus on whether or not the event (such as the thunderstorm) actually occurred.

Reliability may then be ensured by describing observations as concretely as possible (Seale 1999, in Silverman 2001). This involves to be honest to observations and to seek to distinguish between the observation and interpretation(s) of it (Aase and Fossåskaret 2007). When writing my field notes I was careful to distinguish observed events and objects from direct quotes and field conversation, and again to distinguish these from my own reflexions on what I saw and heard. Still, I do recognize that despite every attempt to describe an event as concretely as possible, every observer is inevitably positioned (Kirk and Miller 1986, Massey 1995). At some point observations must be interpreted to become data and whether my interpretations comport with the understanding of objects and events of my informants is a question of concept validity.

3.4.2 Validity

Generally speaking, validity concerns the relevance of the data for the research questions (Grønmo 2004). There are several types of validity and many of them concern quantitative methods, but of particular importance to qualitative studies such as this is 'concept validity'. At the emic level of analysis concept validity is the extent to which the researcher represents the empirical material in a way that the informants can subscribe to. This involves to interpret objects and events in terms of local categories and concepts and to have a proper understanding of these. For instance, I learnt that people in Jharkot call themselves 'Tibetan', not 'Nepali' although they are residents of Nepal. At the same time, the distinction between 'Nepalis' and 'Indians' exists, but is of less importance since India is not considered 'abroad'. In my western mindset national borders are prominent, but the reason I got was that residents of Nepal have no visa obligations to India. When I asked whether an informant had ever been 'abroad', he would often say no – but when I next asked if he had ever been to India, the answer was positive. Further, to be 'brothers' does not always mean to have the same parents, but is also used as a symbolic concept. This is but two examples of how local concepts must be properly understood to ensure concept validity, meaning that I have a proper understanding of what my informants actually refer to when they use a certain concept. Other examples will be presented and explained throughout the analytical chapters of this thesis.

3.5 Analysing data: Scientific concepts and analytical frameworks

So far, this chapter has concerned fieldwork methods for data production. The next step is to analyse and discuss the data in the light of theories. Precisely defined, formal concepts must be applied to enable communication of findings to the scientific community (Aase and Fossåskaret 2007). In this process, attention must be paid to concept validity to ensure that the applied theoretical categories and concepts give an appropriate representation of the data. The theoretical concepts should not conflict with the emic level concepts. For instance, I refer to the animal *jhopa* in this thesis and translate it to 'yak – cow hybrid'. To simply call it a 'cow' would be to demonstrate poor concept validity. Furthermore, in farming system analyses the category 'livestock' is often applied, where all domesticated animals are localized and ascribed the same meaning. A Hindu would perhaps object to this categorization and argue that since cows according to Hinduism are holy creatures, they have a completely distinct meaning, involving the prohibition of eating or killing them. Thus, he would probably locate cows in a separate category from goats and sheep. These examples illustrate the importance of awareness of which theoretical categories we apply and how we label them when analysing data. Attention is paid to concept validity between emic and etic level of analysis throughout the farming system analysis. By explicitly referring to local concepts the reader is given the opportunity to re-examine concept validity.

The application of a farming system approach has implications for how data are analysed, but the reader will need a theoretical introduction to farming systems before the consequences for data analysis are evident. Therefore I will address some of the basic assumptions and implications of system analysis in paragraph 4.3. Then I will discuss how a system must be artificially limited for the purpose of analysis and clearify the relationship between focus and context in this thesis. Further, I will discuss the epistemological basis of system analysis and, lastly, justify the methodological choices I make when defining analytical categories, which in this case are the farming system variables. A theoretical introduction to farming systems is the subject for the next chapter.

CHAPTER 4: FARMING SYSTEMS IN THEORY AND PRACTICE

Agriculture is the backbone of a majority of rural communities in the global south, and so it has been for millennia. The human civilisation as such was conditioned by the deliberate favouring of the growth of selected plants in the Fertile Crescent in today's Middle East. Despite the last centuries' industrialization and agricultural modernization at a global scale, the age-old practice of small scale farming is still the most important occupation of a significant share of the population of the world. Scientists from a range of disciplines have been occupied with the study of agriculture, among them social scientists. As expected, the perspectives across the disciplines have diverged drastically both in terms of focus, methods and conclusions. Some have, though, attempted to study agro-pastoral systems as a whole of interrelated variables, and they have tried to do so in a multi-disciplinary way. One of these attempts is the contribution of Turner and Brush (1987), *Comparative Farming Systems*. This chapter will discuss the farming system approach and its theoretical roots in peasant economy and human ecology. Several analytical concepts will be introduced and the case of Jharkot will be applied to concreticise the general theoretical framework. Lastly, the chapter includes a discussion of some basic assumptions in system analysis, leading up to the subsequent indepth analysis if the farming system of Jharkot.

4.1 Farming system approach

A farming system is defined as "any level of unit(s) engaged in agricultural production as it is wedded in a social, political, economic, and environmental context" (Turner and Brush 1987: 13). A farming system approach is then a way of describing and possibly – by the use of theories – explaining agricultural production in terms of units, their interrelations, and the contextual circumstances. It is an interdisciplinary approach which includes various perspectives crosscutting academic divisions. In addition, cooperation between researchers, farmers, and other agents is encouraged. With reference to the preceding tradition of human ecology, it is a holistic system approach trying to capture the complex reality of agriculture in an integrated, non-reductionist way (ibid.).

In terms of scale, Turner and Brush (1987) state that the main unit of analysis is one of micro-level: A farm or household, a village or a small area. The main focus in this thesis is the farming system at village level since the organization of agricultural activities is not only a family matter in Jharkot. There is instead a strong tradition for community work and cooperation at the village level, for instance in irrigation rights and herding responsibilities which are distributed on a daily rotational basis. Even though households are important organizational units in the village life and the basic economic unit in terms of land and agricultural production, the households' participation and membership in the village community is decisive for their entitlements to common property resources such as water, pastures and forest resources. Since these resources are of vital importance in a farming system, I find the village level of superior relevance to a household level in my analysis of the farming system. Analysis at household level is included only to nuance the general picture.

In the farming system approach attention is primarily paid to the internal dynamics of micro-level agricultural units. For the cultivator the units represent factors of production. However, these are not detached from the wider context of social and economic change. External influence on the farming system such as market relations and fluctuations, changes in the natural environment, national politics and the like are contextual factors influencing the farming system in various ways (Turner and Brush 1987). Even though there might be feedbacks of influence also from the farming system to other places and institutions, these will not be given analytical attention in the following analysis. The analytical focus is rather kept at the local ecological factors of production which are relevant for the agro-pastoral production system, such as the fields and crops, livestock and pastures, forest, water and labour. These factors of production are considered as endogenous and interdependent variables in the farming system analysis, together with human practices and social organisation concerning resource exploitation and management.

There are multiple ways of approaching farming systems. The concept has frequently been applied by both researchers and development agents throughout the 20th century, at times with rather diverging focus and methods (Colin and Crawford 2000). However, the work of Turner and Brush (1987) has over the years become a widely cited classic in academic circles concerned with farming system research. Their contribution is threefold. Firstly, they provide case studies from a representative range of the farming systems of the world, conducted by various researchers. Naturally, the great differences between for instance large scale European

farms and, to take another extreme, swidden in the Amazon will lead to rather diverging studies. Nevertheless, Turner and Brush advocate the usefulness of standardised criteria of classification to range farming systems at a global scale. The farming system of Jharkot will later on be classified accordingly. Secondly, Turner and Brush develop a comparative framework for analysis of different types of agricultural systems. Lastly, they address factors of agricultural change. Although the farming system approach represents a temporal snapshot of the current practice in a system and hence is prone to criticism for giving a static representation, the aspect of dynamism is captured in this third attempt. Analysis of current farming practice is therefore useful as a point of departure for further investigation of agricultural change. In this thesis, assessment of the flexibility of a farming system is one of the analytical aims and flexibility is precisely the potentialities for agricultural change. Hence, it will serve as the dynamic aspect of the study in place of the classical theories of agricultural change referred to by Turner and Brush (1987).

When it comes to the elaboration of a comparative framework as mentioned above, "[m]ost classifications and typologies appear to focus on the differences among agricultural systems, often with such precision as to hinder usefulness for comparative assessments and tests" (Turner and Brush 1987: 6). If the aim is to lay ground for comparisons, criteria of classifications are better presented in a continuous way, as ranges with two extremes. According to the writers, three such continuous scales may be identified as universal. Firstly, output intensity, secondly, technology type and mix, and thirdly, production type and mix. The claim of Turner and Brush is that all farming systems include these three components and that change in a farming system will also lead to a change in its relative position at these scales. In this way the scales may serve as a universal system of classification. Even though it is not the intention of this thesis to provide a comparative study, I will second the claim of Turner and Brush that it is still important to facilitate comparative studies at a later stage by classifying each case study. In the following I will therefore attempt to place the farming system of Jharkot in the system of classification provided by Turner and Brush (1987).

4.1.1 A classification of farming systems

The first scale concerns the *output intensity* of the system which is assessed by measures of yield per unit area and time. This quantified measure is only one out of several possible indicators of output, and the importance is not so much the accurate figure but rather the

relative position of one farming system to other farming systems (Turner and Brush 1987). The farming system of Jharkot is a low-intensity system primarily due to short growing season, location at high altitude and labour as the main input. It is a cumbersome task to give accurate figures of output per unit area and time in this case. Climate variability and risk of crop failure cause great variations in yields from year to year. In addition, for the local peasants the size of their fields in square metres is of lesser interest than the quality and irrigation situation for each field. When asked, my informants reported only the number of fields – *kheti* or *shing* in vernacular – not the size of them. I therefore hold that a better indicator for output intensity is the yields per unit seed grain a normal year, although my informants strongly emphasized a significant variability from year to year.

> *"We get 4 times the seed here, it's not much. The same for uwa[5], gahun[6]. Because of the height, altitude. In Kagbeni you can get ten times, but here we get four, maybe five… and sometimes we don't even get our seeds back, you know."* (Purna, male 46)

From the quote above we see that yields of four to five times the seed weight is considered normal yields in Jharkot. That is, for one *pathi* (about 4 kg) seed grain, four to five *pathi* is a normal harvest. A harvest of seven times the seed grain is considered to be a very good yield, while *"bad is to plant ten pathi and harvest eight pathi."* (Ram, male 46). The farming system of Kagbeni is located 750 metres lower than Jharkot and has higher yields, indicating the impact of altitude on yield potentials. Output intensity is not solely dependent on natural conditions though, the organisation of the farming system is also a factor of influence.

Labour and water availability are more constrained than land availability in this farming system. Therefore, there is little reason to maximize production per unit area, but rather to optimise the returns to labour and water. Since terraces and irrigation channels must be constructed and maintained for the soil to be productive, cultivation is kept at a limited area despite the relatively rich availability of land. Still, it may be noted that certain households experience lack of agricultural land due to small land holdings. The facts that no outsiders are permitted to buy land in Jharkot, combined with declining population over the past 20 years, have contributed to an extensive abandonment of agricultural land. It is reasonable to assume that the output intensity of the farming system has actually increased per unit area, but that total output has decreased over the last couple of decades.

[5] Barley (Nepali: Oats)
[6] Wheat

The second criterion, *technology type and mix,* implies a continuum from paleotechnic to neotechnic. While paleotechnic systems mostly use human labour as input in agricultural production, systems at the neotechnic end of the scale use a range of input derived from petroleum, irrigation, pest control, mechanisation and genetic material (Turner and Brush 1987: 8). In the farming system of Jharkot little external input is used in agricultural production and the level of mechanization is generally low. Practically no pesticides[7] or artificial fertilizer is used, only local manure is fertilizing the fields. Historically, the high transport costs on goods from the lowlands made human labour the main input in agricultural production. This is still the case although transport costs were significantly reduced with the completion of the road in October 2008. The crops are harvested by hand and sickle, but human labour is supplemented by draught animals for ploughing. The presence of irrigation channels and pipes distinguishes this farming system from purely paleotechnic ones, although the irrigation system is based on gravity and not on electric pumps. From these characteristics, Jharkot is defined as a semi-paleotechnic farming system.

The third criterion, *production type and mix,* describes the degree of market integration from pure subsistence production to the other extreme of commodity production exclusively for the market (Turner and Brush 1987). In the farming system of Jharkot, most of the agricultural production is consumed locally. Some fruits and vegetables are sold at the local market and to lodges, while small amounts of dried apples and apple brandy are exported to the cities. However, the monetary income from such products is quite negligible. Interestingly, there is currently a shift towards increased production of apples and niche products for the markets, an issue to which I will return later. For now it suffice to say that agricultural production is mainly subsistence oriented, and hence the degree of market integration is generally low. Nevertheless, the consumption pattern in the farming community is more complex. In addition to the consumption of local produce, large quantities of rice and other food items are imported to the village. Lodge and shop owners also import manufactured products for sale to villagers and tourists. This is not a new feature since people in the area for centuries have depended on external income for food import.

[7] There is one exception to the general trend; one farmer and lodge owner have bought a small motorized threshing machine, and he have also once used pesticides for some of his apple trees. He did then not use pesticides for his wheat and barley fields, however.

4.1.2 Subsystems

The analytical approach of farming system research is to initially regard the whole system as one entity, and then to analytically split it up into parts and types of relation in order to study each separately (Turner and Brush 1987: 12). There are several possible ways of splitting the complex whole into subsystems, but the categorisation applied by Turner and Brush is threefold: Human, environmental and genetic subsystems. The *human* subsystem is mostly studied by social science and concentrates on resource control, labour intensity and availability, demography, innovations, relations between social and economic units, consumption variables, decision making, and on links between these features and the environmental subsystem. The *environmental* subsystem is the area of agronomic science. Here the focus is on natural conditions such as soil, water, pests and the like. Last, the *genetic* subsystem concerns types of cultivars and animals in addition to population dynamics affecting these, and is the focus of biologists. Even if the farming system framework opens up for multidisciplinary research cooperation, a single researcher will have to narrow down her focus of study, in this case to the human aspects of farming systems. The always present need for limiting the scope of a single study illustrates the practical difficulties of interdisciplinary and holistic approaches. One way of fulfilling the holistic ideal of farming system research is through collections of case studies with overarching discussions, such as the work by Turner and Brush. This thesis may serve as such a case study.

4.2 Theoretical precedents of farming system research

Like most analytical frameworks, the farming system approach did not emerge in a vacuum. Turner and Brush acknowledge the insight gained by several theoretical schools of thought on which they build their framework. A short review of some of the precedents of the farming system research is useful at this point, with particular focus on peasant economy and human ecology. In addition, certain theories of particular geographical relevance influence agricultural research on these regions. When it comes to Nepal since the 1970s, research on agricultural systems have been strongly influenced by the Theory of Himalayan Environmental Degradation (Ives 1987). This theory will therefore be addressed and discussed with reference to the case of Jharkot. Lastly, the theoretical contributions of new ecology will be presented.

4.2.1 Peasant economy

The emergence of farming system approaches were in many ways a reaction to the somewhat reductionist farm management approach of the 1960s (Norman 2002), which focused almost exclusively on economic decisions concerning agricultural production and little on ecological factors and environmental variability. This approach was led by the goal of technological transfer from the western First world to the so called 'backwards' Third world countries (Kerblay 1988). The closely related peasant studies of Shanin (1988 [1971]) and Wolf (1965) also focused on the production side of agricultural life, with frequent references to the early writings of Chayanov. His works marked the shift of attention from the capitalistic firm to the household as basic unit of production in agricultural societies (Kerblay 1988, Turner and Brush 1987). However, opinions on the main determinants for agricultural production varied among different scholars. While Chayanov emphasized households' internal demographic dynamics (Kerblay 1988), neo-Marxists and dependency theorists claimed that external economic relations, domination and exploitation under global capitalism were the main factors in determining production (Turner and Brush 1987).

The increased academic concern with agriculture during the 1960s and 70s raised the need of a definition of the term 'peasant' as an analytical concept (Shanin 1988 [1971]). The term has been applied based on a range of different criteria, and the very attempt to define peasant as a general type has been criticised based on the argument of great diversity among peasants worldwide. Shanin, however, argues that "sociological generalization does not imply a claim of homogeneity or an attempt at uniformity" (Shanin 1988 [1971]: 2). Rather, he pays attention to the similarities instead of the obviously present differences among peasants across regions, countries and cultures, a position shared by Turner and Brush (1987). In order to clarify the relevance of the term peasants for the people of Jharkot, a brief discussion on definitions is appropriate at this point.

Chayanov distinguishes peasants from capitalists when he defines peasants as "partially monetized family farms that do not hire labour" (Chayanov 1966 [1920], in Chibnik 1984: 336). Wolf argue along the same lines when he makes the defining criterion of peasants that they control the land they cultivate (Redfield 1956). Shanin (1988 [1971]), however, takes a less dominant stand on the issue of peasants' control over the land. He points to the fact that many peasants are subordinated the power of outsiders, be it landowners or tax collectors. In

this sense peasants do not always own or control neither the land that they cultivate nor the yields that they produce. According to Shanin, peasants should rather be defined as "*small agricultural producers, who, with the help of simple equipment and the labour of their families, produce mostly for their own consumption, direct or indirect, and for the fulfilment of obligations to holders of political and economic power.*" (Shanin 1988 [1971]: 3, emphasis in original). This definition includes several factors, but a prominent characteristic is that peasants have the family as basic unit for both production and consumption, although they are also partly integrated into market relations.

For most of the peasants living in Jharkot, this description seems to fit quite well. However, Shanin's emphasis on an 'underdog' position of external dominance is not of very great relevance. The most common feature regarding land rights in this area is that families own and control the land that they cultivate, and moreover that the governmental land tax is negligible. In Jharkot, the tradition is still upheld by social consensus that villagers are not allowed to sell land to outsiders, precisely in order to keep the control of the land at local hands. Hence, the last part of the definition of Shanin is less characteristic for the people of Jharkot. However, if the definition is understood in terms of a prototype instead of a category (see Aase and Fossåskaret 2007), this is not necessarily problematic. The definition may then be considered as the prototype of a peasant, with whom the peasants of Jharkot share the most important features, but not all. The understanding of a general concept as a prototype captures the inherent diversity among peasants that Shanin emphasizes, better than a category with absolute criteria. Shanin himself is also close to suggest such an understanding of the term when he elaborates on a number of 'analytical marginal groups' which lie close to, but lack one of the characteristics stated in the general definition of peasants.

A last feature of the peasants of Jharkot should be discussed related to the definition of peasants. In Jharkot, most households have members involved in productive activities outside agriculture, either seasonally or permanent. This brings additional income to the household besides agricultural subsistence production. Still, I will argue that the family – or household, understood as those who own land together – is the basic unit of social organisation at the local level and of great importance for the choices on part of the individual household members. Therefore, even though some of the family members take on non-agricultural work from time to time, the family is still primarily a peasant family. With these considerations in

mind, the definition of Shanin is to be applied in the following. A prototype understanding of peasants precisely allows people to be more or less close to the 'core' meaning of the term.

Classical definitions may be applied without taking on the analytical approach in which the definition arose. Although the farming systems approach of Turner and Brush to a large extent includes peasants, the approach deviates from the analytical interest in peasant economy studies. While Chayanov, Shanin and Wolf were concerned with the households' economic production in terms of input of labour and output of yields, Turner and Brush were more concerned with the totality of the agricultural system, including its ecological factors. However, important contributions from peasant economy were acknowledged in the farming system approach, for instance the claim made by Chayanov that peasants may choose not to increase their production once their needs are met, if the drudgery of the additional work is considered higher than the utility of increased consumption (Chayanov 1925, in Kerblay 1988). Coming to a similar conclusion, the acknowledgement of peasants as satisfiers were central to the thesis of Boserup (Turner and Brush 1987). She clearly distinguishes the decision making of peasants from that of capitalistic profit maximizing firms.

To characterize the people of Jharkot as peasants will have consequences for the later analysis of farming flexibility. Since the definition which is cited above highlights partial market integration as characteristic for peasants, the concept opens up for an analysis of the flexibility to supplement subsistence production with production for the market, and also the flexibility to alternate between these strategies. An alternative typology distinguishing subsistence peasants from commercial farmers would complicate such an analysis of combined strategies as an important area of flexibility in this farming system.

4.2.2 Human ecology

Besides peasant economy, farming system research draws heavily upon the heritage from human ecology, which was quite influential particularly in anthropology and geography during the 20th century. The main preoccupation of human ecology was to study human adaptations to the environment, or in other words, the complex relationships between culture and nature. Quite often, cultural features were explained in terms of the function they served in various subsistence activities, although culture also helped define what was regarded as natural resources (Turner and Brush 1987). Holistic descriptions were often attempted, which

led to case studies of limited geographical scope, a limitation which often ended in ignoring external influence on the system. The classical works of among others Geertz (1966 [1963]) and Rappaport (1968) were typical studies of small isolated societies. However, with the emergence of political ecology the need was met to take into account the influence of external relations on the system, particularly in terms of economic and political processes at higher scales. With the recognition of global interconnectedness as initiated by among others Frank and Wallerstein this need proved even more important. This recognition left its mark also upon the farming system approach, which clearly stated the importance of external links and processes as context for the analysed case, for instance political and economic circumstances. Nevertheless, the most important heritage left by human ecology in farming systems research is the systemic description and analysis of subsistence systems in their context (Turner and Brush 1987).

Classical ecological thinking was for long guided by assumptions of stability, equilibrium and predictability in ecological systems (Neumann 2005). A central contribution to this line of thought was among others the concept of climax vegetation in stable equilibrium, as presented by Clements (1916, in Neumann 2005). Another one was the widely known study of Rappaport (1968), focusing on people's functional adaptation to a stable environment, resulting in system homeostasis – that is, regulating mechanisms in the system to restore the assumed 'balance of nature' (Dice 1955). While Rappaport viewed human culture as a functional part of the system homeostasis, those who rather subscribed to neo-Malthusian theories viewed nature as pristine wilderness which was in balance before the destructive humans entered the scene (Neumann 2005), inevitably overexploiting the natural resource base due to population growth. Such neo-Malthusian arguments of negative environmental effects from rapid population growth have for long been prominent in the political and scientific debate concerning mountain and hill farming systems of Nepal, e.g. the Theory of Himalayan Environmental Degradation.

4.2.3 The Theory of Himalayan Environmental Degradation

In the wake of an international conference on *Development on Mountain Environment* in Munich 1975, predictions were made of an emerging environment catastrophe (Aase in progress). In a particularly influential paper by Erik Eckholm (1975), the concern was expressed that a growing peasant population in Nepal would expand the area of cultivated

land at the expense of forested areas, exerting intolerable pressure on the natural resource base (Aase in progress). In what Jack D. Ives later called the 'Theory of Himalayan Environmental Degradation' (Ives 1987), the various predictions were merged into a coherent theory postulating deforestation and soil erosion in the hills of Nepal with consequences reaching far beyond the farming systems, even to include sedimentation in the Bay of Bengal. Though both the alleged causes and predictions have been extensively refuted and criticized for ignoring the great complexity and diversity of the Himalayan region (Thompson and Warburton 1985, Ives 1987, Guthman 1997, Ives 2006), the theory became a hegemonic narrative among mountain researchers and policy makers (Guthman 1997, in Aase in progress).

In several case studies Aase demonstrates the inaccuracy of generalizing the Theory's conclusions to be valid throughout the Himalayan region. In Gilgit, Northern Pakistan, the semi-arid conditions leave the cultivable valley floor barren while natural forest is found at higher altitudes only, where the rising air cools off and is condensed into mist and rain. Because trees are needed in the farming system, they are planted and irrigated close to the cultivated fields. Due to these local conditions, an increasing population produces more forest – not less as predicted by the Theory (Aase in progress). In Manang, Nepal, the situation differs. This district has experienced a process of massive exodus of people the last four decades, leading to abandonment of agricultural land (Aase et al. 2010). The prediction posed by the Theory of agricultural expansion at the expense of forested areas is thus not a feature of this farming system. The farming system of Jharkot is comparable to both of the referred cases. The natural forests to which the peasants are entitled are located in steep hills by the village Lupra the parallel Panda Valley to the south of Muktinath, three hours walk away from Jharkot, not in the immediate surroundings of the farming system. The only trees found near the fields are those privately planted and irrigated, just like in Gilgit.

During the last couple of decades, Jharkot has also experienced a similar process to that of Manang. A process of net outmigration the last decades has reduced the total number of people in the farming system, and the number of households in the village has decreased from 75 to 62 over the last 20 years. In Jharkot like in Manang, outmigration has been followed by abandonment of agricultural land, as outsiders are not allowed to buy land within the borders of Jharkot. Thus, contrary to the Theory, there is neither population growth with associated expansion of agricultural land, nor would such an expansion be done at the expense of

forested areas. The only way deforestation could then happen was if each household in average collected more wood from the natural forest of Lupra than in earlier times. It is reasonable to assume that this is neither the case in Jharkot. The farming system is located in the Annapurna Conservation Area where the project committee (ACAP) regulates the amount of wood each household is permitted to collect from Lupra each year (15 *bari,* approximately 525 kg). This is more restrictive than in the 1980s when the forest resources were regulated by the *panchayat* [8] (Pyers 1985). Even more, far from everyone choose to collect their permitted quota. Instead they manage with what they can get from their private trees and from alternative energy sources. Those who choose this strategy told me that it is hard and dangerous work to log trees in the steep hills of Lupra and more expensive to buy fuelwood from those who collect than to buy gas and kerosene.

It thus seems clear that the local conditions in Jharkot are completely different from those described in Theory of Himalayan Environmental Degradation. Still, the great influence of this hegemonic discourse is evident. In a recent vegetation study from the Muktinath Valley, Kriechbaum (2002) interprets the semi-arid bush dominated landscape as resulting from a process of massive deforestation, assuming that the area was once covered with trees. She refers to overgrazing and collecting of fuel as reasons for the alleged degradation of the natural environment. Although she does take into account declining population and livestock numbers she expresses her deep concerns: “Without corresponding measures, the last forest of the neighbourhood will disappear too” (Kriechbaum 2002: 84). Whether or not the mountain sides surrounding Jharkot in earlier times were covered with forest I cannot say, but according to a Dombremz and Jest (1970, in Fort 1987), the vegetation cover of the Muktinath Valley 40 years ago was *Caragana Artemisa* and *Caragana Lonicera,* the same low bushes which dominate the valley today. The same observation was also done by Pyers (1985). It is thus not very likely that Muktinath has experienced a process of deforestation the last 40 years as described by the Theory. Seventeen years later, the mountain sides of Lupra also resembled the state in 1970, when they were forested with pine, fir, birch and rhododendron (Pyers 1985, Fort 1987). For the reasons mentioned above I am therefore not as concerned as Kriechbaum seems to be when it comes to the future of the Lupra forest. In more general terms, the gloomy predictions of the Theory have certainly not become true (Aase in progress).

[8] The *panchayat* is a non-party system of local governance, based on representation.

4.2.4 From classical to new ecology

The Theory of Himalayan Environmental Degradation is partly based on the assumption of fixed resources in a stable ecological system, brought out of its equilibrium by destructive human practices. In a farming system case study from Nepal by Ashby and Pachico (1987), this perspective is clearly stated. In their view, the Mid-Hill farming system they study is not representing "a traditional equilibrium relationship between humans and the environment" (ibid.: 195). Rather, the writers present a situation of human generated deforestation and soil erosion, quite in line with the Theory of Himalayan Environmental Degradation and the equilibrium-school of ecology. Important to note, however, is that far from all classical ecologists share this view of humans as disturbing elements, even when system equilibrium is assumed. Quite a few counter the classical western dichotomy of humans versus nature, and support instead the view that humans are parts of nature and should be regarded as an endogenous species in the ecological system in which they live (Dice 1955, Geertz 1966). Nevertheless, the application of system analysis does not necessarily involve the need to assume mechanisms for self regulation to an extent where all changes in the system are seen as inherently destructive. This point exactly is stressed by the advocates of new ecology.

Since the middle of the 1980s there has been a fundamental shift in ecological thinking, towards 'new ecology' theories of non-equilibrium, flux, instability and uncertainty. Emphasis is now put on variability and spatial heterogeneity, claiming that many systems which were previously perceived as unstable may actually be highly resilient (Neumann 2005). This leads us not to automatically think of the Himalayas as fragile, but rather as dynamic mountains (Gurung 2004, Subedi 2007). Still, the shift from an assumed single equilibrium to a dynamic view of agricultural systems is not a completely original idea. Long before the formulation of new ecology ideas, Boserup (1965) suggested the very possibility that agricultural systems possess potentialities for change in the face of need, in her case by intensifying food production through the shortening of fallow periods, in order to meet the demands from a growing population. If these thoughts are rephrazed in the words of new ecology, one temporary adaptation may be left and a new one found for the time being. The dynamism is not a threat but rather a feature of the system, although within certain ecological thresholds of tolerance. This argument will be further elaborated in paragraph 7.2 on flexibility as adaptive capacity.

If we then leave the assumption of equilibrium aside and rather ascribe to new ecology perspectives of variability and change, a better way of addressing the present state of a farming system is to regard it as a *temporary adaption.* This term acknowledges historical dynamism in both external and internal conditions of a system, since a certain state of adaptation is seen as temporary instead of permanent, adjusted to a particular situation historically and geographically. At the same time, the aspect of short-term stability is considered since a certain state of adaptation may prevail for some time before it is challenged by changes in nature or society, inside or outside the farming system. In the face of such challenges – for instance climate change – the farming system must respond and a new temporary adaptation must be sought. To leave the assumption of equilibrium in favour of temporary adaptation permits investigations of the process of change, without normative judgements of the desirability of this change regardless of its consequences. To characterize the current state of the system as a temporary adaptation is in line with the dynamic view of new ecology. Here, historical change and variations are seen as natural features both within the system and in its context.

A dynamic view on both community and environment counters the neo-Malthusian idea that human activity by definition is environmentally destructive, disturbing the "natural equilibrium". There is a certain irony, however, that this thesis concerns precisely the impacts of partly anthropogenic climate change on a farming system. Therefore I wish to stress the point that human practices *may* of course have unintended consequences – such as global climate change resulting from excessive and long lasting greenhouse gas emissions – but that one should not take such negative effects of every human practice for granted at the outset. For instance, the interaction of the peasants of Jharkot with their natural environments, through irrigated agriculture and pastoralism, may be seen as an upgrading of the natural environment in terms of the number of species and the level of biological production, compared to uncultivated areas of the district dominated by thorny bushes.

To draw general conclusions on this point is of little use for two main reasons. Firstly, the multiple and complex human practices in interaction with the natural environment have obviously both positive and negative consequences on the surrounding ecological system. Secondly, what we define as upgrading and degrading mostly depend on our priorities and normative judgements and is thus a highly relative question. Nevertheless, the argument still holds that variability and change have always been features of ecological systems, and is not

introduced solely by human activities. However, wide elaboration on historical changes of the farming system of Jharkot is not a priority in this thesis. Similarly, although other changes than the climatic ones now expected naturally affect the farming system, these will not be extensively addressed. To sum up, the present state of the farming system of Jharkot is best regarded as a temporary adaptation, an adaptation to the social, political, economical and environmental circumstances at a particular point in a history of continuous change.

4.2.5 Two trends in farming system research

It is worth to return for a moment to the theoretical development of farming system research. Generally speaking, Norman (2002) holds that there has been two trends in the evolution of farming system research until today: One is to expand the scope of study and the other is to empower the farmers in all parts of the research and development process (Norman 2002).

Firstly, in terms of scope, the trend has been to include in the analytical focus a larger number of factors as endogenous variables and acknowledging the complexity of the agricultural system. Over time, farming system studies thus replaced the more narrowly focused peasant economic studies. Lately, off-farm activities such as non-agricultural work have increasingly been included in what has been called a sustainable livelihood approach (Norman 2002). Norman thus sees a progressive development in agricultural research, from peasant economy through a farming system approach and over to a livelihood approach. There is still one essential difference worth noticing. While both peasant economy and livelihood studies choose the household as the central unit of analysis, farming system research places in the centre the whole ecological system of fields, pastures, forest, livestock, water – and peasants. Even though those who choose to analyse mostly the human dimension of farming systems are close to a livelihood approach, the analytical point of departure is the farming system as such, not the activities of the household both on and off the farm. In this particular thesis, focus is on the flexibility of the farming system as such, not the totality of livelihood strategies in a household. Hence, a farming systems approach seems appropriate.

The second trend in farming system research concerns the greater efforts which are made to empower the farmers in all parts of the research and development process (Norman 2002). This is attempted through active participation of farmers, by including informal local knowledge and letting the farmers themselves define their problems, possibilities and

constraints. Hence, a bottom-up approach is chosen in contrast to the earlier trend of top-down expert-led research. This trend is especially prominent in circles of development agents, among whom participatory approaches focusing on local empowerment are well known and widely applied (Norman 2002). Just like the 70s and 80s' great preoccupations for an emerging environmental crisis could be seen as an orthodoxy in the development debate, local participation is now the new orthodoxy (Aase in progress). "'Local participation' has become the new mantra of development" (ibid.: 11). At this point I find it appropriate to remind of an important distinction between development agents and researchers. While development agents seek to intervene and change the farming system in question, the aim of researchers is rather to generate understanding of the system in order to build up a stock of knowledge (Colin and Crawford 2000). Nonetheless, arguments have been made in favour of greater appreciation of the knowledge of rural people in agricultural research (Scoones and Thompson 1994).

4.3 Basic assumptions in system analysis

> "First, systems must be artificially limited if analysis is to proceed, and second, described systems are, therefore, heuristic and artificial analytical devices rather than natural phenomena." (Turner and Brush 1987: 27).

In this thesis, the farming system approach structures the model for data analysis. A system approach is, as the quote above clearly states, an analytical device with artificial boundaries imposed by the researcher. Consequentially, the factors that are considered relevant for the internal dynamic of the system are treated as dependent and interrelated variables. Factors that are considered to be of less direct importance for this particular case are thus defined as external parameters or constants only. Thus, it depends on the conscious judgement of the researcher to define where the analytical boundaries of the study should be drawn according to the aim and scope of the study. In this thesis, focus is held on the farming system, its flexibility and potentialities for change under climatic uncertainty. Factors such as migration, tourism, transport, trade, education, wage labour and religion are therefore included only to the extent to which it is necessary to contextualize the case. This does of course not mean to neglect the importance of these factors as such, but rather to acknowledge the need for a specific focus in order to conduct an informative analysis. In other words, in accordance with my research question the farming system is the text while the above mentioned factors are the context.

4.3.1 Epistemological foundation

Just as a system model is not a representation of a naturally delimited entity, it is neither an objective reflection of a part of the world as it *really* is. To substantiate this claim I will at this point permit a brief epistemological discussion. Nowadays, social scientists are generally sceptical to the epistemological *theory of correspondence*. This theory postulates the presence of an objective reality independent of human knowledge and perception. Knowledge is seen as a reflection of the external reality and the criterion of truth is to what degree our knowledge corresponds to this reality (Aase and Fossåskaret 2007). The task of researchers is then to lift the veil separating us from reality, to get as close as possible to knowledge of the world as it really is and describe it in objective terms. However, this theory has been challenged by alternative views on knowledge. The *theory of coherence* disregards the belief in an external, objective reality. Rather, this theory claims that our human senses condition how we perceive the world – leaving it to be a world of phenomena, meaning objects and events as they appear to us. In this perspective knowledge is a human construction relying on meaningful assumptions and logical coherence (ibid.).

The views of Roy Bhaskar (1978, in Hansen and Simonsen 2004) and Andrew Sayer (2006) concerning critical realism deserve particular attention. Critical realism ontologically postulates the existence of an external world, but states that the most significant elements in this world are not directly observable (Bhaskar 1978, in Hansen and Simonsen 2004). Bhaskar presents three levels of reality: the real, the actual and the empirical. At the deepest, real level, causal structures and mechanisms exist. However, these are not predictable, but rather contingent relations. For instance, while a grain of barley possesses the causal powers to grow, whether it grows or not depends on the contingent conditions of other factors such as water, temperature and soil nutrients. If the grain does grow, this is an event at the actual level of reality. Still, human experience of actual events is conditioned by our senses, concepts and interpretations. Our knowledge is thus the third, empirical level of reality. We cannot observe the world objectively, as positivists adhering to the theory of correspondence claim, but neither is the world a product of our knowledge, as idealists argue. Critical realists instead see knowledge as interpretations of observed actual events and dependent on the concepts we apply to these events, but at the same time they stress the realistic argument that objects exist independent of our thoughts about them (Sayer 2006).

Bhaskar's distinction between the three levels of reality permits the combination of an external reality with contingent causal relations, the actual outcomes of these relations and the recognition that human knowledge of actual events is conditioned by human senses and perception. Our knowledge of causal relations must therefore be confined to theories (Hansen and Simonsen 2004). In system analysis, the relations between the variables are thus theoretical assumptions of contingent causal relations, while the resulting observable events occur at the actual level. By means of our senses we can observe and interpret one actual event (e.g. sowing of a grain) and another (the grain sprouts) as being correlated, but we can only theorise – with basis in previous experience – about the real level causality leading from the first event to the second.

The application of a farming system model implies the existence of a set of crucial variables which are interlinked in a way where changes in one variable leads to changes in the others. The model presents these variables in the form of a functional system producing agricultural outputs. The relationships between some of the variables may be independent of human intervention. For instance, it is assumed that crop yields are dependent on sufficient availability of water. The model then has roots in critical realism. By applying this kind of model we assume the existence of an external reality based on contingent causal relations, even if our knowledge of this reality can never be more than theoretical, based on our interpretations (and ignorance) of actual events.

To assume an interlinked nature of system variables has consequences for the later analysis of flexibility. As will later be demonstrated, the system's utility of one variable's capacity may be constrained not only by its threshold of tolerance, but also by the degree of exploitation of a related variable. For instance, the number of cultivated fields is contingent on the availability of labour. A situation of labour shortage then imposes a constraint to agricultural production, despite sufficient availability of cultivable land. This theoretical discussion will be more fully developed at a later stage, when it will also become evident that a model of the farming system in terms of interlinked variables is a prerequisite for a proper analysis of flexibility.

Returning to the original discussion, not everyone would agree on this way of representing reality. Postmodernists who in addition share a relativistic point of view would probably argue against a representation of human – environment relations in terms of one coherent

system, because it will depend on what features of reality are emphasized and whose views of reality are presented. One of the earliest writers on postmodernism, Lyotard, stated the decline of grand narratives under postmodern conditions, replaced by contesting views of reality (Lyotard 1984, in Hansen and Simonsen 2004). The postmodern argument of discoherence is hardly compatible with system analyses such as the farming system approach.

4.3.2 Simplifying a complex reality

Analytical approaches and their models are always simplifications, and much like a map they serve the purpose of enhancing understanding and overview. In the words of Swinton and Black (2000: 69), "[s]ystem models provide a simplified description of important system components and their interactions". The model highlights essential features of the system while downplaying others, since an overly detailed and complex model will probably impede more than enhance understanding. Basically, the model provides categories in which the researcher locates her observations. When the categories are conceptualized, the observation becomes meaningful (Aase and Fossåskaret 2007). Even though the distinction is made between emic and etic level of analysis, data production is inevitably influenced by the theoretical orientation of the researcher. Theories structure the way we think about the subject of study, what we find important and what is of less interest. In this thesis, which objective is to analyse flexibility in a farming system not only in quantitative terms but also in qualitative, the farming system variables are best defined in a way that permits them to take on different qualitative positions. For instance, a broadly defined variable for the cultivated fields may include cultivation of barley, buckwheat or vegetables. The alternative categorisation of one variable per cultigen – to treat barley, buckwheat and vegetables as separate variables – impedes the application of the theoretical concept of flexibility in qualitative terms, and permits only a quantitative assessment of a variable's capacity. In this way, the chosen categorization used in the analytical model structures the potentials for theoretical reflection.

Words are sometimes more flexible than models. Words permit nuances and reflexions beyond the assessment of a variable after one criterion between two extreme values. On the other hand and as discussed above, models may help to structure our thoughts concerning a topic. This is why I make the methodological choice to apply a rather general model of the farming system, where variables are defined in a broad manner. Although exposing the model for the critique of oversimplification of a complex system, I will attempt to enhance the

nuances through a verbal analysis and reflexion on the variables' capacities and opportunities for change rather than letting the model constrain which aspects are subject for discussion. In this way, the model becomes a general structural representation of the system instead of an argument in the theoretical discussion.

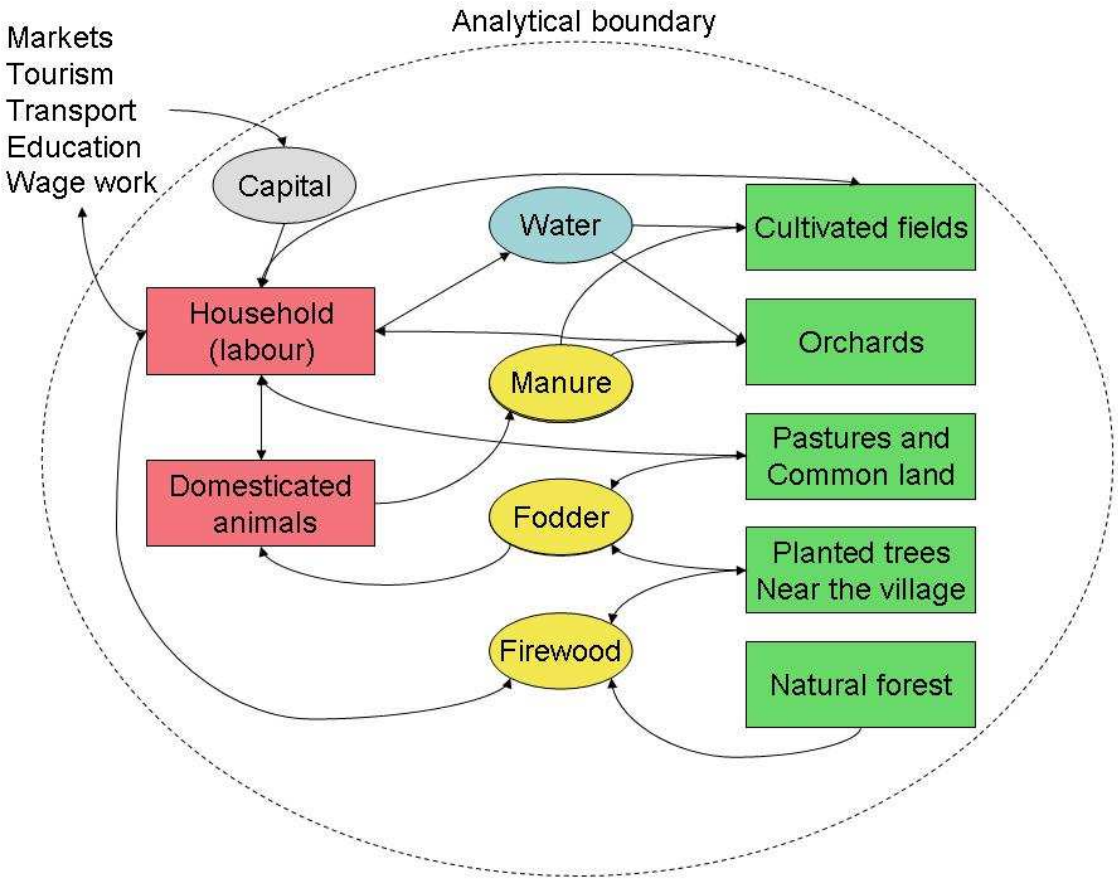


Figure 2: Model of the farming system of Jharkot

It might be worth to remind that the farming system approach by Turner and Brush (1987) serves as a tool for description and analysis of farming systems, not as an explanatory theory. The model (Figure 2) will hence structure the farming system analysis of Jharkot in the following chapter.

CHAPTER 5: THE FARMING SYSTEM OF JHARKOT

Now is the time to investigate the farming system of Jharkot more indepth. The farming system model which is presented above and the concepts provided by Turner and Brush (1987) will structure this chapter and lay the ground for the subsequent analysis of farming flexibility (chapter 6). This chapter is based on primary data from fieldwork except where other references are given.

Picture 4: Terraced fields of barley

5.1 Overview of the farming system

Terraced fields are spread out around the village of Jharkot, which is located at an altitude of approximately 3,550 m.a.s.l.. Water is led to the fields through a complex system of gravity based irrigation channels along the contours. In the terraced fields the main crops are barley, wheat, buckwheat, potatoes and vegetables. Apples and some other fruits are grown in orchards. There are sharp vegetation borders between cultivated and non-cultivated areas, the latter dominated by rocks and bare soil, though scattered with thorny brushes, juniper and some grass species. From November to February the fields are frozen and covered with snow which limits the agricultural production to one or at the most two annual crops.

A traditional farming system with little use of external input often relies on manure to avoid depletion of the soil in the cultivated fields. In Jharkot, agriculture is therefore accompanied with animal husbandry in an agro-pastoral farming system. Cattle, goats, sheep and horses are taken to the village pastures for grazing daily, but during the winter the animals are stall-fed. This raises the need for winter fodder such as crop residuals, dry leaves and some grains, which must be collected from cultivated and outlying fields and from privately planted trees. Suitable fertilizer consisting of animal dung mixed with organic matter accumulates in the staple during the winter and is later spread in the fields. Manure and winter fodder thus link

the agrarian and pastoral subsystems and demonstrate the interlinked nature of the farming system. Lean agricultural periods permit people to utilize additional resources in their surroundings. The farming system therefore includes collection of medicinal plants and berries from outlying fields. Since productive activities vary with the seasons, I shall now turn to an overview of the distribution of activities in the farming system throughout the year.

5.2 Agricultural calendar

The agricultural year starts with the planting of barley in late February and lasts until the last part of October when the snow falls. During the spring months, wheat, potato and vegetables are also planted and all the fields are irrigated. In April – May there is a small peak in tourism before the monsoon. Despite the limited amount of rain brought by the monsoon, the frequent drizzle makes the normally dusty paths quite muddy and hampers the roads and the flight connection from Pokhara to Jomsom. Most tourists therefore avoid the period from June to early September, leaving the great peak in tourism for October – November. In the lean period of May it is popular among young men (and some women) to ride up to outlying fields well above 4,000 m of altitude to search for *yarzagumba* (*Cordyceps sinensis)*, a distinct and quite peculiar half fungus – half larvae which is sold to China and Singapore for medical purposes. From early spring to late autumn, the livestock is brought up to the pastures for grazing every morning and returned at dusk. During the night the animals are stall-fed with weed from the fields. In May while the fields ripen, there is time to arrange a number of religious services, *pujas*, which serve the multiple purpose of religious blessings and prestige for the hosts alongside with opportunities for social contact and relaxation, and lastly the opportunity for the Buddhist monks and nuns to perform services and earn some money.

A quite popular festival also takes place in May where the principal activity is an archery tournament which travels from village to village. Another important festival is the horse race festival (*Yartung*) held in August. Before this celebration, however, the harvest must be secured. In the beginning of July the first barley is harvested after which vegetables and wheat harvests follow throughout July and into August. This is a peak season in agriculture and each household summons as much labour as possible. Children and youths who study in the cities return to the village during their vacation, and may give a hand in securing the harvest. Community collaboration and coordination of activities are also widespread. Right after the first barley has been harvested, these fields are ploughed anew and buckwheat is sown. The

combination of barley – which ripens faster than wheat – and the rapidly growing buckwheat is the only combination allowing two annual crops before the first frost sets in.

Apples, other fruits and berries and potatoes are plucked in August – September. The coincidence of the harvest peak and the monsoon rain has the positive side effect of delaying the big peak in tourism until the end of the harvest period, easing the labour pressure, particularly for women. At this point the farming system of Jharkot differs from those of Manang District, where the peaks in agriculture and tourism coincide (Chaudhary et al. 2007). However, the Indians going on pilgrimage to the Muktinath temple keep the transport business running all through the monsoon period, which occupies a number of young men driving jeeps and motorbikes. Indians rarely stay the night, though, after visiting the temple they generally prefer to return the same day to the district capital Jomsom. Thus, they leave little profit for the lodges of the valley but neither do they take up the time of the already busy women during the agricultural peak season.

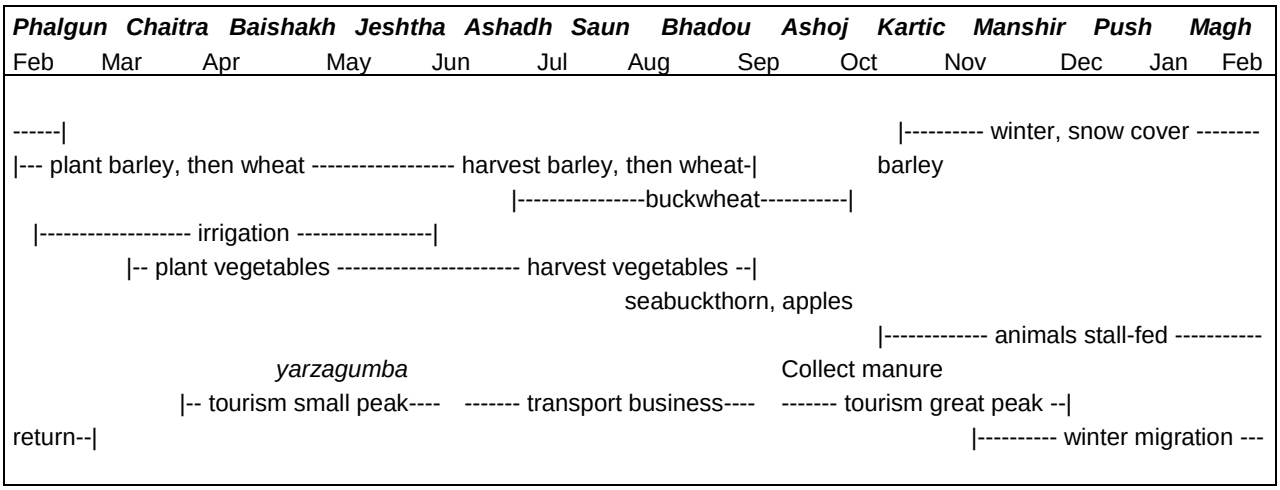


Figure 3: Agricultural calendar for Jharkot

Far from all households are engaged in tourism, though, and there is still agricultural work to do during the autumn. At a fixed date in October all the villagers go out to the communal pastures to collect manure which are later spread in the fields. This is also the time for fuelwood collection before the winter. By the end of October and hopefully in time before the emergence of frost and snow, buckwheat is harvested. Crop residuals and dry leaves are collected and used as bedding for the livestock. Some choose to sow barley in their fields already in October – November, hoping a permanent snow cover will protect the seeds against frost until the coming of the spring. In this way the barley ripens earlier and there is more

time for buckwheat cultivation with reduced risk of frost damage. From November to February there is a period of rest in the farming system and many people migrate south during the winter. According to a small survey I conducted among 38 households in Muktinath VDC (Figure 4), the majority of households in the sample (63%) reported that they keep only one or two persons in the village during the winter in order to care for the animals and watch the house. An additional 18% of the sample households close their house and keep no one in the village, while only the remaining 18% keep more than two persons in the village during the winter. Those who migrate often stay with relatives in Pokhara and Kathmandu, while a fair share of the youths go to India where they attempt to earn some money through small scale trade and business.

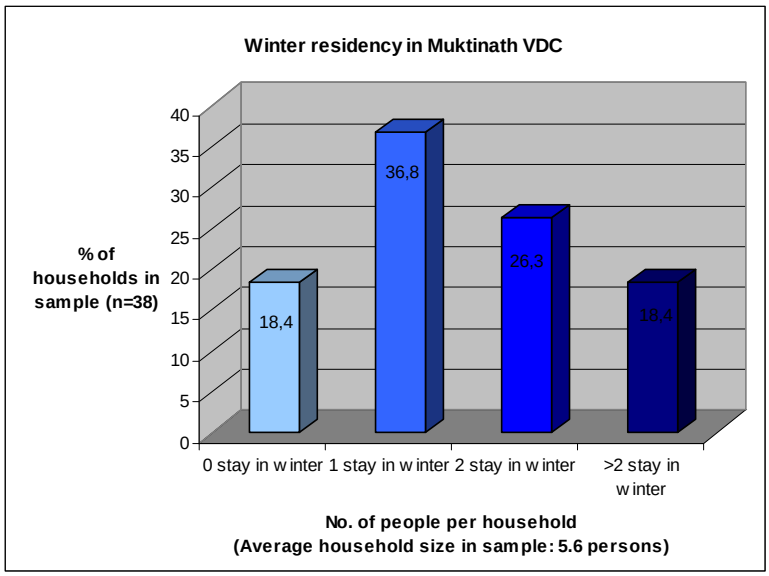


Figure 4: Winter residency in Muktinath VDC (own survey).

As this overview demonstrates, the seasonality of the farming system is pronounced. Both tourism and agricultural activities have lean and peak periods, with highly varying labour demands. Seasonal migration is the traditional adaptive response, especially during the winter in order to save the winter supplies of food and fuel and to escape the cold. In the following chapter I will demonstrate how this mobility gives the farming system flexibility to summon additional labour in peak periods while not having to supply them all with food throughout the winter when there is little productive work to find in the farming system. It should be noted, however, that motivations for migration are complex and that the needs of agricultural production are not necessarily the top priority when compared to alternative occupations (Aase and Chapagain 2005). Still, the farming system is the backbone of community life – to be a peasant is a way of life, so to speak. Now I will turn to the most important variables in the farming system, investigating them more in-depth.

5.2.1 Cultivated fields

Leaving aside the impact of microclimatic conditions, the altitude of Jharkot (3,550m) is not imposing an absolute limit to cultivation as such since there are farming systems in Manang where cultivation is proved possible at 4,200 m.a.s.l. (Chaudhary et al. 2007). The altitude does however contribute to reduced yields compared to lower lying farming systems. In the village Khinga, located 300 m lower than Jharkot, the crops ripen and the flowers blossom 2-3 weeks ahead (Führer-Haimendorf 1975, own fieldwork).

The main cultivated crops are barley (*Hordeum vulgare*), wheat (*Triticum aestivum*) and buckwheat (*Fagopyrum esculentum, F. tataricum*). Barley is sown either in late autumn or early in the spring. The barley sown before the first snowfall germinates when the snow melts in the spring and it ripens about 15 days earlier than barley sown after the snow. Early ripening allows more time for a second crop of buckwheat in the autumn. In general, barley is well adapted to a mountain environment and can grow under quite cold conditions (Chaudhary et al. 2007). There are two types of barley commonly cultivated in Jharkot. Hooded barley is mostly given as fodder to the horses and *jhopas*, while naked barely is primarily for human consumption (Picture 2, p. 22). Naked barley is roasted and milled, and used for making *tsampa,* a traditional Tibetan staple food made of barley flour mixed with milk tea or butter and black tea. Both naked and hooded barley are also used for *chang* and *rakshi*, which are the local beer and liquor respectively. The high level of rice consumption taken into account, peasants often report that they are self sufficient in barley. Any surplus is sold at the local market, where the price for one *pathi* (approx. 4 kg) is 90 – 120 NPR. None of my informants reported that they bought seeds. Barley is called *uwa* in vernacular language, although interestingly enough this is the word for oats in Nepali language. On the other hand, *"the oats we throw away. When it is grass, we give it to the horses. We don't want it, it's not good for the fields."* (Purna, male 46). Oats is considered weed in the local farming system and is not deliberately cultivated, which is also the case in Manang (Andersen and Chapagain 2007).

Wheat and barley are some of the oldest domesticated crops of the world as they have been cultivated for approximately 9,000 years (Chaudhary et al. 2007). In Jharkot wheat (*gahun* in vernacular) is a traditional crop which is important for making Tibetan bread (resembling chapatti) and dough for *momos* (dumplings). Wheat flour is also imported to the village.

While some of the tourist lodges use their own wheat for food sold to tourists, others import the finer milled wheat flour in order to make white bread. When it comes to cultivation,

> *"We choose between gahun and uwa in one field. Not both same year: uwa one year and gahun another."* (Tara, female 18)

> *"We rotate the crops, it won't grow after a while if you always grow the same."* (Purna, male 46)

As we see from these quotes, rotation of crops is practiced, in order to avoid depletion of the soil. The yields for wheat (*gahun*) and barley (*uwa*) are more or less the same, my informants claimed. The use of barley and wheat differs, however. *"We make chang and rakshi [beer, liquor] from uwa, a great share of the uwa goes to this. Gahun is only for eating"* (Tara, female 18). Wheat is cultivated for human consumption alone while barley is also cultivated as animal fodder and for making alcohol.

> *"Ten years ago I would already have had my first chang by now [10 a.m.]. The people used to make a lot of chang. They had chang in their tsampa, like now, for breakfast. Not tea. But now people are more health conscious, they know it's not good to drink that much. (…) They gave the horse-barley to the horses, and the naked one they used some for tsampa and a lot for chang. But less people drink chang these days. They drink less."* (Purna, male 46)

From the quote we understand that a large share of the barley is spent as horse feed and for making alcohol, although the alcohol consumption is somewhat reduced from earlier times. Through field conversations the attitude was repeatedly expressed that alcohol should be spared for social events and festivals. Still, *chang* brewing is widespread, so even today a significant share of the barley is dedicated to this instead of eaten. In Mustang it is estimated that almost half of the barley produced is spent either as animal feed or for making alcohol (NTNC 2008), in other words purposes other than eating.

The short growing season conditions the number of crops that the farming system can produce in a year. Variations in the time requirements of the different species allow for different combinations of crops: *"Gahun takes longer time, we harvest it after uwa. There's no time for phapar [buckwheat] after gahun, only after uwa."* (Purna, male 46). Buckwheat (*Fagopyrum*, *phapar* in vernacular) is planted as a second crop in the barley fields, but not in the wheat fields, due to time constraints before the first frost in the autumn. Although buckwheat is capable of growing under quite cool climatic conditions (Eggum et al. 1981), frost and low temperatures in the night severely affects crop yields. Buckwheat cannot withstand

temperatures below 5^{o}C for longer periods and if the temperature reaches 1 – 3^{o}C, all the plants will die after just two days (Rajbhandari 2004). It is thus crucial not to delay the planting of buckwheat after the barley is harvested.

There are two types of buckwheat cultivated in Jharkot. Sweet buckwheat *(F. esculentum, mitho phapar* in vernacular*)* needs 100 days to ripen, while bitter buckwheat *(F. tataricum, tito phapar)* ripens in only 60 – 70 days. Due to the short growing periods of both barley and buckwheat there are opportunities for a second crop from this combination. The succession of buckwheat after barley increases the utility of the fields without depleting the soil. Buckwheat requires only small amounts of micronutrients as it is able to extract residual nutrients from the soil. It does not respond to applications of additional manure, and is thus an efficient crop in terms of manure and labour. In addition, since buckwheat is not a grass species the rotation of buckwheat and barley prevents the transmission of diseases from one year's barley to the next, and the plant residuals comprise exellent animal fodder (Andersen and Chapagain 2007). Buckwheat is also rotated with wheat, though the short growing season does not allow both crops to be grown within one agricultural year. After the wheat harvest the fields are left fallow for almost a year before a crop of buckwheat is sown in late summer. The subsequent spring wheat can again ble planted (Kriechbaum 2002).

Vegetables are cultivated in separate plots, or in the orchards inbetween fruit trees. Potato, carrot, cauliflower, cabbage, onion, garlic and various local green leafy vegetables (*saag*) are grown throughout the spring and summer. Peas, mustard, fenugreek, radish and flax are cultivated in small amounts (Kriechbaum 2002), in separate plots or intercropped with staple crops. Several informants reported that the cultivation of vegetables is more widespread now than twenty years ago, and that even with increased consumption, during the growing season most households are now self sufficient with vegetables. In addition, many households sell some of their vegetables to the lodges during the tourist season, and some reported that they buy vegetables from the lowlands in periods with little local produce such as early in the spring. With the completion of the road, such purchases have become both cheaper and more accessible, and conversely easier access to the market for those who wish to sell some of their vegetables. Since the growing season for vegetables starts later in Jharkot than in Pokhara, some peasants see potentials for export of vegetables during the off-season in Pokhara, in order to obtain good prices for their products. This opportunity, which is not yet explored, is an example of flexibility in the farming system and will be discussed in the following chapter.

The last fifty years have involved increased diversity of cultivated species in the farming system of Jharkot. In 1964 a government led project further south in Mustang successfully introduced the cultivation of several new fruits and vegetables, and apple farming was particularly promoted (Vinding 1984). The practice of increased vegetable farming was later adopted also by the peasants of Jharkot, who earlier relied mostly on cultivation of grains and potatoes. Lakpa (female 55) could tell that "*before there were no vegetables here. We didn't grow saag, kauli [cauliflower], cabbage, onion in Jharkot before*". Purna (male 46) confirmed this by telling that "*before, twenty years ago, there were less vegetables here.(…) Mithi is old though, that we had before too.*" Mithi is a fragrant green leaf vegetable used in soups and sauces. The plant also prevents the spreading of certain plant diseases when it is cultivated in rows between other vegetables. The diversification into new types of vegetables has several advantages. It facilitates better utilization of labour in the lean period between planting and harvesting of the staple crops, it creates a wider range of products which can be sold to lodges or at the markets and it has probably also contributed positively to the vitamin status of the inhabitants, as it has in Manang, which has experienced a parallel process to that of Mustang in terms of increased vegetable cultivation (Andersen and Chapagain 2007). Still, in addition to labour, vegetable cultivation requires input of manure and water, which will be analysed subsequently. Finally, vegetable cultivation requires available fields.

> *"Many people keep their land like this [fallow] because they have many fields and less people."* (Tara, female 18)

The availability of cultivable fields is generally not a problem in the farming system. To the contrary, there are quite a lot of abandoned fields in Jharkot, fields which earlier were cultivated but are now left empty[9]. That a significant amount of land is abandoned was repeatedly confirmed through observations and interviews with peasants. As Binita (female 39) said,"*we don't grow enough for the whole year. We have enough land, but don't use it all. No time, no people. I want to start other work, but I have no time to do it*". During interviews many peasants said that they had abandoned some of their fields. The reason most frequently given was that the household experienced lack of labour, and thus had left part of their land unproductive. This feature comports with the slight population decrease the recent decades,

[9] In addition, some fields are deliberately kept fallow for a year to let the soil regenerate after several years of cultivation. These fields are planted with grass which is used for animal fodder. Abandoned fields are distinguishable, however, as these are overgrown with thorny bushes and other natural vegetation.

with increased involvement in local non-farm livelihood strategies such as tourism and transport and with increased migration for education and wage work. Some households choose to sharecrop away some of their fields to people with smaller land holdings, who then pay the land owner 50% of the yields as rent. When it comes to land ownership, though, Tara (female 18) stated that *"they cannot sell land to outsiders, it belongs to the villagers."* Several informants confirmed that the cultivable land of Jharkot cannot be sold to non-local residents, according to a decision made by common consent in the village council. The rule prevents immigrants from buying the village land; if they wish to cultivate they must sharecrop.

Abandonment of agricultural land is not a unique feature of Jharkot. Several other farming systems in Muktinath Valley experience the same process of land abandonment, which was observed in Jhong, Chhyungur, Purang/Ranipauwa and Khinga. In Purang/Ranipauwa, the twin-village wich is situated closest to Muktinath Temple and thus most developed in terms of tourism, the villagers have actually altered the local rules to allow outsiders to buy land. Consequentially, immigrants from Dolpa, a quite impoverished neighbouring district of Mustang, have recently taken up cultivation in Purang, through sharecropping as well as through change of land ownership. The process of exodus of people and land abandonment is taking place several places in Mustang (NTNC 2008), and also in the neighbouring district of Manang (Aase and Chapagain 2005, Aase et al. 2010). The process could in fact contribute to create flexibility in the farming system, since agricultural production may be increased if more people choose to return to farming (Aase et al. 2010).

5.2.2 Orchards

Small scale fruit farming has been practiced in Jharkot for at least 30 years, mainly for subsistence purpose. Small, privately owned orchards are situated near the village, where trees of apple, apricot and plums are kept within stone walls. Two walnut trees also grow in the village. Traditionally, apples are eaten fresh during the season, pressed for juice and dried in apple rings. Some also make apple brandy, while *"the damaged apples are for the animals"* (Umesh, male 24). Several peasants report that if they harvest more apples than they need, they give juice and fruits to relatives or sell apples to lodges.

> *"Now many people plant apple trees, because of the road they can sell the whole apples. They can export them to Pokhara and Kathmandu."* (Umesh, male 24)
>
> *"Now with the road, apple export is possible."*(Purna, male 46)

Recently, great optimism concerning commercial apple farming has arised since the completion of the road facilitates whole apple transport at a reasonable cost to the markets in Pokhara. One peasant (Ram, male 46) could tell that he had an orchard of well established apple trees previously, but he cut them all for firewood some years ago because he found it too difficult, expensive and time demanding to transport the apples to Pokhara by mules. Mule transport would cost him six days of travel or 18-20 NPR per kg apples if he hired transport by pack animals, compared to only 5 NPR per kg by motorized transport which takes one to two days. Now that the road connection to Pokhara is completed, Ram has replanted 30 apple trees. Other peasants have done the same, and especially among land prosperous peasants, commercial apple farming seems attractive. The last three years, several households have chosen to plant apple trees in fields which were previously dedicated to grain production, thus converting them from fields to orchards. One relatively prosperous household reported that they had planted 180 apple trees in 22 fields, while keeping four fields for grain and vegetable cultivation. Another household have planted 200 trees over the last two years. Both of these households run lodges in addition to farming and are significantly better off economically than that the average household in the village.

"*Some plant many many trees, and many people plant 15 to 20 trees*", Ram (male 46) told. 15 to 20 trees make one medium size orchard. Another less land holding household, which cultivate all their land every year, had no plans of planting more apple trees but kept a few trees for subsistence purpose only. The same strategy was repeated in several other households with small land holdings. Thus, among my informants there seems to be a tendency that households with easy access to land and capital choose to invest more in apple farming than households with smaller land holdings, who in turn rather keep to subsistence production of grains. Still, no one reported that they had converted all their fields to apple orchards. When compared to grain production,

> "*apples give less work, people here are educated, so they want less work. So less work, and more profit from apple trees.*" (Umesh, male 24)

> "*We have to make new things, opportunities here, or else the children will not come home. Hotels, apple trees, that's good. At first I didn't want to plant, I said, 'who will come back here to keep them?' But my wife wanted to, for the children. And it's good.*" (Purna, male 46)

From these quotes we understand that among the important reasons for engagement in apple farming are the opportunities for monetary income and less workload than grain production. Since many households experience lack of labour, partly because household members are studying or working in the cities, they see new business opportunities for their children by investing in apple farming. Their aspiration is that profitable market production will motivate more young people to return to the village and take up farming, thus helping to relieve the labour constraints frequently experienced in the farming system. Apple farming generally demands less labour than grain production once the trees are well established. The trees are fertilized with one basket of manure per year which is split between late autumn and spring. Some pruning and irrigation are required during spring, but the most labour demanding task is the harvest. Purnima (female 49) could tell that she sometimes hires immigrant workers to help her with the apple harvest to relieve the household's labour constraints.

Mustang apples are generally known to be of good quality, better than those of Manang (Andersen and Chapagain 2007). The peasants of Jharkot know that they may benefit from this status since they can brand their apples as Mustang apples. This gives them an advantage in marketing their produce. During winter migration to Pokhara, several peasants have established networks and trade relations on which they can rely for marketing of their apples, and many have relatives living permanently in the city. Nonetheless, the lion's share of agricultural activities takes place in the cultivated fields, and these need to be fertilised.

5.2.3 Manure

When the harvest is removed from the fields for human consumption, the best way to replace the necessary micronutrients in the soil is to fertilize with animal manure mixed with crop residuals. Manure is thus the main link between the agrarian and the pastoral subsystem. Agriculture cannot be sustainably practiced without a way of replacing the soil nutrients, and in a semi-arid and scarcely vegetated environment, sufficient supply of manure is essential. The number of cultivated fields must therefore be proportional to the number of animals in the farming system. The species of the animals also matter. Smaller animals such as poultry produce manure of high quality, though in small amounts only. On the other extreme, yaks and horses produce great amounts of manure, but of poorer quality. The optimal solution is then to keep goats, sheep and cattle for manure purposes. In addition, these animals provide milk, wool and meat, although as Hari states,

> *"I haven't seen anyone using chemical fertiliser. Only cows. That's why they keep the cows, you know, the small ones. For manure. Or else it would just be loss for them, what do they give, the big ones give maybe a litre of milk, or half a litre only… It's for manure they keep them."* (Hari, male 30)

> *"We don't use any pesticides, but I bought 60 mule-loads of manure last year. Locally, from some people up here, 6-7 families with goats, they sell the droppings. Goat droppings are good."* (Purna, male 46)

All interviewed peasants reported that they fertilized their fields with manure only, no one used chemical fertilizers and no one knew anyone who did, with one experimental exception in an apple orchard. Own observations also show that there are considerable numbers of small cattle in the village. Purna (male 46) could also tell that *"we don't eat cow meat, only ox. It is a courtesy to the Hindus. We just throw them to the vultures when they die. It's a cultural thing"*. From these quotes we understand that manure is the main purpose for livestock keeping. Especially small cattle are of little use besides providing manure, since they do not provide milk. Horse manure is not well suited as fertilizer and is not used (Andersen and Chapagain 2007). Generally, manure from larger animals such as yaks does not serve the purpose as fertilizer, but it is sometimes burnt as fuel together with some cow manure which is also burnt. The best quality manure from poultry is saved for vegetable fields, while larger quantities of cow and goat manure are spread in the grain fields and orchards. Since manure is such a valuable resource in the farming system, it is collected from the stables and from common pastures. Manure collection in pastures is a beneficial way of transporting nutrients from outfield to infield (Andersen and Chapagain 2007). In order to ensure equal access to this resource, there are restrictions on when people can collect manure in common lands.

> *"We have our own rules and regulations for when to go. Some specific people give the orders, the gemba [village leader] gives the order when to go. They have a village meeting and decide, then the gemba says a date. The meeting decides, now we will do barley, irrigation, manure."* (Umesh, male 24)

> *"3-4 years ago they made this rule, for the date, for collection of the droppings. But that is for the big one, cows' droppings up on the pastures. Manure for the fields. Before that it was open, but then some got and some did not. So they made a rule and set a date. But here in the village you can pick everyday. You can see it when they go out with the animals in the morning, they carry a basket and throw it in there."* (Purna, male 46)

These quotes demonstrate how manure collection in common lands is regulated at village level to ensure fair distribution of this valuable resource among the village households. The

fact that the regulation was made in response to the expressed needs of the villagers indicates that collective authority at village level is bottom-up oriented and accountable primarily to the villagers and not to an external authority. The existence of such a village council which ensures equal access to common resources is not unique for Jharkot, it is also found in other Trans-Himalayan agro-pastoral communities (Mishra et al. 2003).

> *"We heard some people used this chemical fertiliser before, and their land was destroyed. Nothing grew there, they had to remove all the mud and all. So you can destroy your fields completely from that, nothing grows for years. So we use only animal dung. And I also heard that it needs a lot of water, and we have water problems from before, so… We collect from the stable you know, from cows and the jhopa, in the fall we collect leaves and put in there and it mixes with the dung and it gets good manure. And we collect also, in fall. But if we don't have time to collect, we buy also. But only from animals."* (Purna, male 46)

There are several possible explanations for the refusal of fertilizer and pesticides. When asked, the immediate response of the peasants was expression of general scepticism towards both fertilizer and pesticides, between which many did not distinguish too precisely. Stories similar to that of Purna were often repeated, of peasants who had tried and ended up with declining yields and destruction of their fields. When it comes to pesticides, peasants worried for pesticide residuals in the crops. In addition, the story of a girl from the nearby village Kagbeni, who died from accidentally mistaking pesticides for juice and thus drinking the poisonous liquid, seemed like reason enough to stay away from it altogether. A third mentioned reason to avoid pesticides was that *"it is not good for Buddhists to use it, it kills animals"* (Ram, male 46). To turn to an economic factor, the prices on such input factors are quite high compared to the monetary income from agriculture. Since most of the agricultural produce is for subsistence purposes and since transport costs until recently have been quite high, external input of factors of production is not currently part of the farming system.

Although the reluctance towards fertilizer and pesticides may of course be subject to change, some peasants are more interested in being certified as organic farmers in order to obtain higher market prices for their apples. In case they need to increase the manure supply, there are still opportunities to do so without rising larger herds. The District Agricultural Office in Jomsom is currently working on a project promoting the production of organic compost manure by the use of organic waste, crop residuals, small amounts of manure and an added extract of *effective microorganisms.* To include organic compost manure in the farming

system is an uncommitted potentiality to increase the flexibility of the system, since fewer animals are then required to produce enough manure to fertilize a unit area of cultivated fields. Nonetheless, in general there seems to be enough manure currently available in the farming system. At the local market, manure is sold for 50 NPR per basket, which provides one apple tree with the annually required amount.

5.2.4 Domesticated animals

The farming system depends on domesticated animals for various purposes. Large herds of goats and cattle provide manure and milk, sheep are kept for manure and wool and small numbers of poultry are kept for eggs and high quality manure. *Jhopas* serve the purpose as draught animals, as they are said to eat less than yaks, but to work harder than cows. Horses and mules are used for travel and transport, although the last few years motorized transport such as jeeps and motorbikes have been emerging due to the road connection. According to my informants, the number of horses has decreased the recent years. Each horse eats approximately 1 kg of grains (mostly hooded barley) per day in addition to grass and weed. The total amount of grains consumed by horses is far from insignificant, as in Manang where horses consume 16% of the produce of all cultivated land (Aase and Chaudhary 2007).

On the other hand, horses are the traditional means of travel, locally they have a strong cultural standing and they are the centre of attention in the horse race festival each year in August, the *Yartung*. Traditionally, the saddle-covers made of carefully woven carpets have been among people's most valuable items (Führer-Haimendorf 1975). Yaks are also highly appreciated among people of Tibetan descent for their nutritious milk, meat and suitability as pack animals under cold, high mountain environmental conditions (Führer-Haimendorf 1975). Nowadays yaks are kept mainly for their sales value and their meat, which is considered a delicacy and is primarily served at special occasions such as festivals and *pujas* (religious services). The price of one live yak bought from Upper Mustang is currently as high as 40,000 NPR, and only a few wealthy households in Jharkot keep yaks nowadays. Nirmala (female 20) could tell that *"people come from Lo Manthang with yaks, and sell the meat here. We buy from them"*. Several informants told that they preferred to buy yak meat if they wished for it.

> *"I don't kill animals, I only eat meat. Other people kill the animals, special people. Butchers, you know. Sometimes they have a tent outside the village, take goats and so on out there, and kill the animals there. Then they eat, or dry it for the winter. Yak meat too, we can buy, but it is expensive."* (Umesh, male 24)

It is somewhat paradoxical that people consume meat in a Buddhist community, a practice which will inevitably involve the killing of animals. However, in an agro-pastoral farming system where animals are important for the system performance, the consumption of meat is perhaps interpreted as a negotiation between religious ideals and practical functionality where the solution is to engage non-Buddhist butchers. It is then quite remarkable that the Hindu ban on eating cow meat is upheld by the Buddhists. Anyhow, many households are practically vegetarian since meat, and particularly yak meat, is too expensive for everyday consumption.

When it comes to cattle and goats, the number of livestock has decreased together with the number of inhabitants in the valley (Kriechbaum 2002). While historically both goats and sheep were kept in large numbers (Führer-Haimendorf 1975), nowadays goats are preferred over sheep: *"They [sheep] eat more than goats. Goats are better, they are strong"* (Purna, male 46). *"It is too cold for sheep here in the winter. Goats are better"* (Tej, male 30). One peasant told that during a cold and fodder scarce winter, he had lost 100 out of his 150 sheep, an incident which led him to sell the remaining sheep as well. Goats are well adapted to the local environment since they can fend for themselves even under dry conditions. By browsing for fodder from a wide range of vegetation they can feed from shrubbery and weed not suitable for sheep and cattle (Führer-Haimendorf 1975). When the animals are not grazing in the pastures, they are stall-fed with weed and grass, dry leaves and crop residuals and low quality apples. As should now be evident, the interrelationships between the pastoral and the agricultural subsystem are not limited to manure. Animals also provide milk, meat, eggs and wool, they are used for ploughing, transport, travel and are even items for conspicuous consumption. In return they need herding, tending, water and winter fodder.

5.2.5 Pastures and common property resources

The village pastures are situated in the mountainsides southeast of the cultivated valley floor, at an altitudinal range from 3,500 to 4,000 m.a.s.l.. The grazing areas are not naturally forested with trees, but instead vegetated by thorny bushes (dominantly *Caragana artemisa* and *C. lonicera*) juniper (*Juniperus wallichiana* and *J. squamata*) and various grass and flower species. In addition, a selection of berries, herbs and medicinal plants may be found. It is to these areas the cattle, goats, sheep and horses are brought for grazing. The pastures are divided into common property for each village. All households of a certain village are entitled

to let their animals graze within the defined village areas, while households of other villages are excluded, contrary to the claim made by Kriechbaum (2002) that there is no management of the pasture areas. Herding is done on a rotational basis and the animals are brought back to the village every day at dusk and stall-fed during the night.

The common property alpine meadows provide resources beyond the single use as pastures. Despite the rather barren appearance and lack of naturally growing trees, a variety of valuable plant resources thrives in these areas (for comprehensive lists, see Kriechbaum 2002, Shakya et al. 2002). Wild growing berries, herbs and medicinal plants may be found and the villagers frequently gather from these resources for subsistence and some for sale. The alpine meadows are commonly referred to as *bun,* and Tej (male 30) could tell that *"'Bun' is what we call forest, although there are no trees there".* The natural forest – vegetated by trees – is called 'jungle'. Since it is in the *bun*-'forest' the gathering of berries, herbs and medicinal plants occur, these are elaborated in the follwing and not in the subsequent subchapter on natural forests, despite a somewhat misleading name since in the literature, such resources are widely referred to as non-timber forest products.

Non-timber forest products (NTFP) are a collection of wild growing edible plants, medicinal plants, and non-edible plant resources (such as juniper incense) traditionally used in subsistence based farming systems and some which are objects of trade. In Mustang at least 70 species are used for medicine by *amchis,* Tibetan doctors (NTNC 2008), while more than one hundred NTFP species are consumed by the local people of Mustang (Chhetri and Gupta 2007). The collection, use and sale of NTFP is widespread also in other districts such as Manang (Bhattarai et al. 2007). In Jharkot, NTFPs contribute to diversify the subsistence base and offer occupational alternatives in lean seasons. Among the economically most important species are *yarzagumba* (*Cordyceps sinensis*) and seabuckthorn (*Hippophae tibetana,* or *tora* in vernacular) and the following discussion will be confined to these two species.
Yarzagumba is a larva infected with a parasite fungus, and the name literally means 'winter worm – summer grass' (Hsu et al. 2002). In traditional Tibetan medicine it is eaten dry or soaked in rakshi to relieve fatigue, altitude sickness and knee pain, while various additional medical properties are documented (Hsu et al. 2002, Nishizawa et al. 2007). It can be found in the soil at high mountain meadows at 4,000 m.a.s.l. from late May when the parasite fungus is properly developed.

Only for two years have the villagers of Jharkot systematically gathered *yarzagumba* for commercial purposes, while in two of Mustang's neighbour districts, Dolpa and Manang, people have collected it for decades (Chaudhary et al. 2007, own fieldwork). The gathering is individual but the harvest is sold to contractors, who in turn export the pieces to China and Singapore. As an indicator of the substantial potential value in this business, Manang district sold *yarzagumba* worth 15 million NPR in 2005 (Chaudhary et al. 2007). Gathering is only allowed for a certain period of time in a dedicated area and it is regulated at VDC-level. While insiders (i.e., inhabitants of the Muktinath VDC) must pay an entrance fee of 500 NPR to receive permission to gather, the fee is 2000 NPR for outsiders. A clever gatherer may earn quite a lot of money, but generally there is no guarantee that the profit from gathering will exceed the entrance fee. In Jharkot the attitude was expressed that *yarzagumba* gathering is a gold digger's game, and that there is no guarantee for profit at the outset. However, my informants expressed that the social dimension of *yarzagumba* gathering is quite significant.

Partap (1999) emphasizes the benefit of economic diversification by making use of NTFP, but concerns are also raised of potential overharvesting and local extinction of NTFP such as *yarzagumba*, especially due to illegal harvesting, and the fact that scarcity normally raises the market value (Bhattarai et al. 2007, Chhetri and Gupta 2007). However, where the gathering is regulated, high entrance costs for outsiders seems to have effect. In addition, local weather conditions might contribute to unintended conservation. 2009 was a poor *yarzagumba* year in Muktinath VDC. Several collectors returned to the village after less than a week's search, reporting that snowfall in the mountains made the search too cold and difficult and with meagre results. Still, while the *yarzagumba* represents a highly uncertain source of income, other NTFPs are much more reliable, like the seabuckthorn.

Seabuckthorn[10] is a low thorny bush which grows wild in the Muktinath Valley in relatively moist locations such as along streams and channels (Kriechbaum 2002). The berries are rich in vitamins C, carotenoids, antioxidants and several other micronutrients and internationally it is used in various cosmetics, food supplements and for medical purposes (Beveridge et al. 1999, Partap 1999, Kallio et al. 2002). The seed oil can also be used as a natural sunscreen absorber (Beveridge et al. 1999) which is quite useful in the strong high-mountain sun. The plant grows on sandy and meagre soil, is nitrogen-fixing and has the ability to regenerate soil

[10] A variety of seabuckthorn, Hippophae rhamnoides, also grows wild in Norway and is known as 'tindved'.

and prepare it for subsequent vegetation (Beveridge et al. 1999, Partap 1999). In addition, it can survive extreme temperatures ranging from -40 to +40^{o}C, and is drought resistant (Partap 1999) although it thrives in moist locations. The plant is thus excellent for stabilising slopes and the edges of streams and irrigation channels, a purpose it serves in Jharkot. The berries are traditionally used for juice and for animal fodder, while "*the remainings we dry in the community hall. We can make tealeaves, cream and oil from it. I haven't tried to make oil yet, but some have tried*" (Purna, male 46). The multiple uses of the seabuckthorn are evidently recognized locally as is the awareness that this is a healthy food item with great potential for commercialisation. The bushes grow wild in three locations on Jharkot common land. Until recently there was no regulation of entitlement to the bushes and berries for the villagers, but in 2008 the village meeting decided to give the Women Development Group (WDG) responsibility and control over the seabuckthorn. This was the start of a community project where on a given date in August – September, one person from each household is obliged to participate in plucking seabuckthorn berries. The WDG then makes and bottles juice from the berries and sells it to a contractor, which then can make additional profit of the juice by selling it as a niche product to tourists. The WDG then saves some money for buying sugar and preservants, before paying each household according to how much they contributed to the harvesting. In 2008 the villagers received 40 NPR per kg berries they had harvested and in addition the WDG could give each household 5,000 NPR after the juice was sold.

The first year the contractor was a group of local women, and most of the juice was sold locally. However, from 2009 some juice was also sold through contacts in Jomsom, Pokhara and Kathmandu, and there are plans to market the product as a health-food niche product in the cities in order to create greater demand. Promotion posters are printed, bottle labels designed and the juice will be taken for lab testing to document the vitamin contents. The plant grows wild only in a few locations in Mustang and is mostly used for subsistence purposes, so competition is limited from other producers. In 2009 the WDG also planted some new bushes, still on common land not otherwise used for cultivation. The women had also invested in a juice squeezer and at the time of fieldwork they were dedicating a separate room in the community hall to the juice production. The idea to produce and market seabuckthorn juice as a niche product arose more than twelve years ago when there was an organised training of members from all villages in the Muktinath Valley. Since then, the idea has remained an uncommitted potentiality in the farming system, a potential productive use of local resources. When juice production is now initiated the villagers have made use of this

opportunity. This indicates a strong capacity for coordinated action through community projects in Jharkot, in tandem with entrepreneurship through a system of private contractors.

5.2.6 Natural forest

The natural forest plays only a modest role in the farming system of Jharot. As discussed earlier, the natural forests closest to Jharkot are situated in the neighbour Panda Valley by the village Lupra, a three hours walk south of Jharkot. The villagers are entitled to collect a regulated amount of firewood from this forest, although Hari (male 30) could tell that

> *"It is time demanding, dangerous, hard work. Now people don't even log their limit, they don't have the manpower and it's too dangerous. Many don't go. Some hire people to go for them, but that's expensive. They use kerosene, gas, solar cookers. Few people know how to log now."*

The statement of Hari was reconfirmed through a number of peasant interviews. While some choose not to go to Lupra at all, others go only every other year while still others occationally go but without filling their permitted quota. The reasons frequently given were that it is too dangerous due to steepness, too hard work and that their households do not have appropriate and sufficient labour for this task, meaning grown males. In the model (Figure 2, p. 56) of the farming system, the natural forest is distinguished as a separate variable to emphasize the point that the circumstances underpinning the Theory of Himalayan Environmental Degradation are not characteristic for the farming system of Jharkot, as previously discussed. The planted trees near the village form a considerably more important resource in the farming system than the natural forest does. However, although many households nowadays supply their energy requirements with kerosene, solar cookers and electricity, the benefit of having access to a natural forest from where they can get fuelwood should not be totally disregarded. While some households choose to go to Lupra and log their permitted quota, others regard the drudgery from logging as greater than the utility and choose to collect wild rosehip shrub and dung from their private lands and to rely on wood from their private trees.

5.2.7 Planted trees

In Jharkot, private trees are carefully planted in or on the edges of the cultivated fields, within the community stone fence. Some tag their trees with the family initials to state their ownership. These trees have multiple functions. The long, straight branches are cut and used

for roof construction, while smaller branches and twigs are dried and stored for firewood. The tree trunk remains, however, and regrows new branches. In the autumn, dry leaves are collected for animal fodder and bedding in the staple. Winter fodder is thus another link between the agricultural and the pastoral subsystem. Planting trees around the field edges and along the irrigation channels have the additional beneficial function of stabilizing the edges of fields and channels, thus preventing erosion and channel blocking. Rosehip and seabuckthorn, which are often found growing near the water channels, serve the same purpose. This feature is also found in similar farming systems elsewhere, as in Karakoram (MacDonald 1998).

5.2.8 Water

Due to the semi-dry environment, water is primarly provided for by meltwater running down from the surrounding mountains. The steep and pronounced topography of the area makes water supply a highly localized affair. Over the centuries, people have adjusted to the local conditions as well as altered them by constructing irrigation channels along the contours. The irrigation system facilitates cultivation in areas that would otherwise remain unproductive. The principal stream in the Muktinath Valley stems from the mountains east of the valley, from above the Muktinath Temple. The water first runs through 108 holy wells in the temple complex before it is led down through the valley. Here, many smaller streams confluence in a larger stream, Jhong Khola. Jharkot receives water directly from the Muktinath wells and from some smaller streams south-east of the village, not from Jhong Khola which runs below the village fields. Jharkot is therefore first in line to receive water for its fields[11]. In addition, snowfall during the winter makes some contributions, though with small amounts only.

> *"The snow melts and becomes water, so snow is good. This year there was very little snow. When it rains here, it only drizzles, there's not much from it, not much water."* (Ram, male 46)

Several peasants confirmed this statement, saying that the monsoon rain contributes only slightly and that rainwater not suffice for the fields. The farming system is thus totally dependent on meltwater for irrigation. One round of irrigation normally takes about one to three hours, but in the month of May 2009, Tara (female 18) could tell that

> *"It is difficult to get water now. Yesterday father and uncle went to irrigate the fields, it was their turn, and they did not come home until midnight. It took so long time. There was too little water coming."*

[11] Although Ranipauwa is located higher up and closer to the Muktinath water spring than Jharkot, its fields lie lower than the village and are irrigated by water from the Jhong Khola. Only water consumed by the households in Ranipauwa is led into the irrigation channels after use and end up in Jharkot.

Other peasants also told that they experienced seasonal lack of water during the spring months of March, April and May, before the monsoon arrives in June. Spring is a critical period in terms of water for the barley and wheat crops, and also vegetable fields and orhards require irrigation. Limited and variable water availability in the spring imposes a constraint to agricultural production in the farming system. Just as with short growing season this is a natural environmental condition not easily altered. However,

> *"Now we get water from the Muktinath stream only, and it is not so much. When the new pipe is completed, then water will be no problem."* (Tej, male 30)

> *"They [a village committee] are making a new water pipe now. Because there was less water the last years, so now they have started to make a new one. From another source, they started a year ago. They got funding from a sponsor in Europe."* (Umesh, male 24)

A new irrigation pipe is currently under construction in Jharkot, origining from a separate source than Muktinath. The new source is locally known as Rashakesh[12] and is located at 4,700 – 4,800 m.a.s.l. in the mountains south of Jharkot, but the irrigation pipe will be led from a well more conveniently situated (4,000 m.a.s.l.)

> *"From this lower source we can get water earlier, like this month and the next and the month before [March – May]. (…) Because now, this season, we have too little water. After, the rest of the year it is no problem. But now these months it's scarce."* (Purna, male 46)

Purna could also tell that *"It is an old source, from our grandparents*", but since the channel previously was only a ditch in the soil, most of the water ran off along the way and little actually reached the fields. For many years the channel was therefore not mainaned. In 2006, however, the villagers initiated a community project to construct an improved channel with a closed pipe. Funding was raised and one person from each household was summoned for voluntary work, in addition to some hired labour. In 2009 the channel was constructed and tested, but only a third of the distance was yet completed with pipe. According to plan the pipeline will be completed in 2010. The aspirations are high to this new pipeline: *"Once it is finished there will not be a water problem here anymore!"* (Purna, male 46). This new pipeline is an excellent example on how the farming system may expand its flexibility through targeted investments where it is needed.

[12] The name Rashakesh is vernacular and does not occur on official maps.

Still, a critical question should be raised: Will the new pipeline create conflicts over water distribution between Jharkot and other farming systems downstream from the Rashakesh well? The Rashakesh stream is one of several feeders of Panda Khola in the parallel Panda Valley to the south of Muktinath Valley. The only village here is Lupra, which is included in the Muktinath VDC (Map 1, p. 8). Lupra is situated in the steep mountain side right by the stream Panda Khola, which frequently gives the village a challenge from floods in the valley floor, damaging their wooden bridge over the stream. For Lupra, the challenge is rather to lead water from the stream to the fields, not an absolute scarcity in the stream. According to my informants, Lupra villagers were consulted and they welcomed the pipeline because they assumed it would contribute to reduce the risk of floods in the lower part of their village.

5.2.9 Collective authority and social organisation

There seems to be a strong tradition for cooperation both at village level and between the villages throughout the Muktinath Valley. People have experienced that everyone benefits from elimination of competition by monopolizing cooperatives and fixed prices, especially for tourist services. The home-woven, colourful scarves which are sold to tourists hold for instance a set price of 200 NPR, resulting from an agreement between women in several villages. Although tourist souvenirs in general are open for bargaining (and overcharge), prices on goods and services originating from collective initiatives are strictly regulated.

Common property resources are divided geographically between the villages. In Muktinath VDC, the four villages have negotiated their internal distribution of entitlements to water, pastures and forest resources. As a young girl from Khinga stated, *"if Jharkot people let their animals graze there [in Khinga's pastures], then we get angry"* (Canchi, female 18). The pastures of Khinga are thus open only to the herds of Khinga households, and repeated confirmation of this regulation assured me that the same goes for the pastures of Jharkot. Similarly, agreements for water distribution are made with the villages in the neighbouring Jhong VDC, since the stream Jhong Khola serves both areas with water. Whether or not there have been disputes over water my data cannot assess, but no such incidents was reported.

The household is the primary unit of organization in Jharkot and entitlement to water, fuelwood, pasture and forest resources follow the household. However, these common resources are managed at village level. Each household has the right of representation at

village meetings which are held whenever decisions of collective interest are to be taken. Agreement is normally sought through consensus, though in case of disputes, the village leader has the final word in the matter. Village meetings are frequently held and if a specific project is initiated, the meeting appoints a dedicated committee (*samiti*) for the purpose.

In the formal administrative system of Nepal, the lowest administrative unit is the Village Development Committee (VDC), which is managed by an elected representative council and led by a Chairperson. In Muktinath, however, no VDC election has been arranged for several years. Still, this does not imply a lack of local leadership. Parallel to the formal system, a traditional system of *gembas* (village leaders) and *rolos* (assistants) is functioning. This is a system at village level, so each of the four villages in Muktinath VDC has their own *gemba* who is appointed annually. The system resembles that of *khambas* in Manang (Aase and Vetaas 2007), although with slight differences. In Jharkot, all male villagers over the age of 18 may become a *gemba*, but since the system is based on rotation he can sit only one period. Men over the age of 60 are freed from all community duties and leadership responsibilities when they have hosted their 60s anniversary celebration (*tarjang*). The *gemba* is responsible for most of the coordinated action in the village, for instance setting the starting date for manure collection in common lands, command collective work for common benefit and leading village meetings. Also appointed are a vice-*gemba* and four assistants called *rolos*. The duty of the *rolos* is to patrol the fields looking for cattle grazing in the fields and fine the owner 50 NPR for each animal caught.

The system of *gembas* and *rolos* is probably of Tibetan origin, and according to my informants it is the system of local leadership actually in function. One informant explained the authority of the *gemba* as *"they have no formal power, but locally they have power"*. While the position of *gemba* is rotated annually, the appointed leaders of ad hoc project committees (*samitis*) are often respected senior men and women in the village, who generally speaking are influential in local affairs. Quite often the same person leads the committees for different projects. Several factors contribute to the appointment of committee leaders, but among the important factors are social networks and the ability to raise funds for projects. The leader of the Women's Development Group (WDG, earlier called *amasoma* – the mothers' group), told that she was asked to lead the seabuckthorn project because of her extensive social network both locally and in Kathmandu. Other local projects initiated by the village meeting are an adult education project (two hours teaching every night to reduce adult

illiteracy), a preschool nursery, the construction of the new irrigation pipeline and the construction of a new community hall. The latter project is partly funded by the Indian Embassy of Nepal, an agreement made effective by the local committee leader.

It seems clear that in Jharkot there is a strong tradition for collective action and cooperation at village level. This strengthens their capability to start community projects for common benefit. Strong social ties within the village both in terms of kinship and dependency on common resources serve the community with multiple opportunities for social sanctions if someone chooses to break the social conventions or collectively decided rules. Referring to a fine decided by the village meeting, a committee leader said, *"if someone refuses to pay, we collectively punish them in our own way"* (Purnima, female 49). What kind of punishment she referred to was not specified, but in a local community with densely tied and overlapping social relations, social sanctions can probably be expressed in multiple ways.

How may this remarkable local capability for coordinated action be explained? Taking the historical context into account, the capability could tentatively be related to the historical autonomy of the people of Mustang and the limited influence from the central government. The Mustang Raja was recognized as a ruler in feudal relationship to the King of Nepal until less than sixty years ago, and Mustang was one of the few districts of Nepal not exposed to the Maoist resurgence during the late 1990s. When the government of Nepal resigned in late May 2009, the news was given little attention by the villagers. Considering that no VDC elections have been arranged for years, the general attitude seems to be that the villagers alone are responsible for any initiative of coordinated action. They therefore rely on village meetings led by the *gemba* and on project committees. A strong sense of community and mechanisms for social sanctions make the village meeting decisions effective.

However, there is a quite influential regulating institution affecting decisions in Jharkot. The Annapurna Conservation Area Project (ACAP) regulates tourism in the area and makes rules concerning certain aspects of villagers' entitlement to common resources. For instance, even though the four villages in Muktinath VDC had already limited how much each household was entitled to log annually from the natural Lupra forest, ACAP later reduced the quota. My informants repeatedly reported the lowest amount of fuelwood when asked how much they could collect, though many said that they chose not to go, rather managing with wood from their private trees and alternative energy sources. Still, more research is needed to assess to

what extent the ACAP regulations are actually upheld in practice. Furthermore, even if people do not exceed the ACAP quota, the question still remains unanswered whether people do so *because* they adhere to and respect ACAP regulations in general.

A possible, theoretical explanation of the local capability for coordinated action refers to the mutual dependency on water resources. Führer-Haimendorf (1975) states that the need for irrigation in agriculture enhances cooperation and coordinated action at the village level, since all members of the community depend on a functioning system for water distribution. This statement is associated with Wittfogel's theory of the hydraulic society[13], which in short claims that in locations where climate conditions make agriculture dependent on artificial irrigation, the need for coordinated water control "necessitated the interference of the centralizing power of the government" (Wittfogel 1957: 374, in Leach 1959: 3). This led to the raise of powerful 'Oriental Despots' even though the means of production were owned by the people, according to Wittfogel (Leach 1959). The case of Jharkot supports the first part of the argument, as Führer-Haimendorf also notes. The coordinated irrigation system at village level is a prominent feature of Jharkot, but as discussed above, the influence of the central government is limited. Thus, it seems less relevant to draw the argument beyond the local level. Suffice it to say that the need for irrigation channels on which the whole village depends certainly gives an incentive for coordinated action and cooperation. Even though it is not obvious that the need for cooperation in irrigation will necessarily lead to coordinated action in other sectors of the community, in Jharkot this seems to be a general tendency. The village level is not only the organizational unit for water distribution, but also for manure collection, entitlement to common land and herding. It is the task of the *gemba* and the four *rolos* to see that village meeting decisions are enforced.

Whether the capability for coordinated action is due to low influence from the central government, to the dynamics of a 'hydraulic society' or to completely different reasons is a question for further research. Knowledge required to conclude in this matter would include acquaintance with historic social organisation in the area, indepth studies of how coordinated action is practiced today and investigations on the relationship between formal and informal authorities at different levels. Whatever being the reasons, though, the capability for coordinated action is in any case an advantage for people in the village. I will argue that this

[13] For a critical discussion of Wittfogel's theory, see Leach, E. R., 1959. Hydraulic Society in Ceylon. *Past & Present,* 15**,** pp.2 - 26.

capability facilitates creation of flexibility in the farming system because collective projects involving substantial investments are made possible when people are willing to invest in community projects for the aspiration of later benefit for all.

5.3 Summing up: The farming system of Jharkot

From the farming system analysis it seems clear that the analytically separated variables are interlinked in complex ways. The utility of one variable's resources is dependent on the availability of other variables' resources and how these are distributed. The utility of the cultivated fields is for instance dependent on sufficient availability of water, labour and manure. I have also demonstrated that social organization and cooperation at the local level, including formal and informal rules for entitlement to resources, influence how the farming system is managed. Furthermore, it is apparent that far from all variables are fully exploited in the farming system. Instead of regarding this as suboptimal exploitation of the variables' resources in strictly economic terms, I will argue that the underexploited variables provide the system with opportunities for change that constitute the flexibility of the system. The flexibility reflects the adaptive capacity of the system under highly variable environmental conditions, in particular under conditions of climatic variability and change. An interesting question to ask is then how to conceptualise and analyse flexibility in farming systems? The next chapter will address this question.

Picture 5: Parsley, apple flowers and cattle

CHAPTER 6: FARMING FLEXIBILITY

Small production systems in mountain regions are often characterised by diversified practices which enable people to be flexible in response to changes (MacDonald 1998, Bishop 1998, Mishra et al. 2003). This kind of flexibility in farming systems is the focus of this chapter. Building on Gregory Bateson's (2000 [1972]) definition of flexibility I will present and theoretically discuss the concept of flexibility. Referring to my theoretical research question I will attempt to operationalize the concept to an analytical tool with relevance for farming systems. By guidance from the operationalised flexibility concept I will next turn to my second research question and analyse some aspects of the farming system's flexibility to maintain or even increase agricultural production under present climatic conditions. I will also identify factors that constrain this flexibility. Lastly, the analysis will inform a short theoretical discussion concerning thresholds of tolerance in ecological systems.

6.1 How to understand flexibility?

Bateson (2000 [1972]) discusses the concept of flexibility in human – environmental systems, which in the following I will call ecological systems. A farming system is an example of an ecological system and the factors of production in a farming system are in Bateson's terminology called variables. According to Bateson an ecological system consists of interlinked variables, each with an upper and lower threshold of tolerance. Within these thresholds the variable's value can be moved to reach adaptation, but beyond them "discomfort, pathology, and ultimately death must occur" (Bateson 2000 [1972]: 504). When a variable is exposed to stress and takes on a value close to one of its thresholds, the system lacks flexibility for that variable. The interlinked nature of the system leads to spreading of inflexibility because other variables cannot be adjusted without pushing the stressed variable beyond its threshold. The short-term response of the system is to push the stressed variable towards its threshold of tolerance, and rather find new solutions to make the situation more comfortable. To take an example from a farming system, if there are drastic reductions in the available amount of manure, the immediate response may be to spread out what is left and use less manure per field. This, however, does not solve the underlying problem of the stressed manure variable. It is rather a denial of taking the consequences from the present situation, as

this strategy in the long run will deplete the soil – an interlinked variable – of essential nutrients and eventually lead to reduced yields or crop failure.

According to Bateson, the solution is to do what it takes to rebuild a positive budget of flexibility, to save up a buffer zone of unexploited capacity that can "be spent (like fat) upon needed change" (2000 [1972]: 505). This means that the only sustainable way to preserve the capacity of system variables is to *avoid* permanent exploitation of their maximal capacity. Flexibility is then the exact opposite of specialisation as well as intensification, in other words to avoid pushing the value of a variable to its threshold versus actively seeking just that. This leads to the definition of flexibility "as *uncommitted potentiality for change"* (Bateson 2000 [1972]: 505, emphasis in original). The general flexibility of a system depends on keeping many of its variables at values somewhere in the middle of their thresholds of tolerance (ibid.: 510) to make sure that there is unexploited capacity free to be used in times of need. Nevertheless, it is important to notice that if a variable is kept stable over a long period of time its total capacity may decrease as other variables expand into its space of unused freedom. It becomes rooted, so to speak. This implies that the flexibility of the system must be used once in a while in order to prevail.

These abstract ideas of flexibility in ecological systems can provide analytical insight into the farming system of Jharkot in several respects. First of all, the peasants are managers of the factors of production in the farming system. They are thus managers of flexibility in the system. Furthermore and with ontological basis in critical realism, a farming system consists of interrelated variables in the sense that the utilization of one resource, for example the cultivated fields, depends on sufficient input of resources from other variables such as labour, manure and water. The most constrained variable, then, limits the utilization of the related variables even if the latter are not restricted as such. Even if the peasants have an abundance of cultivable fields, labour and manure, lack of water would still constrain agricultural production since all factors of production must be available in sufficient amounts if good yields are to be harvested. Theoretically, limited capacity in one variable may constrain the utility of many or all related variables in the system. In a system naturally exposed to climatic variability, a lasting situation where crucial variables are maximally exploited will constrain the flexibility of the whole system, since there will be no room for extra input in times of greater needs.

6.2 Flexibility in the food production of Jharkot

Due to a short growing season, subsistence production in Jharkot has traditionally been complemented with additional food import. Engagement in alternative livelihoods has also contributed to net out-migration and abandonment of agricultural land. Today's actual agricultural production should therefore not be confused with the maximal potentials for production in the farming system. If the farming system is seen in terms of flexibility, maximal exploitation of factors of production is not assumed a priori. In the broader context of probable rising food prices and climate change, renewed interest in local food production is not unlikely in a future where global food scarcity may become a reality. It is therefore worth investigating the potentialities for increased agricultural production in local farming systems. In the case of Jharkot, it means to assess the flexibility in the farming system to maintain or even increase the overall agricultural production.

The preceding farming system analysis demonstrates that there are many abandoned fields in Jharkot. These fields serve the farming system with flexibility through the uncommitted potentiality to reclaim land. Should the people of Jharkot find it necessary or beneficial to again increase their reliance on local food production, they can do so by allocating more of their labour into agriculture at the expense of alternative livelihoods. Additional labour needs can be met by hiring casual workers in peak periods and by encouraging more sharecropping, opportunities which have already been committed in Jharkot. Groups of casual workers reside periodically in Jharkot, and there are cases of local tenants who are permitted to keep more than the usual 50% of the yields. In addition, it is possible to change the rule of exclusive local entitlement to land ownership and instead allow outsiders to buy agricultural land. In a village close by Jharkot, some peasants from Dolpa have been permitted to buy land, so it is not unlikely that the same could happen in Jharkot. This flexibility to reclaim land is also discussed by Aase et al. (2010) in a similar case study from Manang. However, available fields and labour are not sufficient for increased agricultural production since this is also conditioned by the availability of water and manure. The flexibility to reclaim cultivable, but currently abandoned, fields is dependent on the system's flexibility in these related variables.

Sufficient availability of irrigation water is a prerequisite for agricultural production in a semi-arid environment such as that of Jharkot. Not only the total amount, but also the timing of the water is essential, and seasonal variations can be both a blessing and a curse for

agricultural production in the farming system. Even before climate change and the local scale uncertainty it entails is accounted for, natural variability of precipitation and temperature causes variations in water availability, which in turn conditions agricultural production. Water is thus a complicated variable and will therefore be discussed indepth later on.

In Jharkot today, availability of manure is not constraining agricultural production. Peasants claim that they have enough manure to fertilize their fields, and those who cannot produce sufficient amounts from their own herds buy additional cow or goat manure locally at a reasonable price. The farming system has significant flexibility to increase the use of manure, meaning that a significant share of the variable's full capacity is left unexploited. In a situation of agricultural expansion and thus greater needs of manure, the period of regulated collection from common pastures may be extended in time to ensure that a larger share of all manure is collected. Although this could hypotetically contribute to pasture degradation in the long run, flexibililty includes the ability to rapid adjustments, to make use of an opportunity temporarily. Referring to Bateson (2000 [1972]), the unexploited capacity of a variable can be used temporarily to facilitate change in the system. If there is a risk of pasture degradation, intensified collection of manure can be used as a transitional strategy until more sustainable solutions are found. A more permanent potentiality for change is to avoid the burning of cow manure for fuel, and rather use kerosene, fuel wood and dung from yaks and horses since this is not suitable as fertilizer. A third opportunity is to welcome the organic compost manure project using effective microorganisms, which is a sustainable solution in the long run. The total amount of manure available in the farming system is thus quite flexible, even before larger herds are raised. Hence, the present adaptation for use of manure is somewhere in the middle of the variable's total capacity, and there are at least three uncommitted potentialities for change to increase the amount of manure available for cultivation.

Since the number of animals in the farming system historically has been significantly larger than today, yet another opportunity is to again raise larger herds. In addition to producing manure these would also provide meat and milk. In an interlinked farming system, however, larger herds would create greater demands for related resources such as winter fodder. How flexible is the system to make changes in this variable? Firstly, more cultivation means more weed and crop residuals, and consequently more fodder. Secondly, if the additional crop residuals do not suffice, more trees could be planted, although it would probably take too long time to be a short-term solution. Alternatively, a third opportunity is to alter the composition

of the herds. The large number of horses in the farming system already consumes large amounts of both grains and winter fodder without producing suitable manure for the fields. With the introduction of jeeps and motorbikes, the importance of horses for travel is also reduced, according to my informants. Thus, an uncommitted potentiality in times of winter fodder scarcity is to reduce the number of horses and raise larger herds of goats instead. This reallocation of winter fodder would increase the returns of manure relative to winter fodder and relieve manure as a potential constraint for increased grain production. Fewer horses would also permit human consumption of grains that would otherwise be spent as horse feed (Aase et al. 2010). If the reclaimed land was dedicated not primarily to grains but rather to vegetable cultivation, the number of poultry could be increased at the expense of horses.

It seems clear that the availability of cultivable land, manure and winter fodder is far from constant in the farming system, and that these variables can be adjusted in multiple ways to allow for expansions of production in the farming system. Hence, these variables do not constrain the potentialities for increased local food production. Theoretically speaking, since there are opportunities for change in many of the system variables, the exploitable capacity of one variable depends on the temporary adaptation – the value – of its interlinked variables. In the case of manure and winter fodder, both the types and the available amounts can be adjusted, often within one agricultural year. These variables have unexploited capacity and are currently not exploited to their thresholds of tolerance. The opportunities for change in these variables contribute to the flexibility of the farming system. However, the situation is more complex for labour and water.

A reasonable objection to the above discussion is that this rather functionalistic perspective ignores the cultural significance of horse keeping. Cultural events such as the popular horse race festival (*Yartung*) could make substitution of horses with goats a quite unpopular strategy. In Manang, horse keeping is an index of success (Aase 2007), and traditionally they have the same high position in Mustang (Führer-Haimendorf 1975). Horses could thus be regaraded as traditional items for conspicuous consumption (Veblen 2005 [1899]). However, the merit achieved by conspicuous consumption is not necessarily tied to the very items as such. Umesh (male 24) claimed that *"nowadays very few have horses, they are taken to rural areas without roads, like Dolpa and Manang. Now very less horses, they use bike and jeep instead"*. In the Muktinath Valley motorbikes have become increasingly popular recent years, especially among young men who use every opportunity to show their possessions. A

motorbike indicates that the owner has been able to raise a significant amount of money, and it gives income opportunities by driving Indian pilgrims from the jeep stand at the end of the road to the Muktinath temple. During wedding ceremonies, the married couple traditionally rides on horses with beautifully decorated horsecloths, but at one occation in Ranipauwa the horses were substituted by a decorated motorbike instead (Krebs forthcoming). This event indicates that the items for conspicuous consumption could be changing in the Muktinath Valley. Even though the effect on winter fodder availability is not likely to be intentional, it is nonetheless beneficial for the production potentials of the system (see Mishra et al. 2003).

The people of Mustang's ability to adapt to changing conditions (such as the introduction of modern industrial products) while still securing cultural continuity is discussed by Messerschmidt (1982). The transition to new items for conspicuous consumption could be interpreted as a recent expression of this ability. In the words of Bateson (2000 [1972]), it represents the flexibility of ideas, that is, the flexibility to adjust cultural ideas to changing conditions. The adjustment of a cultural expression is possible because the level of generality is low, so the fundamental cultural idea of conspicuous consumption is not actually challenged. According to Bateson (2000 [1972]: 510), the highly generalised, basic ideas of a culture are often inflexible because they become premises upon which other ideas depend. If a fundamental idea was to be rejected, a whole set of derived ideas would follow in its wake. It is therefore easier to be flexible in changing the idea's expression, from horses to motorbikes, than to abandon or even change the general idea of conspicuous consumption altogether.

6.3 Three aspects of flexibility

Bateson is not the only one raising the issue of flexibility in the discussion of agricultural production or ecological systems. Especially in agricultural economic studies other definitions and distinctions have been applied (Adams and Mortimore 1997, Weiss 2001). Of relevance to the present discussion is the distinction which is made between operational and tactical flexibility (Carlsson 1989, in Weiss 2001). While operational flexibility is the ability to diversify production and switch productive capacity from one good to another, tactical flexibility is the ability to adjust the produced amount to external shocks. In other words and transferred to farming systems, I argue that flexibility may be analysed both in terms of *type* and of *scope*. Flexibility of type refers to uncommitted potentialities for change in a qualitative way by exploring new crops and resources and initiate new productive activities in

the farming system, while flexibility of scope refers to the potentialities for change in a quantitative way by expanding or reducing the scope of a resource or activity already in use. The analysis above of the potentials for increased overall production in the farming system thus represents the general flexibility of scope in the system, which may be further increased by using the flexibility of type. Scope and type thus constitutes two dimensions of flexibility (Figure 5). Although Bateson implicitly addresses flexibility both in terms of type and scope, an explicit distinction makes the flexibility concept more useful for analyses of farming systems. From the distinction I suggest theoretically that whithin each committed potentiality of type (e.g. to start cultivation of vegetables) there is an additional dimension of scope (potentiality to increase or reduce the amount of produced vegetables). Still, in an interrelated system, *all* potentialities of scope cannot be utilized simultaneously since the capacity of related variables (e.g. water) may be constrained in scope.

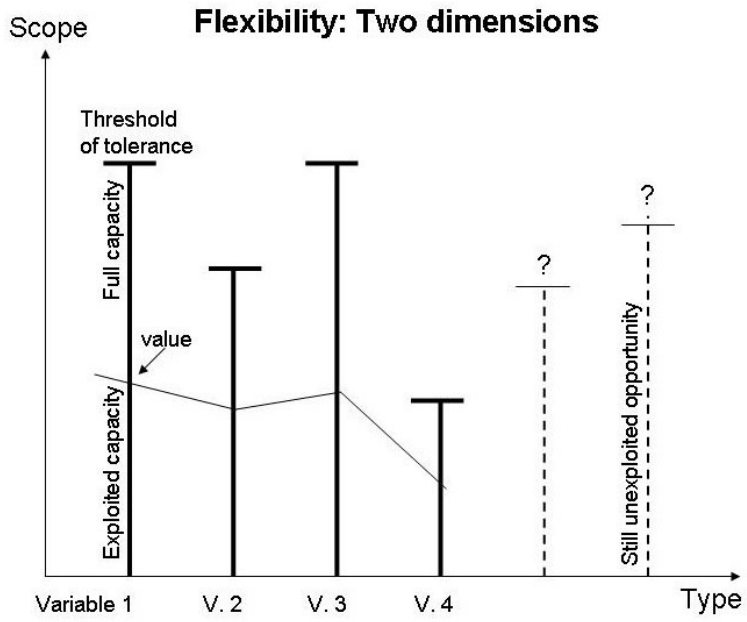


Figure 5: Opportunities of type and scope in system variables

The dimensions of type and scope are applicable both at system level and variable level. In the following I will reserve the concept of flexibility for the system level, emphasizing the overarching focus which is flexibility in farming systems. It is also worth to remind that the peasants manage this flexibility by making choices of where they want to allocate factors of production. Since the flexibility of the system depends on keeping many of the variables at values in the middle of their thresholds of tolerance, system flexibility requires that there are some opportunities for change in central variables. These can be opportunities of scope or

type. For water, the dimension of scope is the most important since there are limited opportunities to change the quality of water. For the remaining variables, opportunities for change in both scope and type are of relevance for the discussion of system flexibility.

In an interlinked system, to exploit opportunities of type in one variable may release the constraints of scope in *another* variable. The recent decades' transition from sheep to goats in the farming system could be interpreted as an exploited opportunity of type. Peasants claim that goats are stronger than sheep, they are more resistant to low temperatures, they eat less and they can find fodder where sheep cannot. Though wool from sheep is better suited for spinning than the hair of goats, nowadays few take the trouble of home spinning since manufactured clothes, textiles and threads for weaving are easily bought in the cities. Thus, sheep have lost the only function not already fulfilled by goats in the farming system. By substituting sheep with goats the pastures and winter fodder are more efficiently utilized, the risk of losing animals due to cold weather is reduced and good quality manure is produced. Such a change could relieve potential constraints of scope in winter fodder or in pastures.

A third aspect of flexibility may be conceptualised as *temporal flexibility* and defined as the time it takes to make adjustments in a variable or system, either in terms of type or scope. Bateson does not address this aspect of flexibility, but I will argue that the greater temporal flexibility a system possesses – the shorter adjustment time in central variables – the better is the adaptive capacity of the system under conditions of climatic uncertainty in general and climatic variability in particular. Temporal flexibility differs from the two previously discussed aspects. Flexibility of type and scope represent structural dimensions of flexibility, the ranges of uncommitted potentialities for change in the system. These can be statically identified in a snapshot analysis regardless of the time it takes for the changes to occur. While changes in a variable can repeatedly be made back and forth in these dimensions, temporal flexibility is an expression of how rapid the changes may be committed. Temporal flexibility thus represents the dynamic aspect of the system. Just as the farming system analysis provides a snapshot of the system structure, the opportunities of type and scope statically represent opportunities for adjustment in the system variables. Temporal flexibility is then an expression of the time it takes for these changes to occur. An opportunity which can be committed rapidly gives a high temporal flexibility, while an opportunity that demands significantly longer time to be committed gives a lower temporal flexibility. Since Figure 5 (p. 89) illustrates the structural dimensions of flexibility through the relationship between

opportunities of type and scope, the dynamic aspect of temporal flexibility is not included in the figure. Turning to my theoretical research question I find Bateson's conception of flexibility relevant and useful for farming system analyses. Furthermore, I find the concept to be even more useful as an analytical approach now that I have explicitly distinguished between three aspects of flexibility. In the following I will attempt to demonstrate the usefulness of this approach.

6.3.1 Flexibility of type and scope: Cash crops

The potentialities for maintained or even increased production in the farming system include not only the flexibility of scope to produce more of the same crops already under cultivation. It is perhaps even more interesting to investigate the flexibility of type, the opportunities for making rearrangements in system variables to identify uncommitted potentialities for change in qualitative terms. Several such potentialities are recently realized in Jharkot. One is the last two years' attempts of commercial apple production for export to markets, which was spurred by the reduced transport costs. The benefits of this strategy are that once the trees are well established they demand less labour than grain cultivation, cash crops are seen as more attractive than subsistence cultivation for young people and the expectations for profit from market sale are high. For the money earned, food, clothes and manufactured products can be imported to the village.

However, investment in apple production also involves uncertainty, mainly in tree ways. Firstly, land slides frequently cause the road to be blocked for several months at the time. This happened two times during the first year of road connection in a risk prone part of the road, south in Mustang. The road is particularily exposed to blockage during the summer monsoon, which may cause the road to stay closed all through the harvest season, obstructing the apples from reaching the market in a fresh state. Secondly, production for markets involves exposure to price fluctuations and competition. Pokhara is a large regional trading centre and the Mustang apple farmers do risk quite high price competition from apple producers in China and Kashmir. Thirdly, peasants report that pest occasionally damage the fruits and make them unsuitable for sale. These three challenges impose significant elements of uncertainty to the profitability of commercial apple production in Jharkot. When fields are converted to apple orchards, they are made unsuitable for grain production, so the peasants have limited flexibility to return to grain production without actually uprooting the trees. The temporal

flexibility is thus low. On the other hand, apples can be eaten whole, dried or squeezed as juice and superfluous apples can be spent as animal feed. Some households also make apple brandy and many peasants cultivate vegetables in between the fruit trees, so the orchards do have certain subsistence functions even if the apples do not reach the market and obtain a good market price.

Risks of crop failure due to pest, frost or seasonal drought during critical periods are present also in subsistence production. In that case, peasants wait a couple of weeks before they later try to plant another crop, such as buckwheat or vegetables. The possibility to replant the fields makes the temporal flexibility greater in grain production than in apple production. Still, monetary savings must often be spent to buy additional food when grain crops fail. There are thus uncertainties involved both in subsistence and cash crop production, but the risks are not necessarily the same. Cash crops are exposed to risk of sudden road blocks preventing the apples from reaching the market, but money earned from apple production can be saved as a buffer in case of crop failure the coming years. Subsistence crops are unaffected by road blocks and markets, but still exposed to risk of crop failure. Therefore, to combine subsistence and market production reduces the dependency on either one strategy. As no households in Jharkot have converted totally to apple farming but rather choose to diversify their crops, they act in accordance with a well known peasant strategy for risk reduction through diversification (MacDonald 1998, Mishra et al. 2003).

The diversification from pure subsistence production to include some cash crops implies to make use of the flexibility of type in the farming system. Since many households choose to convert only one or two fields to apple orchards while keeping the others for grains and vegetables, the temporary adaptation of the farming system is a middle position between subsistence and market production. Such an adaptation is probably also the most flexible as there are alternatives available should one strategy fail in a given year. As long as there are sufficient availability of cultivable land to include both grain fields and apple orchards, the peasants can keep the middle position, preserving the opportunity to make use of the flexibility of scope in either one direction. If the road is closed for a long period of time and the prospects are poor for obtaining good apple prices, then scarce resources such as labour and water can be reallocated from the orchards to the fields of grains and vegetables. Conversely, if the winter barley should fail, then more labour and water could be invested in obtaining a good apple harvest. In sum, while the temporal flexibility is low in terms of type

(it takes a long time to convert a field to an orchard or back again), if both orchards and fields are kept then the temporal flexibility in terms of scope is quite high. Since the peasants of Jharkot have chosen this strategy, their middle position between market and subsistence production actually increase their temporal flexibility through preserving the opportunity to alternate between cultivation in fields and orchards. Such a middle position also makes Shanin's (1988 [1971]) definition of peasants relevant for the people of Jharkot, small agricultural producers who produce mostly for their own consumption with the help of simple equipment and the labour of their families, while they are also partly integrated into market relations.

6.3.2 Temporal flexibility: Vegetable cultivation

Households with small land holdings have not planted new apple trees but rather keep to subsistence production of grains and vegetables. Although they do have the opportunity to rent and sharecrop additional land, which some also do, this entails giving half of the yields to the land owner and results in small returns from the additional labour investment. Poorer households often do not risk investing in new and uncertain activities such as apple production. Still, there are opportunities of type available also for them. With the introduction of tourism to the valley, local demand for vegetables increased as lodges began to serve food to tourists. The risks involved in vegetable cultivation are smaller than those of apple farming. Diversified vegetable cultivation demands smaller investments than apple tree planting, and the risk of road blocks is outruled since the market is local. Furthermore, since the same fields may be used both for grain and vegetable cultivation, the temporal flexibility is greater than by converting fields to orchards. Hence, it is easier to alternate between grain production and vegetable cultivation in one field compared to grain production and apple farming.

The temporal flexibility is also evident in the fact that vegetables are planted later in the spring than barley and wheat, so potential losses from crop failure in grain fields can be mitigated by plouging again and planting vegetables later in the season, an opportunity which is known and applied by local peasants. Likewise, if a field of vegetables should fail in the spring, the field can still be prepared for a crop of buckwheat later in the season. The temporal flexibility to change within the same growing season is possibly the greatest advantage of this strategy. If local demand for vegetables is low during a certain period, vegetables still have a significant subsistence function. Since the completion of the road, some peasants have also

started considering the opportunity for off-season vegetable export to Pokhara, a still uncommitted potentiality. Altogether the diversification of vegetable cultivation the recent decades, both for subsistence and for local markets, represents a flexibility of type in the farming system. The exploration of this flexibility of type has opened for new opportunities of scope to increase or reduce production of different crops and to alternate between them. Careful use of the temporal flexibility in vegetable farming contributes to mitigate the loss from crop failure in grain cultivation. Opportunities of type and scope are thus a prerequisite for temporal flexibility, and when a system's temporal flexibility is high, the system has considerable ability to cope with climatic uncertainty.

6.3.3 Flexibility through niche product diversification

Historically in Mustang, trade took place at the trade centres along the Kali Gandaki River and in the cities. The monetized market was other places, not in the Muktinath Valley where only small scale barter trade occurred. It was the tourists who brought the market to the Muktinath Valley through local demand for food and souvenirs. From that time on it became popular to take up the old tradition of weaving colourful Tibetan style scarves for sale to the tourists. A community weaving project was initiated and a fixed price was set for homewoven scarves. Women weave in lean periods, particularly during the winter when weaving is an effective way of making use of the abundance of spare time. Even households which do not engage in tourism in any other way often have some scarves to spare, and many a tourist is charmed by being invited into a home for a cup of milk tea and is later willing to buy a homewoven scarf or two.

Weaving represented the very start of coordinated niche production for the local tourist market, after which other initiatives have followed. Seabuckthorn juice was for long an uncommitted potentiality in the farming system, an opportunity of type of which the villagers were aware for more than ten years before they chose to make use of it. The juice production is still in its initial phase and there are great opportunities to increase the scope of production if the juice is successfully advertised and sales agreements are established in the cities. The contractor of 2009 stated: *"Slowly, slowly, piece by piece we develop it. I will soon take it to the lab, get it tested and identify the contents. And then I will get it registered as a juice"*. In 2009 the Woman Development Group did not collect all available berries because a proper supply chain was yet to be established, and because the juice was still in the process of being

properly developed as a niche product. There are opportunities to further increase the availability of berries by substituting rosehip bushes with seabuckthorn. Rosehip (*Rosa sericea, cherma* in vernacular) grows extensively in locations which are also suitable for seabuckthorn such as by the edges of streams, but rosehip plays only a marginal role in subsistence. The alternative uses of seabuckthorn for cosmetics and oils are not yet explored but there is a possibility that commercial enterprises would be interested in buying unprocessed berries. However, it is quite uncertain what price per kg the pluckers would get from such an agreement, and local control of the resource could deteriorate. As of now, the community is in control of the whole business from planting to sale, a control which renders possible active use of the opportunities of scope in seabuckthorn juice production.

Increased use of seabuckthorn has ecological implications in addition to the economic ones. Since the plants grow in common lands they do not compete with grains, vegetables or fruit trees for space in fields and orchards. Seabuckthorn is normally not irrigated, though this could occationally become necessary to secure good berry quality now that the plant is more deliberately harvested. Being resistant to great variations in temperature and water availability, seabuckthorn is a well adapted plant even under conditions of climatic uncertainty and variability. It means that the uncertainties involved in juice production are market related rather than climate related, as opposed to grain cultivation. Since the uncertainties involved in grain cultivation and seabuckthorn juice production diverge, a combined strategy will reduce the cost of failure in either one. The people of Jharkot's reliance on both strategies is thus a very flexible adaptation, facilitating the opportunity to adjust the scope of either one and to do so rapidly, even within one growing season.

The acquired experience from community projects of niche production may be transferred to other non-timber forest products, such as herbs and medicinal plants. Fragrant mint, rosehip and various medicinal plants used by the *amchi* (Tibetan medical doctor) grow wild in the common land of Jharkot, and there is an opportunity of type to make use of these non-timber forest products commercially. *Yarzagumba* gathering represents one such committed potentiality, although it cannot be successfully domesticated. Since it is generally hard to find and nearly impossible to find under the cover of snow, gathering is an unreliable activity. Other medicinal plants such as herbs are easier to domesticate. They are therefore more reliable for development of niche products and for sale to pharmaceutical companies. There is currently a growing international market for herbal products from Nepal, and multinational

pharmaceutical companies are searcing for active substances in wild plants for development of new medicines (Chhetri and Gupta 2007). Herbal products are often of high monetary value relative to weight and they may be sundried, stored and transported down to the cities whenever it is most convenient. Compared to commercial apple farming the transport challenges and costs are significantly lower for herbal products. The people of Jharkot already use a wide range of non-timber forest products for subsistence purposes, and the *amchi* possesses important knowledge of the properties of the various plants, so the potentialities for commercial exploitation are substantial. Herb cultivation is also an opportunity that is easily adjusted in scope, meaning that the production can rapidly be increased dependent on labour and water availability, the prioirities of the community and on the estimated chances for making good money on the business. The temporal flexibility of herbal niche production is in other words high.

6.4 Limits to flexibility: Constrained variables

As Bateson (2000 [1972]) clearly states, there are limits to flexibility. These limits are defined as the variable's thresholds of tolerance so that the full capacity of a variable consists of its opportunities of scope between these thresholds. However, limited or underutilized capacity in one variable can actually constrain the general performance of the system. In Jharkot today, the most constraining variables are labour dedicated to agriculture and water in the spring. How do people allocate labour and water in the farming system of Jharkot?

6.4.1 Flexibility and constraints in labour availability

Agriculture is characterised by great seasonality but particularly so in farming system with long lean winter periods such as Jharkot. This requires flexibility in labour availability. While the demand for labour is high during the peak summer harvest, the total produce of the system is not sufficient to sustain the same number of people throughout the lean winter season. The traditional adaptive response has been one of seasonal migration and diversification into alternative seasonal livelihoods like salt trade and labour migration. The practice demonstrates that the people of Jharkot have found a temporary adaptation which includes a significant flexibility of labour. However, the farming system is also affected by social changes such as increasing levels of education. When asked for the main constraints in agriculture, Purna (male 46) stated that

> *"There are two things. One is lack of water, the other is that people are going away, like I told you, for education in Pokhara, Kathmandu… So we have to change, to plant other things, like this tora[14]. We have to think of our children, what they want to do in the future."*
>
> *"I don't want to become a farmer, I don't know how to do it, I can't work that hard. If I come back, I want to start a hotel, do business."* (Bijay, male 28)

From the first quote we understand that the two main constraints to agricultural production are lack of water and labour. Most parents put great efforts into giving their children education, and thus send their children to the cities at young age. After having spent ten years or more in the city, with sporadic returns to the village only during longer holidays, far from all youths choose to return to their village of origin to take up farming after completed education, as household interviews and the second quote above demonstrate. The needs of agricultural production are not necessarily of top priority (Reardon 2000, Aase and Chapagain 2005). Many households rely on remittances from family members who are working abroad or in the cities, and young males are often sent out for this purpose. Seasonal migration to India is quite common and although most return in time before the harvest, not all do. To engage in local livelihood strategies in transport and tourism is also an option if one is lucky enough to succeed. In sum, a large share of the labour burden from farming is left to the women, which add to their already significant burden from activities such as child care and house keeping. The same flexibility of labour through migration is now used to such an extent that it actually constrains agricultural production. The temporary adaptation of labour available for agriculture is in other words close to its lower threshold not only during the winter, but also more generally throughout the year. The system's flexibility of scope in labour availability is then quite large since it is possible to reallocate significantly more labour into agricultural production if people choose to do so.

On the other hand, flexibility must be used once in a while in order to prevail (Bateson 2000 [1972]). While seasonal migration represents labour's flexibility of scope in the system, too much migration at the same time involves a loss of flexibility as it will be more and more cumbersome to return to farming as time passes by in the city. In the words of a mother: *"When the children are home, they don't work in the fields. They can't work in the fields, they don't know, they are students"*. A father who had recognized this stated that *"I always bring my children back home, in every holiday. So they remember, or else they will forget, if they*

[14] Tora is the local name for seabuckthorn.

are not here in many years". In one particular case, a family chose to give up their flexibility to return and instead abandoned their house and fields altogether, moving permanently to Kathmandu. As land can not be sold to non-Jharkot residents, the family chose to hand over their fields to the community, which in turn manage the fields collectively by sharecropping them out and letting the owner's share be distributed among the village households. This strategy leaves the community in control over the land, although the household in question has lost their flexibility to return to farming. Another household, also of which all members live permanently in Kathmandu, chooses to keep their house and fields empty in Jharkot. One of the sons visits the village occasionally, and although he does not farm or keep animals, he manages to keep the social relations active. The flexibility of this household is to some extent kept, even though a return would demand significant investments of capital for buying animals, seeds, manure and labour to rebuild terraces and maintain the irrigation system.

At the village level, however, cooperation in the community gives the farming system greater flexibility than what a single household can manage to build up. Some households coordinate winter stall-feeding so that a household keeping one or two persons in the village can care for the animals of their neighbours as well as their own. When a proper stock of winter fodder is built up, only the daily feeding is left for the person staying behind. One of the households choosing this strategy keeps fewer animals than they need for manure and buys additional manure locally. Conversely, households with smaller land holdings have the opportunity to build up larger animal herds in order to sell the excessive manure from the stables. The interdependence of the system is evident in that there must be a balance between the two strategies, since large herds demand large amounts of winter fodder, which is contingent upon the availability of dry leaves and crop residuals in the farming system. Thus, the specialisation of one household is only flexible if it is balanced by the converse specialisation of another household in the farming system. In Jharkot, there seems to be such a balance in terms of manure and winter fodder. As argued above there is unexploited capacity of scope in both these variables. Since one of the main constraints to increased agricultural production today is seasonal lack of labour, local food production may again be increased in scope, at least before local impacts of climate change is considered.

6.4.2 Flexibility and constraints in water availability

The farming system analysis demonstrates that scarcity of irrigation water is periodically a constraint in the farming system, particularly in the spring. Seasonal variations are quite normal and over the years the farming system has adapted to these through practices such as coordinated irrigation and delayed planting practice. Coordinated irrigation at village level secures all households equal entitlement to water. Since the days of irrigation are distributed among the village households, there are incentives to optimise the allocation of water during that time. The system has flexibility of scope since in times of water abundance, only a fraction is used while the rest bypasses the fields and instead flows straight into the stream. In times of scarcity, however, the full capacity of water is used and each peasant must prioiritize where he wants to allocate his share of the water. Still, the total amount of irrigation water is sometimes too low to meet the requirements of agriculture. In other words, the variable is stressed and takes on a value close to its upper threshold.

On the other hand, water is a resource with high temporal flexibility. Through the irrigation system, water can rapidly be reallocated from apple orchards to grain or vegetable fields. In comparison, to plant new trees takes several years from the decision is made to the results are seen. The high temporal flexibility renders possible a deliberate spending of water in times of scarcity which is essential for the utility of other variables' opportunities of type and capacity of scope. There is little use in having available capacity of scope in the cultivated fields if it cannot be exploited rapidly enough in times of need. At the same time, opportunities of type in the cultivated fields and orchards reduce the sensitivity to short-term water scarcity since not all crops are in critical need of irrigation at the same time. Only a combination of all three aspects of flexibility can reflect the adaptive capacity of the farming system under conditions of climatic uncertainty.

In sum it seems clear that in Jharkot the most constrained variables in terms of scope are labour and water. These two variables are crucial in the farming system. Without sufficient availability of both, agricultural production is constrained. However, both water and labour have short adjustment times and thus high temporal flexibility. Water and labour can therefore rapidly be reallocated in response to external changes and variations, such as those of climate. The flexibility of the farming system to make changes in type and scope can be used to

optimise productivity to water or to dedicated labour[15] when these are under stress, making the most out of the stressed variable by allocating it to where it is most needed. In the words of Bateson, system flexibility depends on keeping many of the system variables in the middle of their full capacity of scope. The opportunity to change priorities in the system is in this way preserved. Speaking more directly, in times of water scarcity the apples may be neglected for one season and irrigation water instead allocated to barley. More labour could still be invested in seabuckthorn juice production, since seabuckthorn normally does not need irrigation. Likewise, collection of medicinal plants such as *yarzagumba* does not require extra water.

The total amount of meltwater in the high mountains is dependent on temperature and precipitation, conditions on which the peasants of Jharkot have no influence. The prospects for water availability in the context of climate change will be discussed in the next chapter, which concerns local climatic uncertainty. However, the amount of irrigation water can in fact be altered to some extent at the local scale. Before a new pipeline from the Rashakesh well is completed, lack of water in the spring constrains agricultural production. The fact that a previously underutilised water source is now being brought into use demonstrates that the total capacity of available water may actually be expanded by allocating more of the mountain meltwater to the farming system. In addition, the pipeline is expected to affect the timing of the water and thus increase the temporal flexibility of water, making more of the meltwater available to the farming system at the time when it is needed the most.

The case demonstrates an important point concerning boundaries in system analysis. If the system was to be defined narrowly, treating the water access as an external factor, then the present water availability would be taken for granted and assumed to be fixed. When water is instead included as an internal variable of the system and analysed in terms of flexibility, then the uncommitted potentiality – which is currently being committed – to expand the scope of water running through the system becomes evident. In other words, it is of vital importance how the boundaries of the system are defined and that important factors are not a priori defined as independent variables. Similarly, the case of the new pipeline demonstates that a variable's capacity should not be assumed as absolute, even if this is how it immediately seems. The nature of thresholds will be discussed more indepth in the following.

[15] This statement should not be interpreted as an argument in favour of exploitation of labour, but to the contrary to increase the productivity of the amount of a household's labour which is dedicated to agriculture.

6.5 The nature of thresholds in ecological systems

According to Bateson (2000 [1972]), each variable in an ecological system allows movement between an upper and lower threshold of tolerance. If the variable is exposed to stress to the extent where it is ultimately pushed beyond one of these thresholds, the variable could collapse and consequently the whole system would suffer. If the argument of Bateson implies that that the thresholds of a variable are assumed to be fixed, some interesting questions arise: Is it not possible to actually change the thresholds of tolerance, not by denying their existence, but rather by expanding the capacity of the variable? Or is the very nature of such a threshold to be fixed, describing the point beyond which the variable cannot be sustained over time? At this point there is a need to specify which dimension of flexibility the question addresses. Since the theoretical argument of Bateson implicitly refers to the dimension of scope in system variables I will confine the discussion to the quantitative dimension of flexibility. Before addressing the question, though, some contextual knowledge is needed in order to understand the position of Bateson in this matter.

6.5.1 Flexibility in context: Limits to growth

Bateson originally published his book, Steps to an Ecology of Mind, in 1972, which was still quite early in the coming decades of environmental and ecological concern. To his abstract argument Bateson applies the example of overpopulation and human refusal to bear the consequences from it, such as famine and epidemics. Without ascribing to Bateson a particular discursive position which he might not share (see Vayda 1996), this example is in line with the neo-Malthusian revival of the 60s and 70s, predicting an ecological crisis in tandem with what was described as a population explosion. The main advocates for this view were Ehrlich and Hardin (Benjaminsen 2002). Throughout the following decades, reports such as The Limits to Growth (Meadows et al. 1972) and Our Common Future (Brundtland 1987) also advocated this view, as did adherents of the Theory of Himalayan Environmental Degradation (Eckholm 1975). Although the most severe predictions have been modified or even refused during the last decade, great influence remained from this debate such as concepts like sustainable development and carrying capacity, the latter clearly associated with thresholds of tolerance.

The neo-Malthusian school of thought met great resistance from those adhering to the argument made by Boserup (1965). She perceived population growth as a resource and stated

that agricultural production may actually be quite flexible. Her argument was that in the analysis of agriculture, population growth should be seen as an independent variable and food production as the dependent one, quite contrary to the Malthusian argument. Further she claimed that through intensification plus technological and efficiency improvements, total food production may be increased (ibid.). Human demands can thus be met without immediately imposing a threat to the ecological system, she argued.

The essential difference between these two opposite positions is exactly the question of whether the thresholds of tolerance are fixed or themselves flexible. While few deny the total absence of an ultimate limit, the question is rather where the line goes. Returning to Bateson, the question is whether or not it is possible to expand the full capacity of a variable, or its elbow room, to use the metaphor of Bateson. His theoretical argument does in fact logically allow a variable to expand its capacity at the expense of another variable. To quote Bateson,

> "if a given variable remains too long at some middle value, other variables will encroach upon its freedom, narrowing the tolerance limits until its freedom to move is zero or, more precisely, until any future movement can only be achieved at the price of disturbing the encroaching variables." (Bateson 2000 [1972]: 511)

This means, theoretically, that a crucial variable may actually expand its full capacity if other variables are accepted to be narrowed in their freedom of manoeuvre. Hence, it becomes a question of priorities, where the flexibility of having available capacity is assumed to be most needed, even if this capacity cannot always be exploited. Applied to a concrete example this could mean to keep fields instead of orchards in order to preserve opportunities for rapid change of crops, which is greatest in the fields. Such a change would expand the capacity of the fields at the expense of orchards, even if the full capacity could not be used due to limited availability of water or labour. In case of drought or crop failure, there is still an opportunity of type in the fields to plant a second crop of vegetables or buckwheat later in the season.

6.5.2 Thresholds of tolerance and constraints

A premise for the argument above is that the amount of available water is often insufficient to allow for utilization of the full capacity in fields and orchards simultaneously. It is thus the capacity of a third variable which constrains the utility of fields and orchards' capacities of scope. At this point there is a need to distinguish between constraints and thresholds of tolerance. The *constraints* imposed to a variable (e.g. fields) make parts of its full capacity

unexploitable because of limited availability in related variables (such as water). On the other hand, a *threshold of tolerance* is rather the point where the variable's full capacity is exploited in scope (all cultivable fields are cultivated every year). The distinction is decisive for which solutions are suggested to a given problem. When the whole system is considered, it implies to look for constraints to increased agricultural production not only in the fields as such, but rather in the related variables such as availability of water. If the water variable possesses opportunities of scope and more water becomes available, this could actually relieve the constraints imposed to the capacity of the fields and thus permit increased production.

This is not to deny the existence of ultimate thresholds of tolerance, though, only to say that the premises for a variable's full capacity of scope should not be taken for granted from the outset. In the preceding analysis I have attempted to demonstrate that even water availability may be expanded in scope. As in the dispute between Boserup and neo-Malthusians the question is not whether ultimate thresholds of tolerance exist in ecological systems, but rather where the lines are drawn. In that regard it is important also to investigate the premises of the system, such as the potentials for increasing the water access of the system in the example above. Still, there might be other premises not yet addressed. The short growing season of Jharkot is for instance one such premise which until now is taken for granted and defined as an external constant in the analysis, since the feedback from the farming system to the average temperature of the valley is negligible. However, when the influence of climate change is to be considered in the next chapter, the average temperature and consequently the length of the growing season can no longer be assumed as a constant premise to the flexibility of the system even though it is defined as contextual.

After having analysed the farming system of Jharkot in terms of flexibility, I argue that the conception of flexibility provided by Bateson is a useful tool for the purpose. With my distinction between the three aspects of type, scope and temporal flexibility, I find the approach even more useful for an empirically based analysis. Hence, Bateson's theoretical notion of flexibility may be operationalised and applied in farming system analyses. The next question, then, is how flexibility relates to the concept of 'adaptive capacity' of a farming system under conditions of climate change? The next chapter will address this question.

6.6 Meeting an uncertain future

This chapter has demonstrated that in the farming system of Jharkot there are great opportunities of type and scope in many, but not all, of the system variables, and the temporal flexibility to facilitate rapid changes within these dimensions of flexibility. There is unexploited capacity of scope in cultivated fields and orchards, in domesticated animals and manure, in pastures and planted trees. All of these factors of production can be exploited more intensively, as has been the case historically. Furthermore, there are opportunities of type which involve diversification of agricultural production to include commercial farming of apples, cultivation of vegetables and niche production of seabuckthorn juice, medicinal plants and herbs. It is argued that each new committed potentiality of type opens for an additional dimension of scope, although the full capacities of all the crops cannot be exploited simultaneously. It is further suggested that to keep a middle position between market and subsistence production probably is the most flexible strategy since it preserves the ability to alternate quickly between different productive activities. This strategy is widely applied in Jharkot. Hence, in many respects there are rich potentialities for maintained or even increased local agricultural production in the farming system of Jharkot.

However, there are two main constraints to the overall flexibility of this farming system. The farming system is exposed to seasonal scarcity of labour and water. Scarcity in either one of these variables constrains the general performance of the system since without sufficient availability of labour or water, the capacity of the related variables cannot be fully utilised. Still, it should not be assumed that the restricted variables have reached their absolute thresholds of tolerance. I have argued that not only should constraints be distinguished from thresholds of tolerance, but also that it is possible to permanently expand the capacity of scope in a central variable, here exemplified by the effort made to increase the available amount of irrigation water by a new pipeline.

When taking into account the uncertain climatic future of local farming systems in Himalaya, flexibility becomes a highly relevant issue. How can farming flexibility strengthen the system’s ability to cope with expected, but locally uncertain climate change? To what extent does the farming system of Jharkot have adaptive capacity to maintain local agricultural production in the face of climate change, and what about the constraints? It is now time to include climate change in the discussion of farming flexibility.

CHAPTER 7: THE CHALLENGE OF CLIMATIC UNCERTAINTY

Himalaya is among the regions of greatest concern in the scientific debates on climate change. Being the water tower of several great rivers systems, the diminishing of snow and ice resources in the Himalayan mountain region will have consequences far beyond mountain areas. However, in small Himalayan communities, climate change is only one of several global processes to which people relate. With extensive migration, international tourism and trade, rising levels of education and infrastructure and communication development, remotely located Himalayan communities are far from detached from large scale processes in the wider world. In a recent study from Manang, Aase et al. (2010) have analysed farming flexibility in small Himalayan farming systems similar to Jharkot. One of their conclusions is that despite living in a remote location, the people of Manang take part in global processes of tourism and trade, and through dynamic adaptation to changing conditions they are capable of exploiting new opportunities to their own benefit. The same conclusion could probably be drawn from Jharkot where the people could be regarded just as dynamic as their neighbours in Manang. A focus on flexibility is therefore a fruitful way to approach the question of adaptation to various global processes. At this point, however, the discussion will be confined to one particular global process – climate change – and the potentials for maintained or even increased local agricultural production if people wish to do so. Addressing my third research question I will discuss whether and how flexibility in the farming system of Jharkot may enable the system to maintain or even increase agricultural production under changing local conditions in temperature and water availability.

7.1 Climate change: A brief overview

The potential impacts of climate change on agricultural production in Himalayan farming systems are many and complex. One may focus on the risk of natural hazards such as seasonal droughts and floods, landslides and erosion, on changes in biodiversity, pests, pollination and migration of species, or on indirect effects resulting from risks of road blocks and rising food prices. Of crucial importance to all farming systems, however, are changes in temperature and water availability, the two climatic factors constraining agricultural production in the farming

system of Jharkot. Temperature and water availability will therefore be in focus when I in the following give a brief overview of climate change research and projections for food production in Asia and for temperature and water availability in the Himalayan region.

7.1.1 Climate change impacts on food production in Asia

The climatic outlooks for Asia are rather gloomy when it comes to water availability and food production. According to the IPCC[16] (2007: 471), Asia must prepare for enhanced climate variability, intense rainfall over shorter periods of time and more rapid melting of glaciers. These changes will most likely alter the water supply of millions of people and impose great challenges to agricultural production in Asia, resulting in decreasing yields and rising food prices (ibid.: 482-483). During the past few decades, rice, maize and wheat production has declined in many parts of Asia as a result of increasing water stress, arising partly from changing weather conditions. Furthermore, rice yields were observed to decrease by 10% for every 1^{o}C increase in growing season minimum temperature (ibid.: 475). Additional losses in agricultural productivity in Asia are expected throughout this century as a consequence of climate change, with decreasing crop yields up to 30% by 2050 in Central and South Asia (ibid.: 479). Furthermore, global cereal prices are projected to increase more than three-fold by 2080 (ibid.: 482). These prospects represent a serious threat to food security for millions of people in Asia, particularly since water from the Hindu Kush – Himalaya and central Asian mountain regions today supports more than half of Asia's cereal production with water (Nellemann and Kaltenborn 2009).

Should these projections become the future reality in Asia, local small-scale food production will probably become increasingly important for food security. If more people will choose to engage in agriculture and increase their reliance on local production, the potentials for maintained and even increased local agricultural production will be of crucial importance. The need for more research on such potentials under conditions of climate change has been repeatedly expressed (NTNC 2008, Richardson et al. 2009). What are, then, the climate change projections for temperature and water availability in the Himalayan region?

[16] Since the objective of the Intergovernmental Panel on Climate Change (IPCC) is to synthesize all relevant scientific acknowledged resources on climate change, they refer to an extensive range of research in their reports. Instead of including all indirect references, page numbers from the IPCC (2007) report are included here.

7.1.2 Himalayan melting: Climate change outlooks at a regional scale

It is thoroughly documented that rising levels of greenhouse gases in the atmosphere leads to near-surface warming (Barnett et al. 2005, IPCC 2007: 471), and that Asian surface air temperatures generally show a rising trend (IPCC 2007: 472). Studies from Nepal indicate that current warming at higher altitudes occurs much faster than the global average (Nellemann and Kaltenborn 2009), according to some studies upto three times as fast (Xu et al. 2009). It is projected that the Asian land mass will experience an average annual mean warming of about 3^{o}C by the 2050, and about 5^{o}C by 2080, and even more on the Tibetan Plateau (Rupa et al. 2006, in Xu et al. 2009, IPCC 2007: 471). This has serious implications for the large snow and ice covered areas of Himalaya, which form the largest body of ice outside the polar caps (IPCC 2007: 493, Hua 2009). Not only have rapid reductions in the volume of Himalayan glaciers already occurred (Xu et al. 2009), but Himalayan glaciers have also been retreating more rapidly than glaciers elsewhere in the world (Cruz et al. 2007, in Kehrwald et al. 2008, Dyurgerov and Meyer 2005, in Xu et al. 2009). Only glaciers at very high altitudes seem to be on safer grounds, since net mass reduction is rare for glaciers above 6,000 m.a.s.l. (Kehrwald et al. 2008). Still, IPCC projections suggest that by 2100 the current coverage of glaciers in High Asia is likely to have declined by at least 43% (low estimate, 1.0^{o}C temperature rise) and up to as much as 81% (high estimate, 6.0^{o}C temperature rise) (Zemp and Haeberli 2007). With rising temperatures the extent and amount of snow will also decrease as the snow line moves to higher elevations (ibid.).

The massive melting of snow and ice will have serious consequences for millions of people whose water supply is dominated by meltwater since the impact on river flow patterns will very likely be profound (Xu et al. 2009). While meltwater discharge increases during melting, it will most likely be followed by a rapid decline when the glaciers have reached new equilibria or disappeared completely (Barnett et al. 2005, IPCC 2007: 483, Xu et al. 2009). Snow and ice covered areas serve the purpose as water storages which delay the meltwater and distribute it throughout the dry season. With rising temperatures more of the precipitation will fall as rain and thus not be stored in ice and snow. Hence, the seasonal discharge patters will probably shift, exposing areas which depend primarily on meltwater to more and longer periods of critical water shortage, particularly during the dry season (Barnett et al. 2005, Zemp and Haeberli 2007, Xu et al. 2009). As a consequence, seasonal variations in many meltwater fed rivers will probably be amplified.

The outlooks for precipitation patterns are more complex and uncertain, however (Barnett et al. 2005). The last few decades, monsoon patterns have shifted in the Himalaya, but the picture remains ambiguous (Shresta et al. in Xu et al. 2009). Still, increased variability in precipitation is expected (Cruz et al. 2007, in Kehrwald et al. 2008), with intense rain occurring over fewer days, followed by longer dry periods (IPCC 2007: 484). Changes in precipitation tend to affect the volume of water in the streams, while temperature changes mostly affect the timing of the water (Barnett et al. 2005). Nevertheless, even without reductions in the annual volume of precipitation, annual figures cover up seasonal variability in precipitation, and less storage capacity in mountain ice and snow could cause the discharge to be more directly correlated with precipitation patterns. With intense rain over shorter periods of time and limited storage capacity, much of the water would be lost to the ocean during wet periods.

In sum, the Himalayan region will most probably face rising temperatures throughout this century, with increasing melting of ice and snow as a consequence. With less storing capacity for water in the mountains, the timing of the water will probably change, involving increased seasonality of river flows. Changes in precipitation patters are complex but expected to include more intense rainfall over short periods of time, increasing the risk of seasonal droughts and floods. Declines in the overall food production in Asia are expected although the changes will probably involve significant local variations in productivity.

Despite these rather alarming regional outlooks, there are nevertheless great variations in micro-climatic conditions. Climatic variations between localities are covered up in regional estimates and reliable models for local climate are still to be developed (Aase et al. 2010). Thus, regional projections are of limited value for local communities and farming systems trying to adapt. In farming systems like Jharkot, *uncertainty* is probably the best characteristic of future climatic conditions, particularly since natural variability will add to long-term changes in temperature and water availability. The best the people of Jharkot can do is therefore to increase the adaptive capacity of their farming system, the ability of the system to cope with varying climatic conditions. As earlier suggested, one way of doing this is by seeking to enhance flexibility in the system and look for ways to reduce the main constraints. In the words of Bateson, to create flexibility is to create preadaptation to unpredictable change (2000 [1972]).

7.2 Flexibility as adaptive capacity

In the literature there is a multitude of concepts related to adaptation to climate change in social and ecological systems. Some of these are vulnerability, sensitivity, resilience, exposure, capacity of response, adaptive capacity and adaptation. Not only do they constitute a complex web of partly overlapping concepts, but there is also lack of general agreement on the precise meanings of the different terms (Gallopín 2006). This is, however, not the place for thorough discussions of the definitions and demarcation of the various concepts as these can be found elsewhere (Adger et al. 2003, O'Brien et al. 2004, Gallopín 2006, Smit and Wandel 2006, Vincent 2007). Instead, I will permit a brief discussion on how flexibility is related to adaptive capacity and adaptation.

In relation to climate change impacts, the IPCC (2007: 869) defines adaptive capacity as "[t]he ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences." Building on Smit and Wandel (2006), I suggest that the flexibility of a system may be seen as an expression of its adaptive capacity. Flexibility is precisely the total range of uncommitted potentialities of type and scope that the system may explore to adjust to changing conditions, in this case confined to climate change. Furthermore, adaptive capacity is characterised by the ability to adjust to changes quickly and easily (Denevan 1983, in Smit and Wandel 2006), a feature I have conceptualised as temporal flexibility. By regarding flexibility as an expression of adaptive capacity, I find the flexibility concept to be relevant and useful for analysing the ability of a farming system to cope with locally uncertain effects of global climate change.

'Adaptation' is defined in numerous ways in climate change literature, but according to Smit and Wandel (2006: 286), "[a]daptations are manifestations of adaptive capacity". If the adaptive capacity of a farming system is expressed in terms of flexibility, it follows that adaptation means to make use of uncommitted potentialities of type and scope and to preserve the ability to make rapid adjustments in the system. A short-term adaptive measure is not necessarily a permanent change, but rather the utilisation of flexibility in the system. For instance, a cultivated field could be dedicated to barley production one year and vegetable production the next. In paragraph 4.2.4 on new ecology I suggested that the current state of a system could be called its temporary adaptation and that dynamism is not a threat, but rather a

feature of the system. This is a flexible approach to adaptation. At the same time, adaptation also includes long-term and permanent changes. In short, a system adapts when changes are made, regardless of the time horizon of the particular change. Furthermore, adaptation can be responsive as well as proactive (Smit and Wandel 2006). Proactive and long-term adaptation could for instance be to stabilise slopes before landslides occur, or to construct new irrigation channels when greater seasonal variations in water availability are expected.

Naturally, people's expectations of climate change are not necessarily the main motivation behind every measure of adaptation, since people and farming systems also adapt to other global processes. For instance, the choice of many households in Jharkot to let a significant number of their family members migrate for education or wage work does in fact often constrain the agricultural production of the household in question through seasonal lack of labour. Nonetheless is the decision an expression of the priorities of the household. If people in the future will find local farming more attractive relative to alternative livelihood strategies, for instance in response to changes in food prices or labour markets, the potentials for maintained or even increased local agricultural production are important to investigate. Returning to the farming system of Jharkot, it is time to discuss these potentials under various trajectories of change in temperature and water availability at the local scale.

7.3 Opportunities under warmer climatic conditions

> *"We harvest the uwa [barley] in July. And then, immediately after, we plant phapar [buckwheat]. If the frost is late, we get good phapar. If it's early, the harvest is not good."* (Purna, male 46)

Short growing season has historically been a constraint to agricultural production in Jharkot, but with rising temperatures, the growing season could possibly be prolonged. Although uncertainty exists at the local scale due to microclimatic conditions, a rise in average temperature is plausible since warming is expected to amplify at higher altitudes. In Jharkot, warmer climatic conditions will increase the risk of thaw periods followed by frost during the winter. Today, some of the fields are sown with seeds of barley in October in order to be harvested two weeks earlier than the remaining crops. A permanent snow cover normally protects the seeds during the winter. This is done in order to make time for a second crop of buckwheat before the first frost in the autumn. However, if winters warming occur, thaw periods followed by frost on bare ground could cause frost damage to the winter barley.

Today, peasants delay the sowing of some of their fields to February in order to spread the risk of crop failure, but spring sowing does not allow time for a second crop of buckwheat.

On the other hand, higher temperatures may delay the first frost night in the autumn and generally prolong the growing season. In that case there could be time for a second crop of buckwheat even in the barley fields sown in February, and possibly also in the wheat fields, which would include a change in the agricultural calendar. The peasants are thus flexible to choose the time of sowing, before or after the winter. If the winters generally turn out to be warmer, they have the opportunity to delay sowing of all crops until February – and still have time for a second crop of buckwheat. Still there is climate uncertainty, however. If greater *variability* in temperature turns out to be the greatest challenge, in one year there might occur both winter thaw and frost nights early in the autumn. Under this quite unfavourable scenario, the most flexible strategy would probably be to keep spreading the risk through delayed planting practice, to plant some fields in October and some in February. Should the first annual crops fail, the fields are available for early buckwheat cultivation while a smaller crop of February-planted barley is still secured. In short, the peasants' flexibility to choose sowing time and to alternate between different combinations of crops reduces the risk of total crop failure, not only under a scenario of increased mean temperature, but also under conditions of increased temperature variability.

For wild perennial plants, however, peasants cannot influence the response of the plants to rising temperatures. A recent study from the Arctic shows that species like mountain crowberries (*Empetrum Hermaphroditum*) and other dwarf shrub vegetation are considerably damaged from winter warming events with subsequent frost (Bokhorst et al. 2009). During periods of thaw the protecting snow cover melts away and premature foliage in the plants make them more prone to damage when frost reoccurs. To what extent these findings are transferrable to the farming system of Jharkot is debatable however, since the temperature requirements of wild berry-shrub do differ. In Jharkot, seabuckthorn is the berry of highest economic value and as mentioned earlier the plant is remarkably resilient to temperature fluctuations, being capable of surviving extreme temperatures from – 40^{o}C to + 40^{o}C. Hence, this recently commercially exploited resource is probably resistant enough to survive more frequent frost – thaw alternations during the winter. However, the impact on the berry quality is still uncertain.

Higher temperatures could open for new opportunities of type in the cultivated fields. Certain species currently cultivated at lower altitudes could in the future possibly be grown also in Jharkot. In the village Khinga, located 300 m lower than Jharkot, maize is cultivated. Attempts of maize cultivation have been made in Jharkot, but so far with poor results. Under warmer climate conditions, however, new attempts could perhaps be more successful. Maize cultivation might become an uncommitted potentiality of type in the cultivated fields. Furthermore, conditions for vegetable cultivation could be improved by rising temperatures and longer growing season, giving additional opportunities of type in the cultivated fields. Today, some peasants experiment in vegetable cultivation by means of basic technology greenhouses, small tents made of sticks and white plastic covers. New vegetable and herb species could perhaps be introduced to the farming system if experimental attempts in greenhouses turn out to be successful. When vegetable cultivation was first introduced to the farming system several decades ago, the farming system's flexibility of type was expanded, providing new cultigen options among which the peasants could alternate. With changing and most probably rising temperature conditions, this flexibility could be further expanded. Greater diversity of cultigens increases the peasants' opportunities of type to alternate between different crops, and their opportunities of scope to expand and reduce the amount of each one. Since vegetables are planted in April and May, the cultivator may also delay the decision of what and how much they will plant and consider the weather outlooks for the season before they decide. Hence, the people of Jharkot possess temporal flexibility to make rapid adjustments in type and scope of their crops. Active use of this flexibility improves the ability of the farming system to maintain agricultural production under changing temperature conditions. Temporal flexibility is conditioned by available capacity and opportunities of type in variables such as fields, manure and labour, to enable the cultivators to spread the risk of crop failure and make new attempts later in the season if the first crop is unsuccessful. However, the utility of system flexibility is conditioned by sufficient availability of water.

7.4 Changing availability of water

If rising temperatures and consequently amplified seasonality of the volume of water in the streams become the climatic future in Jharkot, people should probably prepare for longer periods of water scarcity. Even today, dry periods in the spring is a well known challenge in the semi-arid environment of Jharkot. Since regional precipitation outlooks are rather uncertain and local topography plays an important role for local water availability, I will

discuss three possible scenaria for water availability in Jharkot throughout this century: 1) Increased annual volume of available water, 2) Constant annual volume of available water, and 3) Reduced annual volume of available water. All three scenaria assume higher, but varying temperatures and increased seasonality in water volumes in the streams. Naturally, these are only three possible scenaria in a climatically uncertain future.

The first scenario is based on the expected increase in annual volume of meltwater resulting from increased melting of snow and ice in the mountains. Within a short time horizon this scenaro is plausible. More meltwater will probably disperse throughout the growing season and reduce the risk of long periods of water scarcity. Although increased intensity of precipitation is expected, in Jharkot today the rain only drizzles and the rain volume is low, so great changes must occur before intense rain becomes a serious problem. The importance of rainwater is rather its contribution to the streams, adding to the discharge from melting snow and ice. If local topography permits Jharkot access to more water in the years to come, flexibility of scope in the farming system could perhaps increase. More available water in combination with extended growing season would improve the climatic conditions for agricultural production in Jharkot, although the change could be temporary. Nevertheless, such climatic conditions would facilitate agricultural expansion and make the opportunity to reclaim abandoned land more attractive. The previous chapter demonstrated that there is available capacity of scope in the farming system for cultivable land, manure and winter fodder and that people may raise larger herds. Not only available fields but also the interrelated variables thus permit agricultural expansion, if the people of Jharkot in the future want to dedicate more of their labour to agricultural production.

However, unless precipitation patterns change to Jharkot's advantage, it would be an unsustainable solution in the long run to base future production on rapidly diminishing snow and ice stores. When glaciers have either disappeared or stabilised to a new temperature regime, precipitation becomes the main determinant for the volume of water in the streams. With more of the precipitation falling as rain instead of snow, seasonal variations in streams will probably increase even if the annual volume of water remains constant. These projections lead to the second scenario, in which people must prepare for longer periods of water scarcity and unpredictable timing of water. In that case, high temporal flexibility will be of crucial importance, the ability to rapidly exploit available opportunities of type and scope. Today there are many available opportunities of type among which the peasants can choose. They

can cultivate new vegetables in fields and simple greenhouses; they can convert some of their fields to apple orchards and cultivate apples as a cash crop; they can invest more time and labour in developing seabuckthorn juice; and they can develop new herbal and medicinal niche products. All of these opportunities can subsequently be adjusted in scope.

Most of the opportunities require irrigation, but not necessarily at the same time of the year. If the first crops of barley and wheat fail due to early spring water scarcity, the peasants can wait some weeks before they prepare the fields for vegetables and buckwheat later in the season. By relying on several crops with different needs, the water requirements are also spread out in time and water can be allocated to where it is considered most needed for the time being. The risk of total crop failure will then be decimated. As previously argued, the most flexible adaptation is probably to engage partly in subsistence production and partly in market production. To preserve available capacity in both fields and orchards may permit flexible adjustments in the scope of both. Hence, while flexibility of type is the opposite of specialisation, flexibility of scope is the opposite of intensification. Furthermore, temporal flexibility is kept high by preserving the ability to alternate rapidly between production of grains, vegetables, fruits and niche products dependent on the water supply situation. Together the three aspects of flexibility reflect the adaptive capacity of the system under conditions of water scarcity. Although long dry periods will probably involve yield losses, the farming system is probably flexible enough to cope with dry periods of medium duration.

Seasonal water scarcity represents a potential source of conflict in the farming system, however, since unpredictability in the timing of water may challenge the present system of water distribution. Today, irrigation rights rotate daily among the households, permitting two (out of the total 62) households to irrigate their fields each day during the critical spring period. If the irrigation channels suddenly dry up before all households have been served and half of the village is deprived from irrigating their fields, conflicts over water distribution could rise. The villagers will do wise in considering in advance how they might deal with this potential challenge. By relying on the local system for collective authority they probably have the capability to establish arrangements for compensation of affected households and agree on rules for crisis relief before winners and loosers are identified. The strong sense of community in Jharkot is probably beneficial for avoidance of severe conflicts and could help mitigate the losses of affected households if such events should occur. By relying on local institutions the community may create preadaptation for unpredictable change (Bateson 2000 [1972]).

Capability for coordinated action is of even greater importance for successful adaptation to the projections of the third scenario. If the climatic future of Jharkot turns out to involve drastic reductions in the annually available volume of water, with seasonal variations adding to general scarcity, the community will meet severe challenges in providing sufficient irrigation water to maintain agricultural production even at today's level. The temporal flexibility in the system to rapidly adjust production to seasonal scarcity will become exceedingly important under this scenario. However, limited availability of water may constrain the utility of related variable's capacity (e.g. fields and orchards). For agricultural production to be viable the system is fully dependent on the availability of at least a minimum volume of water. There is thus a lower threshold of tolerance for water availability in the system. Below this threshold agricultural production can no longer be the primary productive activity in Jharkot, despite all other aspects of flexibility in the system. Hence, under conditions of drastic reductions in water availability, the primary task becomes to search for ways to again increase the capacity of scope for water, in order to relieve the water constraint to agricultural production.

The community of Jharkot is currently demonstrating capability to do precisely so. By constructing a new irrigation pipeline from the Rashakesh well, they expand the total volume of water available to the farming system. They have appropriate local institutions that enable them to invest labour and money in community projects, the ability and contacts to raise additional finances and a committee to manage the construction of the pipeline and ensure necessary maintenance once it is completed. Hence, the community of Jharkot has demonstrated ability to expand the capacity of one of the most constrained variables in the system – water – the very same variable which is potentially under threat from substantial climate change. However, as climate change is a large scale process there is a risk that precipitation patterns in the whole Himalayan region will be altered to the extent where more and longer pipes can no longer solve the problem. Still, as long as local water supply in volume and in timing can meet the requirements of agriculture, the farming system is probably flexible enough to enable people to maintain and even increase local agricultural production. Given sufficient water availability, the future of agricultural production in Jharkot is largely in the hands of the local people, permitting them to choose their continued adaptation to various global processes. The comprehensiveness of climate change determines whether or not they will continue to have flexibility to increase their reliance on local agricultural production in the years to come.

CONCLUSIONS: FACING THE FUTURE WITH FARMING FLEXIBILITY

Concerns have lately been raised over the prospects for local food production in the face of uncertain local effects of global climate change. I have approached this issue by focusing on the farming system of the village Jharkot. My objective has been to analyse the flexibility of the farming system to maintain or even increase local agricultural production under conditions of uncertain local effects of global climate change. By applying a farming system framework I have described the agro-pastoral farming system of Jharkot. The factors of production in agriculture are represented as system variables, and I have argued that a system approach in terms of interlinked variables is a prerequisite for a proper analysis of flexibility. In Jharkot, irrigation water, manure, pastures and forest resources are collectively managed, and therefore I found it appropriate to approach the farming system at village level instead of at household level. Still, the household is an important unit in the community, since it is the unit where decisions of cultivation are made and since entitlements to common resources and right to representation in village meetings belong to the household.

In the semi-arid high mountain environment of Jharkot, seasonal water scarcity and a short growing season impose climatic constraints to agricultural production. Yields are thus generally lower in Jharkot than in farming systems located at lower altitudes. Seasonal migration is common during the cold and lean winter and alternative livelihoods in tourism, transport services and labour migration accompany agricultural production. As a consequence, abandonment of agricultural land has occurred over the last couple of decades. The stocks of animals and the number of people in the village have also historically been higher than it is today. The capacity of many system variables are hence far from fully exploited in Jharkot. I have argued, however, that instead of regarding the situation as one of suboptimal exploitation of resources, a more useful approach is to acknowledge that unexploited capacity involves opportunities for change which provide the system with flexibility to adjust agricultural production to changing climatic conditions.

Opportunities for change are the focus of chapter 6, which concerns my second research question on farming system flexibility. Based on the definition of flexibility as "*uncommitted*

potentialities for change" (Bateson 2000 [1972]: 505, emphasis in original), I have suggested an analytical approach to farming system flexibility through distinguishing between three different aspects of flexibility. The first two are opportunities of type and scope, while the third is temporal flexibility and refers to the ability of peasants to rapidly make adjustments in the system. Bateson's notion of flexibility has proved to be highly relevant for analyses of adaptive capacity in farming systems under conditions of climatic uncertainty at the local scale. Furthermore, I found the flexibility concept to be even more useful in an empirically based analysis when I operationalized the concept through the three aspects of flexibility.

In the farming system of Jharkot, there are several opportunities of type and scope. Overall agricultural production may be increased from today's level by reclaiming abandoned land and thus exploiting unused capacity of scope in fields and orchards. Larger herds of animals may again be raised, and the composition of the herds can be changed in favour of more goats and cows which produce the best manure. More trees could also be planted to provide more winter fodder. However, to simply intensify production is partly to use up the available flexibility in the system. Thus, opportunities of type are essential for the creation of system flexibility, which means to introduce new species and start new productive activities in the farming system. With reduced transport costs, many households in Jharkot have converted some of their fields to apple orchards in order to export organic apples as a cash crop, and some see the potentiality for off-season vegetable export. The development of seabuckthorn juice as a marketable product is still in its initial phase. Several herbs and medicinal plants also grow in common lands, species which may have economic value if they are developed and marketed as niche products. The community of Jharkot has the ability to manage collective projects in combination with private entrepreneurship, and in this way creates business opportunities for those who wish to invest. Rich potentialities for change are hence present in Jharkot, and if these opportunities are exploited, agricultural production may be increased also under varying, and to some extent, changing climatic conditions.

It seems that the combination of subsistence and market production is a more flexible strategy than specialisation in either one. A diversified strategy preserves the opportunity of people to rapidly adjust the scope of each crop and reallocate labour and water to alternative crops in response to changing conditions. In other words, the temporal flexibility is kept high. I therefore subscribe to the claim of MacDonald (1998) that diversification is a rational strategy for risk reduction in an uncertain environment.

Despite many potentialities for change in the system, limited capacity in central variables may constrain the utility of system flexibility. I conclude that in Jharkot the most important constraint is the risk of severe and long lasting water scarcity projected in the third climate change scenario. As long as the water supply is not radically altered, flexibility in the farming system strengthens its ability to cope with seasonal variations. Thus, the system possesses rich potentialities for maintained or even increased agricultural production in Jharkot in the future.

There seems to be four conditions for the creation of flexibility which are fulfilled in Jharkot. The first condition is to avoid maximal exploitation of system variables. To have unused capacity saved up for times of greater needs is a condition for the creation of opportunities of scope. The second condition is willingness to take new initiatives and actively adjust to changing environmental or socio-economic conditions, a condition for the creation of opportunities of type. Thirdly, the ability to reallocate limited resources in the system is a condition for the creation of temporal flexibility. And lastly, capability for coordinated action is a condition for the possibility to relieve constraints to system flexibility, which is caused by limited capacity in central system variables.

However, flexibility is never unlimited. The local effects of climate change are highly uncertain and if the climatic future in Jharkot involves drastic reductions in water availability or long and frequent periods of severe drought, water scarcity could impose an absolute constraint to agricultural production. It is not certain that more and longer pipes are sufficient to solve problems of water scarcity in the long run. Although the creation of flexibility may enable successful adaptation in mountain farming systems, at least in Jharkot can farming flexibility only prevail if climate change is confined to include moderate changes in water availability.

If the seasonality of water availability becomes the greatest challenge under warmer climate conditions, how are the potentials for storing water in the mountains? In Indian Himalaya, interesting and successful attempts have been made to exploit micro-climatic conditions in order to store water during the winter. By letting water from streams spread and trickle out in shaded locations, the small droplets freeze and accumulate as snow and ice, permitting the water to be stored until the spring and sowing season (Vince 2009). Although this technology is highly location specific, it could be worth to investigate its potentials also in other places.

However, technological solutions should not be considered isolated from the broader socio-economic and environmental context. The future of agricultural production in Jharkot is not solely dependent on climatic conditions, but also on other large scale processes influencing the community and on the response of people to these processes. Future changes in food and labour markets, rising levels of education, changing tourism patterns and perhaps national and international political processes will have impacts on people's opportunities and livelihood choices, both inside and outside agriculture. Today, outmigration for work and education purposes contributes to seasonal lack of labour in the farming system of Jharkot.

In Manang, ethnic monopoly of land impedes immigrants from buying and cultivating abandoned fields, but exclusive local land rights have also left the Manangis in control of tourism services in the valley (Aase 2007). Aase suggests that land could be reclaimed and agricultural production increased if outsiders were allowed to buy land in the valley. If the people of Jharkot follow the same advice, the immigrants who come from poorer mountain districts could contribute to increase the local agricultural production. However, change of land ownership also includes change of entitlements to irrigation water, pastures and forest resources. Further research is needed to see how permission of non-local land ownership will influence the effectiveness of local regulations and the capability for coordinated action in the community. A comparative study could perhaps be conducted in Jharkot and Ranipauwa, the village favourably located by the Muktinath temple, the end of the road and the tourist trekking path. In Ranipauwa, locally controlled tourism has contributed to economic prosperity in tandem with extensive abandonment of agricultural land. Some land owners rent out their fields to land labourers from the neighbour district of Dolpa, but according to my informants, some immigrants have recently also been allowed to buy land in Ranipauwa. At the same time, prosperous lodge owners residing in Kathmandu have regained interest in their old family farm. Some are said to be *paying* immigrants for keeping their family house and fields and letting them keep all the yields, not claiming the owner's share. As the hotel owner Radha (female 32) expressed it,

> *"Now locals understand the value of culture, of ancestors. Money has not so much value, people can own [lodges] and earn much money now. But memories, culture, ancestors' house and fields have greater value than money for them now."*

The question of rights to land ownership is thus probably not simply a matter of production volumes, but also a matter of people's relation to history, culture and identity. According to Robertson (1992), increased contact between people from different cultures is accompanied

by an increasingly universal tendency to search for a particluar identity. The renewed interest in their place of origin among emigrants from Ranipauwa could perhaps be interpreted as an expression of this tendency. Whether it will contribute to remigration to the village is still uncertain, though. With rising levels of education among the youths, some parents in Jharkot have shared their thoughts on whether their children will return to the village after having completed their education.

> *"I want to make opportunities for my son back here. Here they send their children out for education, but complain that they are not coming back home. So what do you want to do? Come back here and plough the fields? Eat what you grow? You don't need education to do that. You have to make something back home which will match their level of education."* (Purna, male 46)

Purna and his wife have chosen to convert fields to apple orchards and to be active in further development of the seabuckthorn juice in order to make farming an attractive option for their children. The peasant strategy of combining market and subsistence production is thus not only flexible, it is also by some regarded as a more attractive strategy for educated youths compared to pure subsistence production. It is still uncertain, though, whether niche products based on local resources and organic apples can be competitive in food markets dominated by large, modernised and specialised agricultural producers.

Interestingly, farming flexibility is not only a preoccupation of partly subsistence based Himalayan farming systems. Even among highly modernised American and Australian farmers attention is now paid to farming system flexibility. A project run by an Australian farmers' organisation (Birchip Cropping Group 2010) emphasises the ability of small scale farmers to rapidly adjust both the type and scope of their production. They hold that flexible management enables farmers to delay sowing decisions, making them better positioned to adjust production to variations in markets and weather conditions. New and interesting research could emerge focusing on farming flexibility under conditions of market uncertainty. Perhaps there is a niche for small and flexible farming systems to exist parallel to the large and specialised farms in conventional agriculture?

There are reasons to agree with MacDonald (1998) who contradicts those who view small scale mountain peasants as backwards and irrational, and to instead argue that flexible farming is an adaptive and rational strategy in an uncertain environment, whether this uncertainty is due to changes in climate, markets or due to other global processes of change.

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APPENDICES

Appendix 1: Acronyms and Abbreviations

ACA	Annapurna Conservation Area
ACAP	Annapurna Conservation Area Project
CBS	Central Bureau of Statistics
FAO	Food and Agriculture Organisation
ICIMOD	International Centre for Integrated Mountain Development
IPCC	Intergovernmental Panel on Climate Change
m.a.s.l.	Metres above sea level
NPR	Nepali Rupees
NTFP	Non-timber forest products
NTNC	National Trust for Nature Conservation
VDC	Village Development Committee
WDG	Women Development Group
UNDP	United Nations Development Program

Appendix 2: Glossary

Local Tibetan dialect	**English**	**Latin**
Amasoma	Mothers' group	(now called WDG)
Amchi	Tibetan medical doctor	
Bari	Weight measure, appr. 35 kg	
Bun	Alpine meadows ("forest")	
Chang	Local beer	
Cherma	Rosehip	*Rosa sericea*
Gahun	Wheat	*Triticum aestivum*
Gemba	Village leader	Mukhia (Nepali), Khamba (Manangi)
Gompa	Buddhist monastery	

Jhopa	Yak – cow hybrid	
Kali	River	
Kauli	Cauliflower	
Kheti, shing	Irrigated field	
Khola	Stream	
Lama	Buddhist monk	
Mithi	Fragrant, green leaf vegetable	
Mitho phapar	Sweet buckwheat	*Fagopyrum esculentum*
Momos	Dumplings	
Panchayat	Non-party system of local governance, based on representation.	(Litterally: "Five persons' council")
Pathi	Weight measure, appr. 4 kg	
Puja	Religious service	
Rakshi	Local liquor	
Rolo	Village leader's assistant	
Saag	Green leafy vegetables/lettuce	
Samiti	Committee	
Tarjang	60th anniversary celebration	
Tito phapar	Bitter buckwheat	*Fagopyrum tataricum*
Tora	Seabuckthorn	*Hippophae Tibetana*
Tsampa	Flour of roasted barley, often mixed with tea and yak butter	
Uwa	Barley (Nepali: Oats)	*Hordeum vulgare*
Yarzagumba	Yarzagumba	*Cordyceps sinensis*
Yartung	Horse race festival	