

Assessing the role of risk in the Agro-pastoral systems of Northwest Yunnan Province, China

by

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ABSTRACT

Agro-pastoral communities in northwest Yunnan province, China, face many types of risk, including climatic variations, price fluctuation, etc. State policies also have an impact on households by lifting or imposing various constraints, and thereby creating further uncertainty. These households must manage their risk environment as part of their livelihoods based on their perceptions of the risk events. However, some risk-coping strategies are likely to have aggravated households' vulnerability in the long-run by degrading some forms of asset when reducing their risk exposure in the short-run. This study uses the Sustainable Livelihood framework to explore the relationship between risks, assets, livelihoods, and sustainability in the agro-pastoral systems of Northwest Yunnan. During May-August 2004, the research team visited 16 hamlets with 159 agro-pastoral households and 32 groups. Results were generated from the household questionnaire and focus groups. The purpose is to inform policy on effective disaster relief measurements and poverty reduction programs.

To my Mother

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TABLE OF CONTENTS

| | |
|--|------------|
| Approval..... | ii |
| Abstract..... | iii |
| Dedication | iv |
| Acknowledgements..... | v |
| Table of Contents | vi |
| List of Figures..... | ix |
| List of Maps | ix |
| List of Tables..... | x |
| Chapter 1: Introduction | 1 |
| 1.1 Problem statement..... | 1 |
| 1.2 Community setting..... | 3 |
| 1.3 Scope and research questions | 6 |
| Chapter 2: Literature review | 8 |
| 2.1 Risk definition and classification..... | 8 |
| 2.1.1 Risk and uncertainty | 8 |
| 2.1.2 Risk as adversity | 8 |
| 2.1.3 Risk preference | 8 |
| 2.1.4 Objective and subjective risk..... | 9 |
| 2.1.5 Idiosyncratic and covariant risk..... | 10 |
| 2.2 Risk management and sustainability..... | 11 |
| 2.2.1 <i>Ex post</i> vs. <i>ex ante</i> risk-coping strategies | 11 |
| 2.2.2 Risk-coping strategies, poverty trap and sustainability | 12 |
| Chapter 3: Conceptual framework..... | 16 |
| 3.1 Framework selection..... | 16 |
| 3.2 Sustainable Livelihood (SL) framework..... | 19 |
| 3.2.1 Contextual settings..... | 19 |
| 3.2.2 Asset categories | 19 |
| 3.2.3 Livelihood strategies..... | 20 |
| 3.2.4 Livelihood outcomes..... | 22 |
| 3.2.5 Transforming structures and processes..... | 23 |
| 3.3 Incorporating risk management into the SL framework..... | 23 |
| Chapter 4: Methods | 25 |
| 4.1 Data collection | 25 |

| | | |
|-------------------|---|-----------|
| 4.1.1 | Literature review | 25 |
| 4.1.2 | Semi-structured interview | 25 |
| 4.1.3 | Focus Groups (FG) | 26 |
| 4.1.4 | Participatory Research (PR) techniques | 26 |
| 4.1.5 | Household (HH) questionnaire | 27 |
| 4.2 | Selection of study units | 27 |
| 4.3 | Classification of the household types | 29 |
| 4.4 | Data analysis | 30 |
| Chapter 5: | Results | 32 |
| 5.1 | Assets categories | 32 |
| 5.1.1 | Household's assets | 32 |
| 5.1.2 | Comparison of assets owned by various groups | 38 |
| 5.1.3 | Comparison of wellbeing indicators between the HH survey respondents and FGs | 42 |
| 5.2 | Household's livelihood strategies | 42 |
| 5.2.1 | Livelihood strategy—Capital-led specialization | 42 |
| 5.2.2 | Livelihood strategy—Labourer-led specialization | 44 |
| 5.2.3 | Livelihood strategy—Diversification | 44 |
| 5.2.4 | Livelihood portfolio | 44 |
| 5.3 | Risk presence and perception | 45 |
| 5.3.1 | Presence and perception of the severest idiosyncratic risks | 46 |
| 5.3.2 | Presence and perception of the covariant risks | 47 |
| 5.3.3 | Comparison in risk-perception among various groups | 49 |
| 5.3.4 | Comparison of risk-perception between the HH survey respondents and FGs | 51 |
| 5.4 | Risk mitigation | 52 |
| 5.4.1 | Stress-relief actions taken by individual households | 52 |
| 5.4.2 | Stress-relief actions taken by communities | 52 |
| 5.4.3 | Comparison in the risk mitigation actions among various groups | 53 |
| 5.5 | Risk reduction | 54 |
| 5.5.1 | Risk-reduction strategies adopted by individual households | 54 |
| 5.5.2 | Comparison in risk-reduction actions between various groups | 55 |
| Chapter 6: | Discussion | 56 |
| 6.1 | Household assets and wellbeing | 56 |
| 6.2 | Interaction between assets and livelihood strategies | 58 |
| 6.3 | Households' perception of the surrounding risks | 63 |
| 6.4 | Agro-pastoral households' management of the risks | 67 |
| 6.4.1 | <i>Ex-post</i> stress relief actions | 67 |
| 6.4.2 | <i>Ex-ante</i> risk reduction strategies | 68 |
| 6.4.3 | Consequences of the risk management behaviours | 70 |
| 6.5 | Implications for the Sustainable Livelihood (SL) framework | 74 |
| 6.6 | Limitations | 75 |
| Chapter 7: | Policy appraisal and opportunities | 78 |
| Chapter 8: | Conclusions | 82 |

| | |
|---|-----------|
| Reference List..... | 85 |
| Appendices | 90 |
| Appendix A: Agro-pastoral Household Questionnaire | 90 |
| Appendix B: Figure and Tables..... | 103 |
| Appendix C: Agro-pastoral traditional productions | 108 |

LIST OF FIGURES

| | | |
|--------------|--|-----|
| Figure 1: | Classification of the household types | 30 |
| Figure 2: | Income composition of the sampled households (2003-04) | 34 |
| Figure 3: | Expenditure composition of the sampled households (2003-04)..... | 34 |
| Figure 4: | The perception of the severest idiosyncratic risks by the HH survey respondents | 47 |
| Figure 5: | The perception of the non-environmental severest risks | 49 |
| Figure 6: | The perception of the environmental severest risks* | 49 |
| Figure 7: | The selected idiosyncratic and covariant risks identified as severest by the community types..... | 50 |
| Figure 8: | The selected idiosyncratic and covariant risks identified as severest by the household types | 50 |
| Figure 9: | The severity level of the covariant risks to individual households and the focus groups..... | 51 |
| Figure 10: | Risk-mitigation actions and their effectiveness in stress-relief | 52 |
| Figure 11: | Risk-reduction strategies adopted by individual households and their effectiveness in protecting households against future shocks | 55 |
| Figure 12: | Distribution of the household types within the community types | 58 |
| Figure 13: | Distribution of the household types within the wealth groups | 59 |
| Figure B- 1: | The Sustainable Livelihood Framework (DFID)..... | 103 |
| Figure C- 1: | Community seasonal trend diagram: use-pattern of natural resources in response to seasonal and altitudinal variations..... | 108 |

LIST OF MAPS

| | | |
|--------|---|---|
| Map 1: | Yunnan province and Zhongdian County (Shangri-la) in relation to China and the bordering countries | 4 |
| Map 2: | Zhongdian County and the location of the sampled communities..... | 5 |

LIST OF TABLES

| | | |
|-------------|---|-----|
| Table 1: | General statistics of Zhongdian County, 2002 | 4 |
| Table 2: | Demographic information and wealth-group composition of the sampled hamlets | 29 |
| Table 3: | Social capital of the sampled hamlets..... | 37 |
| Table 4: | Natural capital owned by the community types | 38 |
| Table 5: | Financial assets owned by the household types and the wealth groups* | 39 |
| Table 6: | Physical capital owned by the household types and the wealth groups* | 40 |
| Table 7: | Human capital owned by the household types and the wealth groups* | 40 |
| Table 8: | The percentage of household engaged in certain production activities* | 43 |
| Table 9: | The rated severity of the idiosyncratic risks and their frequency of being cited as severest | 47 |
| Table 10: | The rated severity of the covariant risks and their frequency of being cited as severest | 48 |
| Table 11: | Stress-relief actions taken by the households of different wealth groups | 53 |
| Table 12: | Ranking of the risk-reduction strategies in their effectiveness by households of different household types and wealth groups | 55 |
| Table B- 1: | Focus groups' opinion about the manifestation of a household being 'better-off' | 103 |
| Table B- 2: | Rating of the agro-pastoral production activities by the labourer, capital and skill required, profitability, stability and the degree of risk involved | 104 |
| Table B- 3: | Description of the agro-pastoral production activities by the labour, capital and skill required, profitability, stability and the risks involved | 105 |

CHAPTER 1: Introduction

1.1 Problem statement

Subsistence production systems worldwide are characterized by a strong reliance on the surrounding natural resources, a low input and output level, a minimal capital investment, and a deep involvement of traditional knowledge and technologies (Todaro, 1997). These characteristics suggest that such production systems are naturally vulnerable to external shocks; that is, variations of the ambient environment can have a large impact on production. Among many forms of variation, natural hazards such as drought and flood are most common. Nomads and transhumant herders from Sub-Saharan African dryland to European mountains worry about seasonal grass availability and climatic shocks (Smith *et al.*, 2000); crops are even more vulnerable than animals to adverse weather (Templer *et al.*, 1993), suggesting farming is in most of the developing world an inherently risky production. In the context of global economy, the market is exerting an ever-growing effect on subsistence economies at both the macro and micro level (Birdsall, 1999; Leichenko & O'Brien, 2002). A fluctuation in staple-food prices can be detrimental to subsistence producers when contending with international competitors (Shiva, 2003). Furthermore, these producers often experience information failure or imperfect information, and thus they face “price bands (a wide range) rather than a single input price” (Todaro, 1997, p.385). In addition, other forms of risk such as social conflict and war, are potential threats to the subsistence-production systems (Ellis, 1993).

Yet not every community, household and/or individual living in these subsistence-production systems is subject to external risks to the same extent. Intuitively, better-off households have more resources; hence they are better able to recover after a shock, or insure themselves against risks beforehand by diversifying their income sources. This suggests that vulnerability is agent and circumstances specific—who they are, what resources they have and what type of environment they dwell in determine what risks they are subject to and how they are affected. Assets are not only related to vulnerability;

they also represent well-being and correspondingly a lack of these assets implies poverty. Shaffer (2001) points out that vulnerability is not poverty; but very often the poor are more vulnerable to risks and also subject to more severe impacts than the better-off. This has been verified by accumulating empirical evidence. For example, when so called *duzd* (snow disaster) hits Mongolian herders indiscriminately, poor and rich herders lose similar numbers of livestock, however poor herders suffer a greater loss—a relatively larger proportion of their herds, and thus “their ability to obtain a livelihood has been significantly eroded” (Templer *et al.*, 1993, p.113).

Dwelling in a risky environment, the subsistence-households have developed a range of strategies to survive difficulties and cope with uncertainties. For instance, diversifying income sources as well as production varieties are common actions to protect the household against income risk and production failure; smoothing and delaying consumption is practiced to mitigate the adversity after a shock. The type of strategy to apply is not only determined by the assets that a household has, but also based on its own perception and understanding of the risk event. This outlines the epistemic and the communicational dimensions of risk-coping and livelihoods-management; for example ‘doing what others do’ is a popular strategy in some societies (see Bass, 2000).

Studies of how subsistence-households combat risks have shown that the various coping strategies have mixed effects on the households’ livelihoods. There are many cases when coping with imminent risks increases the vulnerability of the household by depleting assets for example to recover from the stresses. Another example may be that child-labour emerges after a natural hazard; yet children’s nutrition and education are sacrificed at their various adolescent ages. Additionally the use of overstocking as a form of insurance against the periodic hazards causes grassland degradation and thus renders livestock and households more vulnerable to future catastrophes, such as soil-erosion (FAO, 2002). The long-term consequences of coping with risk can be even worse when poverty is pervasive, and households are desperate to protect themselves from short-term distress.

The above illustrates the interconnection between poverty, vulnerability and risk. A research framework to include these elements is essential for effective counter-poverty

and risk management policies. More specifically, the framework needs to embrace a dynamic link between a household's assets, its livelihood strategies, and the consequences in both short and long term time frame. The Sustainable Livelihood framework (DFID, 1997) is suitable for this purpose. In addition, by viewing risk-coping as an objective, the ways that a household plans its livelihood and production, reflect how it perceives and copes with risks with relation to its socio-economic surroundings.

1.2 Community setting

The agro-pastoral system existing in Yunnan (YN) province, P.R.C. is an example of a subsistence production system. It normally involves individuals and households pursuing a variety of farming-animal husbandry production practices (Waters-Bayer & Bayer, 1992). Agro-pastoralism practiced in northwest Yunnan differs from agro-pastoralism elsewhere in the province by two main characteristics: 1) the nature of interactions between agriculture, forestry, and animal husbandry, and 2) transhumance.

Transhumance is the seasonal migration of livestock to suitable grazing grounds (Wilkes, 2003). As livestock husbandry has been practiced for centuries, many agro-pastoral communities in the region have accumulated rich indigenous knowledge about fodder species, rangeland, and livestock management (see Song *et al.*, n.d.; Xie *et al.*, 2001).

This study chooses Zhongdian County as the study area, since it is a very typical example of agro-pastoralism (characterized by a combination of farming practices with livestock husbandry, as well as mobile herding patterns). Zhongdian County is located in Diqing Tibetan Autonomous Prefecture, Northwest Yunnan, southwest China (Map1), and is adjacent to Tibet Autonomous Region (TAR) and Tibetan autonomous prefectures of Sichuan Province (Map1 & 2). Zhongdian County belongs to the hinterland of the Hengduan Mountain Range on the south-eastern edge of Qinghai-Tibet Plateau wherein the altitude varies from 1500 to 4000 m. The total population in 2002 was about 122000, consisting of 25 ethnic groups. Tibetans alone make up about 40% of the total population (Table 1). High mountains, deep valleys, and highlands are typical landscapes of the area. Within the whole county, about 24-29% of the land is natural grassland on the mountain below snow-line. Agriculture and animal husbandry are the traditional livelihoods of the local people (Chan, 2002; Xie *et al.*, 2001, Table 1).

Map 1: Yunnan province and Zhongdian County (Shangri-la) in relation to China and the bordering countries



Source: Yunnan E-government.org

Table 1: General statistics of Zhongdian County, 2002

| Overall Demographics | No of Administrative Village (A.V.) | No of Hamlet | No of Household | Population | Labourer |
|-----------------------|-------------------------------------|---------------------|---------------------|-----------------------------------|----------------------|
| | 63 | 686 | 22321 | 122000 | 75110 |
| Ethnicity composition | Tibetan (%) | | Han (%) | | Other ethnicity (%) |
| | 38.2 | | 27.3 | | 23.4 |
| Revenue | Gross revenue (million \$) | | | Annual net income per capita (\$) | |
| | 22.6 | | | 143.9 | |
| Natural resource | Gross area (km ²) | Forestland (%) | Grassland (%) | | Farmland & other (%) |
| | 11613 | 65.2 | 23.0 | | 11.9 |
| Livestock holding | Cattle (head) | Horse & mule (head) | Sheep & goat (head) | Pig (head) | Chicken (no) |
| | 229309 | 19205 | 65457 | 7970 | 93382 |

Source: National Economic statistics, Zhongdian County, 2002

Map 2: Zhongdian County and the location of the sampled communities



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The agro-pastoral production system of Zhongdian County mostly subsists in three main types of community: 1) the highland communities, 2) the irrigated communities and 3) the dryland communities (Map 2). These types of community are distinguished from each other by their geographic topography, microclimatic conditions, natural endowment, as well as the historical development activities. These agro-pastoral communities mostly consist of Tibetans; and these communities exploit different elevations at different time of the year (Appendix C, Figure C-1). Each type is described below in detail:

1. **The highland communities** are located on high-altitude (usually about 2800-3200m), topographically flat plateaus. Temperatures remain low all year around. Semi-arid alpine pasture is the most notable landscape and the most important natural resource that local

- communities predominantly utilize. Highland barley and potato are planted as the staple foods. Surrounding is medium-height mountain ranges with a low forest-cover, resulting from the massive logging campaign between late 1970s- 1990s (UNEP-WCMC, n.d). Traditionally these communities specialized in livestock husbandry. In recent decades, however, a main road was constructed in this area, connecting the County with the rest of the Province. Many households living in the area sold their livestock and purchased vehicles to start a transport business (of goods and passengers); and male family members have actively participated in road construction and other development activities;
2. **The irrigated communities** reside along Wengshui River and Geza River. They usually have sufficient water for drinking and irrigation. Highland barley and potato are important foods for humans and livestock. The altitude of the area is relatively low (around 2500m) and the microclimate is mild. Compared to other types of communities, the natural resources growing here are more abundant and diversified. Due to geographical remoteness (where the main road running through the area is still a half-paved, two-lane gravel road), the natural forests have been well conserved. Notably, the old-growth forests harbour ample Non-Timber Forest Products (NTFP), including *Matsutake* mushroom (*Tricholoma magnivelare*), the most valuable export (mostly to Japan, Hammett *et al.*, 2001). Local communities also collect various herbs for medical use or trading for cash. Currently, NTFP collection accounts for 25-80% of the household annual cash income (Xu & Wilkes, 2003);
 3. **The dryland communities** comprise villages lying in the low altitude (2000-2600m), dry-and-heat valley. The weather is warmer, and the vegetation type is mixed temperate forests and shrubs. Within the area, there are limited places where *Matsutake* is abundant. The relatively warmer microclimate also enables communities to produce a diversity of crops other than barley, such as corn and fruits. Adjacent to Deqin County, the other Tibetan Autonomous County of the Province, the local dryland communities have a profound history of trade business and labour exchange with Deqin County.

1.3 Scope and research questions

The proposed study seeks to understand how agro-pastoral households in different communities plan their livelihoods when facing the surrounding risks. The study adopts

the Sustainable Livelihood (SL) framework as its conceptual and analytical model to explore the functions of the agro-pastoral livelihood systems; incorporating risks explicitly into the analysis makes it possible to study subsistence-producers' risk coping behaviours as a part of their livelihood management.

The primary interest of the study is on the relationships between risks, vulnerability and sustainability. More specifically, the study sets out to ask

1. What assets do agro-pastoral households have and what are their livelihoods;
2. What risks do agro-pastoral households face, and how do different households perceive and cope with these risks; and
3. What are the consequences of a household's risk-coping behaviours on the household and its community in the short and long term?

These questions are to be answered using the SL framework to link livelihood assets, strategies, and outcomes in the context of how people perceive and manage risks.

Household survey, focus groups and semi-structured interview were used in data collection and to assist with triangulation of the validity for the approach. Participatory Research (PR) techniques were also applied in focus groups to facilitate understanding of the unique features of the local socio-economic system; at the same time it presents local communities an opportunity to freely express their viewpoints in a more diversified and innovative way. Data collected in a quantitative form are analyzed with statistical tools, so that results obtained from the study-subjects could be generalized to a wider population.

Chapter 2: Literature review

2.1 Risk definition and classification

2.1.1 Risk and uncertainty

Many risk studies attempt to distinguish risk and uncertainty. In economic analysis, risk “corresponds to events that can be associated with given probabilities” (Chavas, 2004, p.5), or is “restricted to situations where probabilities can be attached to the occurrence of events which influence the outcome of a decision-making process” (Ellis, 1993, p.84). In contrast, uncertainty is related to events or situations where probability assessment is not possible (Chavas, 2004; Ellis, 1993). However, this distinction largely depends on a clear consensus about the interpretation of a probability, which may be hard to reach.

2.1.2 Risk as adversity

Risk more or less implies ‘undesirable effects’, ‘adversity’, ‘loss’, or “potentially unfavourable circumstances” (Smith *et al.*, 2000, p. 1946; see also Henrich & McElreath, 2002). Ellis (1993) sees risk as the probability of disaster—“the probability that the variable outcome of certain events will take on a less than some critical minimum or disaster level” (p.86). To make the existence of hazards and disasters even more explicit, Blaikie (1994) develops the ‘Pressure and Release model’ to study human’s vulnerability to natural hazards. He identifies risk as the combination of the presence of potential hazards and vulnerability which results from root causes (ie. poverty), dynamic pressures (i.e. ways to transform root causes into insecurity) and unsafe conditions (i.e. geographic locations).

2.1.3 Risk preference

Recognizing risk as potentially disastrous suggests avoidance of disaster is the central goal of peasant families rather than profit maximisation. This supports the argument that subsistence households/individuals are risk averse. Risk aversion is defined in economic

analysis as “(a decision-maker) willing to pay a positive amount of money (as measured by risk premium: $R > 0$) to eliminate risk” (Chavas, 2004, p.35). In contrast, risk neutral and risk loving attitudes mean $R = 0$ and $R < 0$ respectively. Disaster avoidance is also inherent in what Lipton (1968) calls the ‘survival algorithm’ of peasants, or ‘safety first’ principle (Roumasset, 1976). Put simply, the poor must cover their household needs from one season to the next, when failure means the difference between survival and starvation for them (see also Ellis, 1993). Numerous studies undertaken on attitudes towards risk among subsistence farmers and producers have verified the fact that these households and individuals are mostly risk averse, and the central objective of their livelihoods is to maximize their chance of survival (see Moscardi & De-Janvry, 1977; Dillon & Scandizzo, 1978; Binswanger, 1981).

2.1.4 Objective and subjective risk

The above description of risk reveals the factors that characterize the way many people perceive risk: a) potential losses, b) the significance of those losses, and c) the probability associated with those losses (Yates & Stone, 1992). If we are to distinguish risk from uncertainty and given this description, an estimate of probability seems inevitable in the assessment of risk. Probability is defined as relative frequency of a repeatable event (Ellis, 1993); yet its measurement for non-repeatable events is almost impossible. In these cases, estimation of such probabilities often requires an experts’ opinion which can vary greatly among the experts. Chavas (2004) thus asserts a probability to be seen as “a subjective and personal evaluation of the relative likelihood of an event reflecting the individual’s own information and belief” (p.11). This corresponds to Yates & Stone (1992)’s view of the identification of risk as a cognitive process of identification, storage and retrieval, which exists in common psychological functions (see Slovic *et al.*, 1976; Ellis, 1993).

The ‘subjective’ construction of risk assessment is further illustrated by a number of studies conducted on the communications of risk between technical experts and the public. Unlike risk experts who tend to focus on ‘objective’ products of risk (involving statistics, experimental studies and risk analysis), the public perceives risk based upon a ‘subjective’ judgment influenced by emotions and personal experiences (Scherer, 1990;

Anderson, 1998). Experimental psychologists have identified certain factors that shape this cognitive process or ‘subjective’ judgment, including newness, dreadfulness, immediacy, controllability and knowledge about the risk, as well as voluntariness of the subjects to the risk (Slovic *et al.*, 1980; Fischhoff *et al.*, 1981; Winterfeldt & Borchert, 1981; Trimpop, 1994; Bronfman & Cifuentes, 2003). Cultural theorists also propose that individuals choose what to fear and how much to fear it based on his or her cultural background (Dake, 1991; Douglas & Wildavsky, 1982; Furedi, 1997). This viewpoint further agrees to the idea that risk perception exists in certain socio-economic environments (Scherer, 1990), and thus communication of risk within the social environment would have an important role in the amplification or ignorance of the risk (Frewer, 2003).

Based on a somewhat lengthy discussion about the multidimensional construct of risk, it is to conclude that given the complexity of estimating probabilities across individuals, a sharp distinction between risk and uncertainty based on probability judgement, suggested by Chavas, is both problematic and unnecessary. Therefore, the study doesn’t differentiate risk and uncertainty strictly; instead individuals can always assess the relative likelihood of uncertain events within their cultural, knowledge and information systems (see also Henrich & McElreath, 2002; “What is risk?” n.d.).

2.1.5 Idiosyncratic and covariant risk

In practice, classification of risk can be helpful to assist disaster management, based on the geographic coverage of the risk’s impacts. There are two main types: idiosyncratic (also called ‘single’, or ‘individual’) risks which only strike individual households (such as sickness and loss of family member, theft and robbery, etc), and covariant (also called ‘common’) risks affecting the whole community or the region (such as drought, and infectious animal disease, etc). It is thus the geographic spread of a particular risk which determines whether it is individual or covariant (Templer *et al.*, 1993). However, Dercon (2002) argues few risks or shocks are purely idiosyncratic or covariant; instead, most have both idiosyncratic and covariant features. Dercon also sees risks and shocks as covariant if all a household’s income sources are affected by the risk events simultaneously.

2.2 Risk management and sustainability

2.2.1 *Ex post* vs. *ex ante* risk-coping strategies

The differentiation of idiosyncratic and covariant risk is important as different disaster relief/mitigation mechanisms are needed at the time of crisis. In the case of idiosyncratic risk events, such as the sickness of a family member, households can be supported through mutual assistance and/or reciprocal action arrangements with other households within the community ('inter-household transfer', as a form of 'informal safety net'). Equally important, the other form of informal arrangements depends on sharing with extended families, relatives, friends and networks outside of the community. To distinguish from 'inter-household transfer' usually taking place within a community, sharing with the external networks, is often termed as 'inter-community transfer'. The pooling of relatively heterogeneous assets and livelihoods can be effective in helping the needy households out of difficulty, when many households or the whole community are stricken by a shock. Faced with geographically widespread hazards, these informal sharing mechanisms lose their function, and government relief programs become vital (as a form of 'public transfer') (see also Skoufias & Quisumbing, 2004; UN, 1998). Apparently, in disaster mitigation, these formal and informal mechanisms are complementary and essential to both households and communities. Unfortunately, there are many stories about how state policies break down the informal safety nets and obstruct public transfer. For instance, the privatization process of Chinese grassland in the 1980s destroyed some important traditional communal inter-household transfer networks, and thus, has caused the shift of the responsibility for risk-coping from the government agencies to the herders (Wu & Yan, 2002). *Khotails* were a form of traditional kin and neighbour-assistance networks in Mongolia, which had provided immediate loans of food and animals to households in need. The economic liberalization of Mongolia starting in 1991 abolished *khotails*, and as a result a pervasive and severe snowstorm led to a rapid increase in the number of poor herding households (Templer *et al.*, 1993, see also Cooper, 1993).

In addition to a State's direct relief assistance, many NGOs have put great efforts in disaster relief/mitigation in many developing countries. Some of these relief programs

tend to focus on livelihood reconstruction in both short-term and long-term. CARE, for example, develops its own disaster relief model to account for the special needs of households at different periods of time after a disaster, trying to link relief to a development continuum. This model has three stages. The first ‘relief’ stage is ‘livelihood provisioning’ with water, foods, etc. to meet the basic needs. The second ‘relief to rehabilitation’ stage aims to prevent further erosion of households’ productive assets and help with their livelihoods (livelihood protection), with short-term intervention including food-for-work and cash-for-work. The third stage of ‘rehabilitation to mitigation and preparedness’ (livelihood promotion) comprises medium to long-term rehabilitation and development activities which emphasize asset-building to improve a household’s access to resources and reduce potential future losses (Sanderson, 1999; Carney *et al.*, 1999).

The above disaster relief framework emphasizes the temporal effects of livelihood reconstruction and the importance of reducing a household’s vulnerability. This notion is essential in both large-scale relief programs and the livelihood planning of individual households. Livelihood (re)construction can be seen as *ex ante* and *ex post* risk management. In general, *ex ante* actions are ‘insurance strategies’ taken prior to a risk event, while *ex post* actions are ‘non-intentional strategies’ especially pursued to meet the special needs after a crisis (Heitzmann *et al.*, 2002; McPeak & Barrett, 2001). *Ex ante* strategies can reduce risk (i.e. eradication of infectious disease of livestock) or lower a household’s exposure to risks (i.e. building warmer-enclosures for livestock in winter); *ex post* actions help victims out of adversity (i.e. selling assets, migration of selected family members, and seeking temporary employment) (Hoogeveen *et al.*, 2000, Parnwell, n.d.).

2.2.2 Risk-coping strategies, poverty trap and sustainability

The above shows that coping with risk can have varied effects at different temporal (*ex ante* or *ex post*) and geographic scales (households and communities). Keeping more and more livestock, for example, reduces short-term risks associated with livestock production; yet it may lead to a long-term grassland degradation jeopardizing the welfare of the whole community (Bass, 2001; Ellis, 1993). Control of animal disease, particularly

in large-scale programs, has always been the subject of debate: environmental concerns have been raised, which discouraged investments in animal disease control (FAO, 2002).

The above indicates that there are always certain costs and benefits associated with risk management. If the total cost exceeds the total benefit of the attempted coping strategy, the strategy would neither be economically viable nor environmentally sustainable (Anderson & Dillion, 1992). In other words, trading short-term risk avoidance and reduction with long-term productivity-reduction of the natural resources increases the probability of exposing subsistence households to future decline in welfare due to escalated environmental stresses. That is, environmentally unjustified risk-coping strategies could render households more vulnerable to future shocks and poverty. What's worse, without sufficient assets or safety nets, shocks may lead to irreversible losses, such as a permanent reduction in human capital. For example, child labour emerges as a way to mitigate the impact of shocks on households *ex post*. However the children's nutrition and education would be sacrificed if they are of school age (UN, 1986; Ligon & Schechter 2003; Christiaensen & Subbarao, 2001; Jacoby & Skoufias, 1997).

In all, the above mentioned actions amplify the risk exposure of the households, especially when they are poor, and thus further trap them in chronic poverty. This 'poverty trap' results from insufficient investment in the sustainable use of natural resources (capital) and human capital, and thus aggravates the vulnerability of the poor (SAGA, n.d.). This recognition shows that the wellbeing of the environment (natural capital) is closely tied into the wellbeing of its inhabitants. The existence of the poverty trap also agrees with human ecologists' view that human society coevolves with natural systems (Berkes & Folke, 1992). The environment represents a significant source of risk (natural variations), and households' risk-coping strategies shape their environment by increasing/reducing environmental risks or even creating new ones (see Christiaensen & Subbarao, 2001). Through this interaction between human and their natural environment, human society tries to survive and adapt to the changes through continuous learning and self-organization. This adaptability of human society to their natural environment is what Berkes & Folke call 'cultural capital'. Cultural capital ensures the long-term sustainable use of natural resources. Small-scale disturbances lead to the 'renewal' and 'reorganization' of human society, allowing innovation to occur and sustaining the

resilience of the system. 'Resilience' is "the capacity of a system or community potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure".(UN International Strategy for Disaster Reduction, n.d.).

The 'vicious poverty trap' has also been framed within the theory of risk-aversion (Perrings, 1996; Nielsen, 2001). Mosley & Verschoor (2004) describe the high degree of absolute risk aversion, as "a state of mind brought about by chronic poverty, which can be measured with an index of perceived vulnerability" (p.2). Risk-aversion reduces one's willingness to undertake the risky investment that may offer an escape from poverty. When poverty is pervasive, especially in the absence of insurance markets and safety nets, "adequate risk management requires diverse livelihoods with low covariant risks (between the factors that cause the uncertainty of income streams of each production activity)" (Mosley & Verschoor, 2004, p.2). Therefore, "failing risk management strategies are bound to lead to a depletion of the (small) physical, human and social capital buffer, thereby increase the likelihood of income poverty in any given year, and thereby increase the likelihood of chronic poverty" (p.2). This largely explains the familiar phenomenon that many poor farmers in developing countries are 'reluctant' or 'slow' in adopting new high-yield production methods and using soil-conservation technologies. In either cases, the poor households are mostly found in low-return and low-variation methods of production (or with crop varieties), even though the alternatives seem more attractive and productive (Ellis, 1993).

When poverty is largely attributed to the risk-averse 'state of mind', it is vital to assess the role of state policies in lifting households out of or compelling them into this 'poverty trap'. Studies on rural Indian peasants' risk attitudes suggest that peasants' reactions to a specific risk event mainly depend on the constraints they face, instead of their risk preference (Binswanger, 1980). Kochar (1995) also indicates that "the set of options faced by farmers offers them little role for preferences" (p.159). In fact, many empirical studies show that households view some constraints as potential risks such as 'access to health medicals', 'school fees', 'consumer goods availability', etc. (Smith *et al.*, 2000; see also Dercon, 2002). In addition, State's transfer programs *ex post* of disasters, may have undesired welfare effects by putting pressure on informal communal-arrangements.

Some households covered by the safety net may have incentives to leave their informal inter-household transfer arrangements, leaving other households less protected (Dercon, 2000).

To summarize, the above illustrates a dynamic interconnection between risk attitudes, risk management, vulnerability and poverty within the policy environment. The next section searches for an appropriate framework which comprises and reflects such a dynamic link.

CHAPTER 3: Conceptual framework

3.1 Framework selection

In search of an appropriate framework, two types of framework are considered: the standard decision-making tools, and models which focus on livelihoods and disaster management. The standard decision-making tools include Cost-Benefit Analysis (CBA), Multiple Criteria Analysis (MCA), Expected Utility Model (EU), and Decision Analysis (DA). The second type of model involves the Sustainable Livelihood (SL) framework and the Pressure And Release (PAR) model. The following outlines strengths and weaknesses of each model, and the most appropriate framework is selected at the end to best suit the purpose of this research.

Cost-Benefit Analysis (CBA) estimates and totals up the equivalent money value of the benefits and costs of certain projects (Konstantinos & Efrosini, 2003). Mostly self-explanatory, benefit less cost in monetary value is used as a decision standard to choose a viable project and/or action. When cost and benefit involve consecutive cash flows, discounting future values is necessary. In practice, there are many operational difficulties such as how to quantify cost and benefit when there seem no standard prices (i.e. environmental goods), how to determine a fair discount rate of the future value between private and public sectors, and how to compare cost and benefit across individuals (especially when beneficiaries are not the cost bearers), etc. Most importantly, by using monetary value as the exclusive decision-rule, CBA is negligent in measuring how well or poorly the proposed projects/actions could possibly attain sustainability; in addition, it assumes the decision-maker is risk neutral, which is inappropriate from the perspective of a subsistence-oriented household. For these reasons, CBA is not suitable for this study. Nevertheless, the rationale of benefit/cost calculation still holds at each decision level (i.e. households normally choose the most economically feasible production).

Multiple Criteria Analysis (MCA) offsets the shortcomings of CBA by comparing tentative projects and actions under multiple objectives, such as maximum economic return, minimum pollution level, etc. Ideally, MCA could be effective in selecting a ‘best

strategy' that scores the highest in meeting all the objectives. In practice a set of alternatives may be characterized by criteria being both qualitative and quantitative, quantified with different units of measure, and/or in conflict with each other (Buede, 2000). Often the multiple attributes need to be synthesized into a single combined value, which involves subjective value judgements by the decision makers. In this sense, MCA models can "provide conflicting rankings of the alternatives for a common set of information even under states of certainty", largely depending on the interpretation of the criteria (Kujawski, 2003, p.1). As a result, Bell *et al.* (1988) argues that MCA should be scrutinized when used as a decision-making tool. Criteria in an extremely disaggregate manner lose the usefulness of their application, especially when the system is dynamic, complex and involves uncertainties. MCA is hence not chosen as the analytical framework for this study. Nevertheless the multiple criteria that determine the wellbeing of an agro-pastoral household were taken from group discussion. These collectively-generated criteria could be used as a reference for determining if certain households are poor, and the possible factors that shape their poverty (i.e. lack of labourers, family member(s) having chronic illness, etc).

In **Expected Utility (EU) theory**, "the utility of an agent facing uncertainty is calculated by considering utility in each possible state and constructing a weighted average, where the weights are the agent's estimate of the probability of each state" ("Expected Utility", n.d.; see also Arrow, 1963). This suggests EU is what people value, and in this sense, maximizing EU rather than profit is probably a fairer and more complete account for the decision-making process. In order to calculate EU, outcomes are to be weighted according to their relative likelihood of occurrence, or relative importance to the decision-makers. Despite the wide application of EU model in assisting decision making (and in behavioural studies), Schoemaker (1982) argues that people do not structure problems as holistically and comprehensively as EU theory suggests; and behaviour responses in laboratory that back up EU theory could diverge greatly from real life decision-making. Chavas (2004) also stresses the reality that people are not invariably risk-averse or risk-loving; instead many people 'insure' against 'downside risk' (with a negative payoff) while at the same time 'gamble' on 'upside risk' (with a negative payoff) (Friedman & Savage, 1948). Related to this observation is the 'safety first' principle and the 'survival algorithm' (see

Section 2)—many subsistence-producers act to maximize their chances of survival, via taking less risky actions which are usually accompanied with a low return.

Closely related to EU model is the **Decision Analysis (DA) model**—a “structured way of thinking about how the action taken in a current decision would lead to a result. In doing this, one distinguishes three features of the situation: the decision to be made, the chance and impact of the known and unknown factors that can affect the results” (Spradlin, 1997). Notably, the above description about DA is very similar to how people perceive risk (**Section 2.1**). Indeed, risk assessment itself is decision analysis in the sense that avoiding or taking risk is the objective of the decision maker. Risk perception is no different than decision analysis; and the multiple dimensional construct of risk perception also applies to decision analysis. In practice, estimating probability and potential losses is inevitable and could produce widely varied results across the decision makers. DA thus will not be used as the major analytical framework for this research.

The Pressure And Release (PAR) model and **the Sustainable Livelihood (SL)** framework both have a strong focus on vulnerability of households. The **PAR** model (Blaikie *et al.*, 1994) recognizes that a disaster is the intersection of two opposing forces: the processes generating vulnerability on one side, and physical exposure to hazard on the other. Therefore extreme natural events are not disasters until a vulnerable group of people is exposed. In **PAR**, ‘progression’ of vulnerability exists in three levels: root causes, dynamic pressures and unsafe conditions. Root causes are the fundamental processes (economic, demographic, political, etc.) that reflect and affect power distribution within a society (and with relation to the functioning of the state). Dynamic pressures channel the root causes into forms of insecurity, through assets acquisition, livelihood portfolio planning, etc. Unsafe conditions are specific forms in which a population’s vulnerability is expressed in time and space in conjunction with a hazard (see Twigg, 2001). Following the PAR model, Blaikie *et al.* (1994) developed a second model—**Access model**, examining ‘access’ and ‘livelihood’ to understand why some households are more vulnerable than others. The **PRA** and the **Access model** hold a rather holistic view of vulnerability; yet they are only useful in explaining the causes of vulnerability, but not measuring it. In addition, their primary emphases are on natural hazards, and thus little attention is given to the idiosyncratic risks that affect individual households, such as illness of family members.

The **Sustainable Livelihood (SL) framework** in contrast, links assets, livelihoods, consequences and vulnerability. This study chooses the SL model as its conceptual framework.

3.2 Sustainable Livelihood (SL) framework

3.2.1 Contextual settings

The SL framework is widely adopted as a guiding principle for rural development practice by many governments and NGOs, including UK Department for International Development (DFID), and United Nations Development Program (UNDP), etc. It puts assets, livelihood strategies, and livelihood outcomes in the context of vulnerability (Appendix B, Figure B-1). This context resides within the surrounding physical, policy, economic and institutional environment. The SL approach puts people at the centre; it takes a holistic view—recognizing that the multiplicity of actors, assets, livelihoods, and outcomes exist in both the micro and macro levels, and the forces that influence livelihoods are dynamic (see Twigg, 2001; Cahn, 2002; Carney *et al.*, 1999). The SL model also expresses the need to maintain an ‘outcome focus’, projecting the possible consequences of livelihood strategies and development activities. The following definition of SL summarizes the focal elements above:

A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets...

...both now and in the future (Carney *et al.*, 1994, p.8), or/and

...while not undermining the natural resource base (Scoones, 1998, p.5).

3.2.2 Asset categories

Development agencies and practitioners have recognized that lifetime freedom from poverty depends on access to a range of assets and livelihood strategies, which can sustain households and individuals through the stresses and shocks (Cahn, 2002). In the SL framework, assets are broken down into five categories, collectively forming ‘the asset pentagon’. These categories include (Carney *et al.*, 1994, p.9):

- Human capital: the skills, knowledge, ability to labour and good health important to the ability to pursue different livelihood strategies;
- Physical capital: the basic infrastructure (transport, shelter, water, energy and communications) and the production equipment and means that enable people to pursue livelihoods;
- Social capital: the social resources (networks, membership of groups, relationships, trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods;
- Financial capital: the financial resources which are available to people (whether savings, supplies of credit or regular remittances or pensions) and which provide them with different livelihood options; and
- Natural capital: the natural resource stocks from which resource flows useful for livelihoods are derived (e.g. land, water, biodiversity, environmental resources).

In addition to the above five categories, Berkes & Folkes (1992) define ‘culture capital’ as “the factors that provide human societies with the means and adaptations to deal with the natural environment and to actively modify it”. ‘Culture capital’ includes worldview (Skolimowski, 1981), environmental philosophy/ethics/religion (Leopold, 1949; Naess, 1989), traditional ecological knowledge (Johannes, 1989), and institutions (Ostrom, 1990). This study doesn’t include culture capital as a distinct capital-category; nevertheless, what the research tries to discover—how people perceive their risk-environment and come up with strategies to cope with these risks individually and collectively, reflects the ‘culture capital’ concept.

Bebbington (1999) explains the role of assets as more than developing livelihoods. More importantly, assets give “meaning to the person’s world”, and “give them the capability to be and to act”. In this sense, assets are “vehicles for instrumental action (making a living), hermeneutic action (making living meaningful), and emancipatory action (challenging the structures under which one makes a living)” (p.2022).

3.2.3 Livelihood strategies

Based on the assets and capitals that are available to households, strategies are developed to build livelihoods. Three broad clusters of livelihood strategies are identified in the DFID’s SL model. These include (Scoones, 1998, p. 9):

- Agricultural intensification/extensification – between capital-led (supported often by external inputs and policy-led) and labour-led (based on own labour and social resources and a more autonomous process) intensification;

- Livelihood diversification – between an active choice to invest in diversification for accumulation and reinvestment, and diversification aimed at coping with temporary adversity or more permanent adaptation of livelihood activities, when other options are failing to provide a livelihood; and
- Migration – between different migration causes (e.g. voluntary and involuntary movement), effects (e.g. reinvestment in agriculture, enterprise or consumption at the home or migration site) and movement patterns (e.g. to or from different places).

Among the above three clusters of livelihood strategies, livelihood diversification is perhaps the most common for rural households. Theoretically speaking, combining two income sources with the same mean and variance will reduce the total income risk, as long as these income sources are not perfectly covariant (Dercon, 2002). In reality, it is difficult to diversify income sources without reducing the level of return. For poor households, they cannot afford the cost of reducing risks (reduced income), and thus are likely to specialize in only one or two activities, with low level of risk and a low return. This is the so-called ‘income skewing’ strategy. As a result, the poor is often seen as less diversified than the better-off. The inequality resulting from livelihood diversification between the rich and the poor is further reinforced at the time of crisis and shocks—rich households having more diversified means can borrow credits or sell assets as part of a buffer stock strategy, while the poor cannot.

Similar to income skewing, intensification/extensification (in both farming and non-farming practices) is capable of creating inequality between the different wealth groups. Dercon & Krishnan (1996) find that entry into the commonly-favoured high-return, non-farming activities, such as cattle rearing or shop-keeping, is restricted to richer households, presumably those with access to capital. Non-agricultural wage employment is restricted to people with education and/or skills (see also Dercon, 2002). Jeffrey & Lerche (2000) observed that patterns of access to high-return versus low-return non-farm activities, could reinforce existing inequalities in access to land in Uttar Pradesh, northern India; however for the landless or land poor there may be no other options available (see also Bouahom *et al.*, 2004). In addition, migration in order to avoid risks/disasters is strictly regulated in many developing countries (such as China). Oftentimes, the poor cannot afford to migrate, and even if they do, they tend to transform from rural poor to urban poor, finding much of the infrastructure provided for migratory labourers remains incomplete in cities (Skeldon, 2002). These cases outline the constraints that confront

poor households, and thus policies aiming at removing or reducing these constraints are complementary to any poverty alleviation program.

3.2.4 Livelihood outcomes

Livelihood outcomes are the consequences of applying livelihood strategies. The DFID's SL model depicts livelihood outcomes as: 1) creation of working days, 2) poverty reduction, 3) improvement of well-being and capabilities, 4) livelihood adaptation, 5) of vulnerability reduction and resilience enhancement, and 6) natural resource base sustainability. Among these projected outcomes, "the first three focus on livelihoods, linking concerns over work and employment with poverty reduction with broader issues of adequacy, security, well-being and capability. The last two elements add the sustainability dimension, looking, in turn, at the resilience of livelihoods and the natural resource base on which, in part, they depend" (Scoones, 1998, p. 6).

Viewing livelihood outcomes from another angle, assets could be seen as both the inputs and the outputs to livelihoods and development activities, in the sense that the amount and composition of the assets are transformed as a result. Two types of relationship between assets are particularly important with respect to vulnerability: sequencing and substitution. 'Sequencing' determines the type of assets serving as the starting point for a household to gain access to other assets, and successfully establish a particular livelihood strategy. 'Substitution' refers to the assets that can be substituted with one another (i.e. can an increase in human capital compensate for a lack of natural capital). The hypothesis of the perfect substitutability between human-made capital and natural capital is a construct of 'sustainability' (Neumayer, 2003). To trade natural capital with human-made capital is a weak way to achieve sustainability for subsistence producers since their survival is tied with the well being of their natural capital. The outcome can be assessed as the 'net livelihood effects' (both negative and positive) for different actors and situations. Overgrazing the community common grassland has always been a rationale for individuals to maximize their welfare; however, 'the tragedy of the commons' would detriment welfare of everybody. In an analysis, the specification of the scale is critical to risk-management.

3.2.5 Transforming structures and processes

Transforming structures and processes are institutions, policies, legislations, societal norms, and incentives that characterize the ambient environment in which households dwell. They have a profound influence on assets, as they i) create assets, ii) determine access to assets, and iii) influence rates of asset accumulation and exchange (Scoones, 1998; DFID, n.d.). Behind these structures and process are various actors playing different roles individually and collectively at all levels. Generally speaking the greater people's asset-endowment, the more influence they can exert. Hence one way to reduce vulnerability may be to support people in building up their assets.

At the heart of the transforming structures are the conflicting and cooperative processes of common resource management (including risk management). The access to common resources and collective risk-management networks can be critical to marginalized groups (Grootaert, 1998). The exclusion from the collective decision-making on these issues is commonly regarded as one attribute of being 'poor'. This corresponds to the experiential dimension of 'poverty' which is characterized by not only assets at disposal, but also the experiences that people are subject to (Bebbington, 1999).

All these suggest institutions could play a crucial role in managing risk and common resources. Institutions crafted by a group of people sharing similar interest and values can usually produce more responsible decisions and behaviours to secure the long-term benefits for their members. The communal common-resource-management institutions, could create and maintain critical social capital (such as trust and transparent decision-making processes), and thus promote 'sustainability' by assessing the 'net livelihood effects' at the household and the community levels. In this way, the individual behaviours may be oriented into the common goal; and the adaptive strategies to cope with shocks and stresses can evolve from collective learning and decision-making.

3.3 Incorporating risk management into the SL framework

After a detailed description of the components of the SL framework, the strengths and weaknesses of the model can be seen. None of the elements in the SL model are new; however the framework itself is innovative, in that its elements have been brought together to represent a holistic and realistic view of livelihood systems and to reflect

poverty in its broadest sense (Cahn, 2002; Twigg, 2001). The SL model is people-centred, taking a dynamic view at multiple levels, designed to be participatory (ideally should be conducted in partnership with the communities), and has an emphasis in sustainability (Carney *et al*, 1999). Being broad and comprehensive is both the strength and the weakness of the SL model. One major concern has been what factors and actors to include in this conceptual framework (Twigg, 2001). The framework is assumed to be linear with no feed back or other relationships, which is also unrealistic (Cahn, 2002).

In addition, Twigg (2001) raises his concern of using the SL model— “there is a risk that natural hazards’ importance may be downplayed by such a model, especially in the case of hazards that occur relatively infrequently...a further indication that natural hazards’ significance may be undervalued is the statement in the short to medium term, and on an individual and small group basis, little can be done to alter the vulnerability context directly.... (and thus) it could lead researchers and implementing agencies to undervalue potentially beneficial impact of local and higher level of disaster mitigation measures... The framework recognizes that hazards can damage natural capital, but place less emphasis on the magnification and creation of hazards by inappropriate resource use” (p.12).

What’s implied in Twigg’s critique is the need to account for risk management as an integral part of the SL system. Risk management, including *ex ante* prevention and reduction strategies, and *ex post* inter-household and/or inter-community transfer arrangement, has prominent effects in reducing poverty, enhancing resilience of rural households to future shocks and stresses, as well as maintaining and improving livelihoods. In fact coping with risk is a part of daily life for rural households in many developing countries (Dercon, 2002). And thus a large part of their livelihood strategies is designed to manage risk, such as income skewing, etc. These reflections have been manifested in the research conducted in pastoral areas in Qinghai Province, China. Researchers found that most households based their decisions on their perceptions of the surrounding risk, the socio-economic framework around the risk, the potential benefit/harm of risk-taking, and the safety nets available in the case of the worst case scenario (Bass, 2001).

CHAPTER 4: Methods

4.1 Data collection

Methods used in data collection are literature review, semi-structured interview, household (HH) survey and focus group (FG) discussion. Participatory Research (PR) techniques were applied, giving local communities an opportunity to express their opinions in an innovative way. A combination of multiple methods provides cross-checks and improves validity (Powell & Steele, 1996); and they altogether ‘triangulate’ each other to link various knowledge worlds through participatory learning and joint inquiry (Ashby *et al.*, 2000; Vernooy & McDougall, 2003). The following discusses the application of each method—the issues and the perspectives that they intend to explore.

4.1.1 Literature review

Literature review mainly examines two divisions of knowledge: the subsistence production systems and risk. The first subject includes the external environment and internal characteristics of the subsistence production systems, agro-pastoral systems of NW Yunnan, and its three typical community-types. The second topic covers the definition and the classification of risk, how people perceive, measure and cope with risk, as well as the consequences of some risk-coping behaviour.

4.1.2 Semi-structured interview

Semi-structured interviews were conducted with government officials and village leaders. It contains the close-ended and the open-ended questions. Interview with the Head of the Grass Station, Zhongdian Animal Husbandry Bureau helped to gain a basic understanding of the agro-pastoral system of Zhongdian County. Other government officials interviewed include the Deputy Head of the County-level Ministry of Civil Affairs (Department of Disaster Relief), and Deputy Head of the County-level Office of Poverty Alleviation and Development. The village and community-level background

information is acquired via interviews with the administrative-village leaders¹, the hamlet heads², and some key informants of the hamlets (if the head was not available).

Community-level background information includes the demographics, key natural resources, significant risks, and the disaster relief strategies.

4.1.3 Focus Groups (FG)

Three pretest focus groups (FG) were conducted prior to the actual data collection. The purpose of a pretest is to examine the readability of the questions (i.e. if they are easily understandable) and the sensitivity of the methods (i.e. gender and age dynamics in group discussion). Pretest FGs indicated that opinions were most notably divergent between age groups rather than gender groups. In the FGs conducted after the pretests, participants were stratified into 1) youth and mid-age (16yr-50yr), and 2) elders (>50yr). In each sampled hamlet both these FGs consisting of 4-7 participants in each FG were held after household survey. Participation in the FGs is completely voluntary. FGs are complementary to household questionnaire, since they emphasize the community's perspective in perceiving and surviving risk events, and assessing the impact of risk-coping behaviours on the community in a longer time-frame.

The research found that FG sessions largely supported the findings from the HH survey. The FG discussion results are reported only where there is any discrepancy between FGs and the HH survey; otherwise, the FG results are not discussed further in the text.

4.1.4 Participatory Research (PR) techniques

The definition of Participatory Research (PR) is subject to a range of variation (Hall, 1996; Rahman, 1994; Selener, 1997; Heron, 1996). A commonly cited definition is “the collective generation of knowledge which leads to the planning and achievement of jointly set objectives” (Collins, 1999). PR differs from Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) in their objectives and means. PR has a special focus on applying PRA tools in the research and information are collected in the form readily to be analyzed using standard tools (such as statistical tests). The purpose of PR

¹ Leader of Administrative Village is a government-paid position.

² Hamlet head is elected by hamlet members; the position is not paid by the government.

is to generalize the results derived from the local context into a wider population, and thus infer possible policy-making changes or improvements.

PR techniques were applied in many situations in this study. For example, key informants recalled the significant natural disasters (and their impacts) and put together a historical-event log for their community; they also drew community maps to illustrate the major landmarks, key communal resources and location of all the households. Matrix scoring assisted focus groups in assessing production activities by their labour and capital requirement, profitableness and the level of risk involved. Unlike in the ranking exercise, FG participants could freely score (within a range) a production activity under a certain criterion. Fully open scoring is preferable to statistical analyses as it leads to ‘independent’ observations (Abeyasekera, 2001).

4.1.5 Household (HH) questionnaire

A household survey elicits information specific to households. The emphasis is on the differences between households of their assets, livelihood strategies, risk-perception and coping behaviours (Appendix A). Unlike FG participant selection, the HH survey participants were not stratified into gender or age groups; they were usually the HH members who were available at the time of survey. After three pretests (HH survey in three pretest sites), the study conducted HH questionnaire in 16 hamlets with 159 agro-pastoral households.

4.2 Selection of study units

During June—mid August 2004, the research team visited 8 administrative villages (AV) and 16 hamlets of Zhongdian County. In each hamlet, about 10 household were chosen for conducting HH questionnaire, and 2 focus groups (the non-elder group and the elder group) were held after the HH questionnaire. The selection of these hamlets and households was based on a three-stage hierarchal sampling scheme.

Stage-one sampling selected 4 townships and 8 administrative villages (AV) out of the 63 AVs in Zhongdian. These chosen townships and AVs consisted of Tibetan-speaking hamlets. They were chosen since they were ranked ‘high’ in having the ‘agro-pastoral’ features (a combination of farming practices with livestock husbandry, as well as mobile

herding patterns). This sampling technique is called ‘ranked-stratification sampling’ which intends to select the sampling units that satisfy a set of criteria and are ranked high accordingly (Wilson, 2002);

Stage-two sampling chose 2 ‘typical agro-pastoral’ hamlets from each AV selected in the first stage, after the research team gained a clear understanding of all the hamlets of the AV (through interview with the AV leaders). Another consideration about selecting a hamlet is when the research was conducted, the chosen hamlets had to have accessible gravel or dirt roads during the rainy season;

Stage-three sampling selected about 10 households from about 30-40 households (the normal size of a hamlet) living in each hamlet for participating in the HH survey. As the study is interested in the inter-household differences (in their assets, livelihood strategies, and risk perception and management), three socio-economic groups of households were surveyed— 1) the better-off (or the ‘rich’), 2) the mid, and 3) the worse-off (or the ‘poor’)³. Before the HH survey, key-informant groups identified the socio-economic status of each household in their hamlet, based on a range of indicators (which were varied between groups; these indicators were further examined in the hamlet focus groups). Approximately 2-4 households were selected from each socio-economic stratum of each hamlet to form a sample size of 9-11 households. Most of these households were randomly chosen from each socio-economic stratum, though some practical issues were also considered— the household selected must have an adult member(s) available at the time of the household visit and know the family well and were willing to participate in the survey. In this sense, the household selection is not completely based on ‘probability sampling’. The drawback of the ‘non-probability sampling’ is discussed in **Section 6.7**. The results derived from the HH survey are most appropriate for comparing the differences between groups.

The AVs and hamlets selected are representation of three types of agro-pastoral community: hamlets of Xiaozhongdian and Jiantang township belong to the highland communities; hamlets of Geza township mainly sit along the waterside of Geza River and Wengshui River (the irrigated communities); and the majority hamlets of Nixi township

³ The use of the term—‘poor’ in this study only stands for being ‘worse-off’, and doesn’t have any discriminatory meaning.

dwelling within the dryland climatic zone, with the exception of Hala (hamlet) located at the transition area between the highland and the dryland communities (Table 2).

Table 2: Demographic information and wealth-group composition of the sampled hamlets

| Hamlet | Township | AV | Community type | Population | No. of HH | No. of HH Sampled | Socio economic stratification (% of the total no. of household) | | |
|--------------|----------|-----|----------------|------------|-----------|-------------------|---|-------|-------|
| | | | | | | | Rich | Mid | Poor |
| Zhiti | XZhd | Hp | Highland | 114 | 23 | 10 | 13.04 | 69.57 | 17.39 |
| Jigong | XZhd | Hp | Highland | 185 | 36 | 10 | 22.22 | 63.89 | 13.89 |
| Shengkeding | XZhd | Tj | Highland | 232 | 48 | 10 | 20.83 | 58.33 | 20.83 |
| Ayanggu | XZhd | Tj | Highland | 166 | 34 | 10 | 29.41 | 58.82 | 11.76 |
| Bisonggu | JT | Nsh | Highland | 208 | 38 | 11 | 10.53 | 73.68 | 15.79 |
| Bulun | JT | Nsh | Highland | 517 | 96 | 10 | 20.83 | 47.92 | 31.25 |
| Bengjiading | JT | Hgp | Highland | 209 | 39 | 10 | 10.26 | 84.62 | 5.13 |
| Dala | JT | Hgp | Highland | 150 | 25 | 10 | 12.00 | 76.00 | 12.00 |
| Gedingshui | GZ | Xgz | Irrigated | 280 | 32 | 10 | 15.63 | 53.13 | 31.25 |
| Gecang | GZ | Xgz | Irrigated | 180 | 32 | 10 | 6.25 | 78.13 | 15.63 |
| Zeyang | GZ | Wsh | Irrigated | 205 | 35 | 10 | 5.71 | 85.71 | 8.57 |
| Yangzhong | GZ | Wsh | Irrigated | 219 | 39 | 10 | 7.69 | 84.62 | 7.69 |
| Tangsheng | NX | Xy | Dryland | 104 | 18 | 8 | 11.11 | 72.22 | 16.67 |
| Jusiding | NX | Xy | Dryland | 78 | 12 | 10 | 25.00 | 58.33 | 16.67 |
| Tanglangding | NX | Tm | Dryland | 320 | 51 | 10 | 5.88 | 88.24 | 5.88 |
| Hala | NX | Tm | Highland | 80 | 16 | 10 | 18.75 | 56.25 | 25.00 |

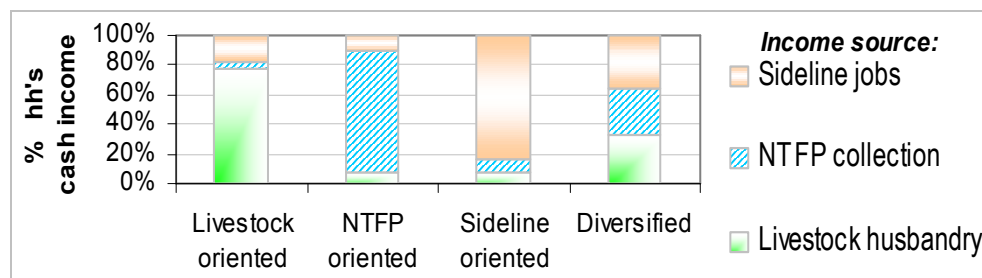
Note: the acronyms stand for the names of the sampled townships and administrative villages (AV): Xzhd for XiaoZhongdian, JT for JianTang, GZ for GeZa, NX for NiXi, Hp for Heping, Tj for Tuanjie, Nsh for Nishi, Hgp for Hongpo, Xgz for Xiageza, Wsh for Wengshui, Xv for Xinyang, and Tm for Tangman.

4.3 Classification of the household types

After the HH survey, the participating households were further classified into four types, based on the household's main income source. The purpose of household classification is to explore if the production mode that a household predominantly pursues has an effect on the household's asset-holdings as well as its risk-management strategies. These household types include: 1) the livestock-oriented, 2) the NTFP-oriented (NTFP—Non Timber Forest Products), 3) the sideline-oriented, and 4) the diversified. A main income source means it has contributed 60% or more household cash income. The livestock-oriented households thus were those drawing 60% (or more) of their cash income from livestock husbandry (by selling livestock, meat and dairy products); the NTFP-oriented were those having 60% (or more) of their cash income from NTFP collection (including mushrooms—primarily *matsutake*, medicinal herbs, fruits, fiber, etc); and the sideline-

oriented were the ones earning 60% (or more) of their income from sideline jobs (including temporary jobs, transport business, specialized trading, working for the government or a factory, tour-guiding and providing horse-back riding services, lodging business, carpentry, etc.). The rest of the households didn't have a distinctive main income source; they obtained their cash income evenly (25-35%) from the above three sources, and they were called the diversified type (Figure 1). Among the sampled households, 10% were livestock-oriented; 23% were NTFP-oriented; 36% were sideline-oriented and 31% were diversified. These types of household don't exist in a sole hamlet or community; neither do they belong to a particular wealth group exclusively. Nevertheless these types of household are distributed unevenly among the community types and wealth groups (more under **Section 6.2**).

Figure 1: Classification of the household types



4.4 Data analysis

Different tools were applied in data analysis based on the form and the nature of the data. Data collected in the HH survey were mostly quantitative, and thus could be readily analyzed using statistic tools. In contrast, a large part of FG discussion results were qualitative in nature. The use of PR techniques helped record these results in a quantitative form. The rest of qualitative information was converted into qualitative form by coding before being analyzed by statistic tools. Most of the FG discussion results supported the HH survey findings, and therefore the HH survey data are the main focus of the analysis.

Statistical tools used in the analysis mainly include 1) simple descriptive statistics, such as mean and standard deviation of the household cash income⁴, 2) significance testing, (such as ANOVA test of variance between means), 3) measure of association (such as Pearson Chi-square statistics) to test the interdependence between two nominal variables, (i.e. the socio-economic status of the household and the severest risk it identified), and 4) correlation between two ordinal/scale variables (i.e. the family size and the number of livestock the household kept).

Any time when results were generalized to represent the agro-pastoral households of Zhongdian, responses (average) were weighted according to the actual composition of the socio-economic strata in these hamlets sampled. In significance testing, 90% instead of 95%, was chosen as the significance level. The drawback of a lower significance level is that the significance testing is less powerful (than that of a higher significance level) to generalize the results into a wider population. However, a lower significance level reduces the chance of making Type I error (rejecting the null hypothesis when it's true), and increases the chance of detecting the valid relationships between variables which is observed 'not by chance'. The analysis focuses on the distinctions between the community types, the household types and the wealth groups; results are shown if the distinction is significant at or above 90% significance level. Differences between hamlets will not be analyzed using significance testing, since the number of respondents sampled in each hamlet (8-10) isn't large enough for statistical tests. With respect to 'measure of association', 'Fisher exact test' was used to replace Pearson Chi-square, in the occasions when the expected cell count (in the crosstab) is less than 5 (Fisher, 1922).

⁴ Normally, descriptive statistics would be enough for describing the overall population and exhibiting differences between groups (such as community types). However, there is a chance that the observed differences between groups occur as a result of sampling error, particularly when the differences are small. Under such circumstances, distinctions between groups should no longer be made; and any interpretation of the distinctions is deemed as neither correct nor necessary. In these cases, statistical significance testing is needed to determine whether the observed differences between groups are real, or merely due to chance.

Chapter 5: Results

This chapter presents the primary results from analyzing the survey and the focus groups. The layout of this section largely follows the sequence of topics presented in the literature review: 1) the form and amount of assets owned by the households and their communities, 2) the livelihood strategies that households adopt to plan their livelihood portfolio based on the assets they have, 3) the perception of risks the households and their communities face, and 4) the actions that the households and their communities take to cope with these risks. In presenting these results, emphasis is on the differences between various groups—the community types, the household types and the wealth groups. Statistical significance testing was applied to determine the ‘real’ distinctions between these groups that did not occur by chance (see **Section 4.4**).

5.1 Assets categories

This section explores five forms of capital (or asset) that the agro-pastoral households own individually and collectively in a community— financial, physical, human, social and natural capital. The study chose a set of indicators to measure a household’s possession of these assets. At the end of the section results are contrasted among various groups; in addition, the survey results are compared with the focus-group discussions, in order to form a comprehensive list of well-being indicators for agro-pastoral households.

5.1.1 Household’s assets

5.1.1.1 Financial capital

The financial capital represents obligations of a household, which usually includes savings, bonds, and any other forms of financial investment. Studies have shown that rural households save in various forms, including cash (at home or for lending to others), cattle, etc (Ntalasha, 2000; Verstralen, 2000; Campos, 2000). Very few HH questionnaire respondents reported savings or deposits in banks or other financial institutions; many said livestock was their families’ savings in physical form. As a matter of fact, more than

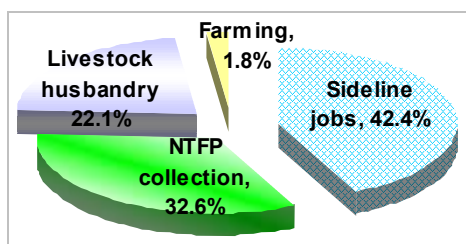
two thirds of the sampled households had negative net cash income in 2003-04 (household expenditure exceeded household cash income), implying a debt instead of savings at the end of a year. In addition, the information about one's financial assets often involves privacy and sharing the information can be sensitive in certain societies. In the survey, this information was based entirely on self-report, which could be under-reported, for example for the purpose to avoid tax (Kim & Weinberger, 1999). Given these considerations, this study chose financial status ('wealth', 'mid' or 'poor'), as measured by household net cash income, to approximate the financial wellbeing of a household. Household net cash income doesn't equate but contributes to savings, since the former is immediate cash flow, while the latter stands for stock accumulated over time. In addition to household net income, the study also measured how variable or stable the household income was between seasons and years (Mishra *et al.*, 2002). Household in-kind income was highly correlated with household cash income; it was the sum of produces used for self-consumption. The information about one's self-consumption was a rough estimate, so that it's not included explicitly in the calculation for a household's net cash income.

5.1.1.1 Household cash income and income composition

Respondents were asked about their cash earnings from each production activity in 2003-04, and the household cash income (2003-04) was calculated as the sum of all these earnings. This one-year household cash income (mean=¥ 19,612⁵) is much higher than the average annual cash income (mean=¥ 10,675, 2001-04) self-reported by the respondents. This observation underlies the fact that the household income is likely to be underreported. Across the study area, earnings from sideline jobs (i.e. transport business, specialized trading, etc) accounted for the biggest share in household cash income, followed by earnings from NTFP collection and livestock husbandry (Figure 2). Farming generated less than 2% of cash income; nevertheless the cash equivalent of the in-kind income (self-produced grain, meat and dairy products) exceeded the household cash income (2003-04).

⁵ The exchanged rate between Chinese Yuan and US dollar is about \$US100=¥ 820 RMB in 2004.

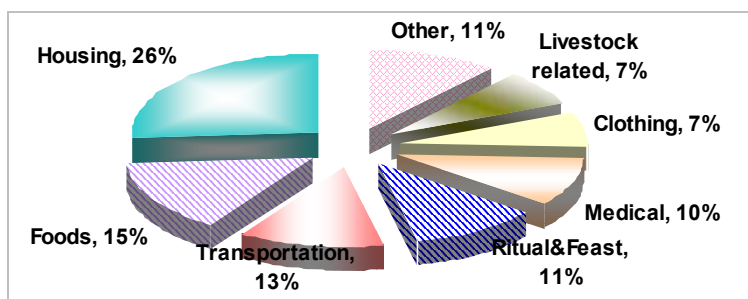
Figure 2: Income composition of the sampled households (2003-04)



5.1.1.1.2 Household expenditure and net cash income

The average household expenditure (¥ 14863) was higher than the average household cash income (2003-04), implying that household net cash income was negative (- ¥ 373). More than two thirds of the sampled households had negative net cash income. For these households, “borrowing from friends and relatives” helped them cover expenses. This on the other hand suggests the household cash income might have been under-reported, and/or the expenses been over-reported. Among many expenditure items, “house” related disbursement (i.e. building a new house or refurnishing the existing one) was the highest (Figure 3); one out of three households had reported this expense in 2003-04. Purchasing foods, transportation, ritual& feast and medical spending altogether accounted for half of the household expenditure (Figure 3).

Figure 3: Expenditure composition of the sampled households (2003-04)



Note: * Other is the spending related to education, farming, energy use and communication (i.e. phone bills).

5.1.1.1.3 The yearly and seasonal variations of the household cash income

Among the sampled households, 86% thought their annual household cash income (2001-2004) was inconstant between the years; and 57% considered their household cash income (2003-04) seasonally variable

5.1.1.2 Physical capital

The main physical capital that an agro-pastoral household possesses usually includes house(s), farmland holding, farming equipments, energy equipments (i.e. biomass stove), electronic appliances, vehicles, and livestock. Tractor, automobile (truck, minivan or jeep), telephone (land-phone or cell-phone) and livestock (cattle, horse, pig and chicken) were selected as the physical-assets indicators⁶. Most of these physical assets are quantifiable in nature. Except for livestock, however, quantification isn't necessary since the possession of these assets distinguishes a household from the rest. These physical assets were thus recorded in binomial answers (Yes/No) instead of the quantity. In the study area, most (70%) of the households had tractor(s); some (17%) owned automobiles and many (42%) had phones. In addition, a typical agro-pastoral household kept 9-10 cattle, 1 horse, 4-6 pigs and 7-8 chickens.

5.1.1.3 Human capital

5.1.1.3.1 Family demographic characteristics

Within the study area, an agro-pastoral household had about 6 members. Males somewhat outnumbered females (male to female ratio=1.3:1); 25% of family members were below 15-year, and 15% above 55. About 75% of family members were active labourers⁷.

5.1.1.3.2 Formal and informal education

There are six levels of educational achievement attained by people in the study area: religious institutions including monasteries and nunneries (of Tibetan Buddhism), primary schools (grade1-6)⁸, secondary schools (grade 7-12), colleges (or above) as well

⁶ This study doesn't include houses amongst a households' physical asset, since all households own their houses which are usually built with similar material (mostly hardwood), and in similar shape and size (traditional Southwest-Tibetan house style). Therefore it's legitimate to assume that houses don't vary much across individual households, when the emphasis is in the inter-household differences. Farmland holding of individual households is also not included in the analysis, since the farmland has undergone on-going redistribution within a hamlet. Starting in mid 1980s, the distribution of farmland in rural China reversed the previous collective ownership of the land under Mao Zedong's arrangement. The initial land allocation was based on and tried to retain egalitarianism over time, which lends the land to redistribution upon a change in the residence of a household, i.e. birth, marriage and death. Therefore, it is inaccurate and misleading to compare the holding of the cropland across households in the snapshot of one year (Chen *et al.*, 1999).

⁷ In China active labourers are people between age 18-55 (female 50, and male 55), without disability and currently not enrolled in any formal school. In rural areas, elders (> age-55) and students are actively involved in the household production; this study thus counts anyone beyond age-15 as an active labourer.

⁸ The primary schooling is mandated in the China's 'nine-year responsibility education' system.

as military schools. Religious institutes are not mainstream educational-institutions; nevertheless, they were thought as useful in providing knowledge and serving for culture and religious purposes⁹. In the study area, half of the households had primary schooling; 30% attained military or secondary schools and 7.5% had family members attending college or above. 9% also reported that their family members went to religious institutes.

5.1.1.4 Social capital

The notion of social capital is closely related to people's relationship with one another. In this study, social capital is measured by three indicators—1) a household's social networks (relative families) within the hamlet, 2) the participation of the household in community meetings and communal decision-making, and 3) a household's trust in its hamlet-neighbours. These indicators were compared between sampled hamlets.

5.1.1.4.1 Household's networks within the hamlet

Fewer numbers of people had lived in these communities several decades ago; and families used to have more members (about 10-20 people)¹⁰. This tradition has changed in the recent years; now the eldest child stays with the nuclear family, while the other children set up their own families when they get married. Hence a family usually has many relative families, and sometimes most of the hamlet-residents are related (such as in Hala hamlet, Table 3). In the study area, a household normally had 10-11 extended families living in the same hamlet, about one third of the hamlet residents (Table 3).

5.1.1.4.2 Trustworthy neighbours and household participation in community meetings

Trust is usually an important indicator for social capital. Except in three hamlets, 90% of the households thought 80% or more of their fellow hamlet neighbours were trustworthy (Table 3). Attending community meetings is usually mandatory for all households; absence is excused for sickness or some special reasons. Except in four hamlets, more than 90% people “always” attended community meetings (Table 3). Due to time constraints, the research team didn't attend any community meeting that were held during the course of the household survey in each hamlet.

⁹ The monastery and nunnery have always been very important to Tibetans, and becoming a lama or a nun was usually regarded as honourable to the whole family.

¹⁰ Before the change in Tibet's status (and the affiliated areas) in 1951, family-splitting (because of marriage) was discouraged with a heavy tax.

Table 3: Social capital of the sampled hamlets

| | <i>HH social network in the hamlet</i> | <i>HH participating in community meetings</i> | <i>HH's trust in their neighbours</i> |
|---------------|--|---|---|
| Hamlet | (% of hamlet HH being relatives) | % HHs "always" attending community meetings | % HHs considering >80% hamlet residents "trustworthy" |
| Zhiti | 39 | 60 | 70 |
| Jigong | 24 | 70 | 90 |
| Shengkeding | 22 | 100 | 90 |
| Ayanggu | 19 | 70 | 100 |
| Bisonggu | 29 | 100 | 91 |
| Bulun | 19 | 100 | 100 |
| Bengjiading | 32 | 90 | 100 |
| Dala | 24 | 90 | 80 |
| Gedingshui | 43 | 100 | 100 |
| Gecang | 24 | 80 | 60 |
| Zeyang | 30 | 90 | 100 |
| Yangzhong | 44 | 90 | 100 |
| Tangsheng | 36 | 100 | 100 |
| Jusiding | 32 | 100 | 90 |
| Tanglangding | 18 | 70 | 100 |
| Hala | 70 | 90 | 90 |

5.1.1.5 Natural capital

The most eminent community natural assets are community forest, winter and summer pasture, and farmland¹¹. Except for farmland, the rest is a common property resource (CPR)—its use is shared among members of the community (hamlet). At the household level, the amount of highland barley produced per member is chosen to approximate the natural productivity of the family farmland¹². A typical household produced 2187 kg highland barley in 2003-04 from its farmland, about 387 kg per person.

¹¹ A community as a whole has rights to decide among members on the extraction quota of timber and fuelwood from their community forest; it can extract NTFP from the National forest and also has the responsibility of protecting it. The use of the winter and summer pasture are usually open to everybody, and is commonly used by those who own yak and/or hybrid yak.

¹² Highland barley, scientific name—the naked barley, is a hardy cereal crop growing in highland of 2700 meters above sea level. It is the most important food for the highland people (TEW.org, 2002). The productivity of a farmland is best measured by the amount of barley produced per mu of the farmland. Assuming that the size of the farmland is positively correlated with the family size, the amount of barley produced per active labour should have the same ratio as barley produced per mu.

5.1.2 Comparison of assets owned by various groups

5.1.2.1 Distinctive assets owned by the community types

The most distinctive assets between communities were their natural resources. The irrigated communities had vast forestland and summer grassland; the highland communities had large winter grassland (Table 4). The dryland communities in contrast were the least rich in these natural resources. Households in the dryland communities also had smallest family farmland; a bigger part of their farmland had been converted into forestland or grassland under the policy of ‘green-for-grain’ (Table 4). In addition, these households only had half number of cattle than households in the other two communities (Table 4). The level of social-capital indicators didn’t vary significantly between the different types of community.

Table 4: Natural capital owned by the community types

| Community type | Natural capital (mu¹/hamlet) | | | Physical capital (unit/household) | | |
|-----------------------|--|--------------|--------------|--|---|------------------|
| | Community forest | Winter range | Summer range | Farmland (mu/HH) | Converted farmland ² (mu/HH) | Cattle (head/HH) |
| Highland (n=91) | 2188 | 1358 | 4944 | 11.4 | 0.5 | 10.5 |
| Irrigated (n=40) | 6500 | 770 | 41250 | 11.2 | 1.9 | 12.1 |
| Dryland (n=28) | 2767 | 373 | 2333 | 6.6 | 3.3 | 7.0 |

Note: ¹ Mu is an area-measurement commonly used in China; 1 hector = 15 mu.

² Farmland converted into forest land or grassland can’t be farmed without permission from the government.

Source: Interviews with the administrative-village officials and the hamlet heads.

5.1.2.2 Assets owned by the household types

5.1.2.2.1 Financial capital

Different household types had distinctive income sources; except the diversified households (Figure 1, **Section 4.3**). The sideline-oriented was the financially wealthiest of all; and they were the only ones who could cover their expenses without debt at the end of the year (Table 5). They also thought their household income was the least variable between seasons and years. Compared to others, these sideline-oriented households spent more in transportation, communication, and the education of their children (Table 5).

Table 5: Financial assets owned by the household types and the wealth groups*

| Financial capital | Household type | | | | Wealth group | | |
|---|---------------------------|----------------------|--------------------------|--------------------|--------------|------------|-------------|
| | Livestock oriented (n=16) | NFTP oriented (n=37) | Sideline oriented (n=57) | Diversified (n=49) | Rich (n=49) | Mid (n=77) | Poor (n=33) |
| Cash income per member (¥, 03-04) | 1414.7 | 1333.3 | 3721.4 | 2207.8 | 4278.4 | 2106.9 | 618.0 |
| Annual cash income per member (¥, 01-04) | 1091.3 | 1190.1 | 3073.5 | 1696.1 | 3523.0 | 1675.0 | 551.1 |
| Net cash income per member (¥, 03-04) | -601.5 | -1335.7 | 1240.5 | -583.2 | 1244.6 | -307.1 | -1644.0 |
| Cash equivalent of the self-produced, % total cash income | 144.2(i) | 135.0(i) | 91.0(i) | 119.2(i) | 57.8 | 104.4 | 226.0 |
| Income from livestock (% total cash income) | 77.1 | 7.7 | 6.7 | 32.4 | 24.5(i) | 22.5(i) | 16.9(i) |
| Income from NFTP (% total) | 4.4 | 79.4 | 9.7 | 30.4 | 19.2 | 36.4 | 39.6 |
| Income from sideline jobs (% total) | 17.3 | 9.5 | 82.9 | 34.2 | 54.3 | 39.2 | 41.0 |
| Food expenditure (% the total household expenditure) | 18.7(i) | 24.3(i) | 21.8(i) | 20.7(i) | 17.6 | 22.2 | 26.8 |
| Medical expenditure (% the total) | 11.4(i) | 10.7(i) | 10.4(i) | 12.2(i) | 8.2 | 10.7 | 16.4 |
| Transportation & communication expenditure (% the total) | 10.6 | 7.4 | 18.8 | 7.8 | 18.1 | 10.5 | 6.2 |
| Education expenditure per child 15-25yr, (¥, 03-04) | 354.2 | 98.5 | 518.6 | 83.2 | 22.7 | 14.6 | 14.4 |
| Income constancy (01-03) ¹ | -0.19 | -0.24 | -0.02 | -0.33 | 0.02 | -0.14 | -0.58 |
| Income seasonality (03-04) ² | -0.19 | -0.68 | -0.09 | -0.53 | -0.14 | -0.40 | -0.64 |

Note: *significance testing is based on ANOVA test of variance in means.

¹ Rated as '1' being 'highly constant', '0' 'somewhat constant' and '-1' 'not constant at all'.

² Rated as '1' being 'not seasonal at all', '0' 'somewhat seasonal' and '-1' 'highly seasonal'.

"(i)" indicates where significant difference is not found between the groups at 90% confidence level.

5.1.2.2.2 Physical capital and natural capital

Different household types used distinctive physical assets in their productions. 33% of the sideline-oriented households owned an automobile (minivan, jeep, or truck). A livestock-oriented household kept 18 cattle (Table 6) on average; each member of these households also produced a lot more barley than other types of household (Table 6). In contrast, the NFTP-oriented households had little holdings in physical and natural capital (Table 6).

Table 6: Physical capital owned by the household types and the wealth groups*

| Physical capital | Household type | | | | Wealth group | | |
|--|---------------------------|----------------------|--------------------------|--------------------|--------------|------------|-------------|
| | Livestock oriented (n=16) | NTPP oriented (n=37) | Sideline oriented (n=57) | Diversified (n=49) | Rich (n=49) | Mid (n=77) | Poor (n=33) |
| Owning tractor (% the group) | 68.8(i) | 59.5(i) | 70.2(i) | 67.3(i) | 65.3 | 75.3 | 48.5 |
| Owning automobile (% the group) | 25.0(i) | 13.5(i) | 31.6(i) | 18.4(i) | 46.9 | 16.9 | 0.0 |
| Owning phone (% the group) | 68.8 | 29.7 | 56.1 | 36.7 | 75.5 | 42.9 | 6.1 |
| Cattle owned by a HH of the group | 18.1 | 9.5 | 8.2 | 10.9 | 14.6 | 9.8 | 5.2 |
| Natural capital | | | | | | | |
| Barley produced per member (kg/capita) | 504.8 | 270.8 | 356.1 | 472.7 | 415.3(i) | 395.0(i) | 327.1(i) |

Note: *significance testing is based on ANOVA test of variance in means.

“(i)” indicates where significant difference is not found between the groups at 90% confidence level.

5.1.2.2.3 Human capital

Different types of household also distinguished each other by their family size and the education levels. The livestock-oriented households were usually large families; the sideline-oriented households were well educated—more than half of them had military or secondary schooling, or higher; many livestock-oriented households had members attending religious institutes; and the NTFP-oriented group usually had small families without much formal schooling (Table 7).

Table 7: Human capital owned by the household types and the wealth groups*

| Human capital | | Household types | | | | Wealth groups | | |
|---------------------------------------|---|---------------------------|----------------------|--------------------------|--------------------|---------------|------------|-------------|
| | | Livestock oriented (n=16) | NTPP oriented (n=37) | Sideline oriented (n=57) | Diversified (n=49) | Rich (n=49) | Mid (n=77) | Poor (n=33) |
| Family demographics (number) | Family size | 6.8 | 5.5 | 5.8 | 6.1 | 6.8 | 5.9 | 4.7 |
| | Number of active laborers in the family | 5.3 | 4.1 | 4.4 | 4.6 | 5.5 | 4.4 | 3.5 |
| | No. of elders (>55 yr) | 1.4 | 0.7 | 1.0 | 1.1 | 1.4 | 0.9 | 0.7 |
| Education (% HHs of the group) | Primary | 43.8 | 67.6 | 38.6 | 49.0 | 38.8 | 50.6 | 60.6 |
| | Military or secondary | 6.3 | 18.9 | 40.4 | 34.7 | 40.8 | 31.2 | 12.1 |
| | College or above | 18.8 | 2.7 | 10.5 | 4.1 | 14.3 | 5.2 | 3.0 |
| | Religious institute | 31.3 | 2.7 | 5.3 | 16.3 | 10.2(i) | 7.8(i) | 18.2(i) |

Note: *significance testing is based on ANOVA test of variance in means.

“(i)” indicates where significant difference is not found between the groups at 90% confidence level.

5.1.2.3 Household assets owned by the wealth groups

5.1.2.3.1 Financial capital

Compared within the wealth groups, the rich households were financially wealthier, as 1) their household annual cash income were 2-7 times higher than the non-rich households (2003-04 and 2001-04); and 2) they managed to save a proportion of their earnings after covering their expenses (Table 4). Concerning the income sources, the rich household group took advantage of the sideline job opportunities; while the non-rich (the mid and the poor) households greatly relied on NTFP collection (Table 4). Different wealth groups also had distinctive expenditure patterns. 30% of the non-rich households' income went into self-consumption, including foods and medical expenses (Table 4). The rich households however, had a bigger spending on their children's education (for both girls and boys in most cases); at the same time, they also spent more in transportation and communication. Despite the fact that the cash income of these rich households actually fluctuated more than other groups (2001-04), they reported smaller variations in their seasonal and annual cash income (Table 4).

5.1.2.3.2 Physical capital and natural capital

The physical capital that the rich households possessed was greater in quantity and variety. Nearly half of the rich households owned one or more automobiles; more than 70% had a phone (Table 5). None of the poor household had an automobile and few of them had a phone; these poor households had only one third the livestock (cattle) that rich households had (Table 5). In barley production, although a rich household produced twice as much barley as a poor household, the amount of barley produced didn't vary on per household-member basis (Table 6).

5.1.2.3.3 Human capital

The rich households in general had larger families with many more active labourers than the rest (Table 7). Many of these rich households were better educated (Table 6). In comparison, only a small portion (10%) of the poor households had members attaining military or secondary schooling, and few reaching college level or above (Table 7).

5.1.2.3.4 Natural capital

5.1.3 Comparison of wellbeing indicators between the HH survey respondents and FGs

The socio-economic stratification of households is most valid at the community level, and the collective views on the wellbeing of a household (the social manifestation of being ‘better-off’) were elicited from focus groups. Among the many well-being indicators FGs put together, many referred to physical assets, such as “a beautiful house”, “many cattle” and/or “a truck or other automobiles”. Some were related to income or expenditure of a family, such as (there are one or more family members) “working for the government”, “having self-employed business(es)” and/or “being able to finance children’s education”. The views regarding the social networks of a household and the well-being of its members were also expressed, such as “family members in good health” and/or “having guanxi (social networks)”. In addition, one FG also cited “being resistant to natural hazards” as an important factor contributing to a household’s well being (Appendix B, Table B-1).

5.2 Household’s livelihood strategies

Livelihood strategies are the ways that households allocate and utilize assets at their disposal. The livelihood strategies employed by the agro-pastoral households include capital-led specialization, labourer-led specialization, and diversification¹³. The choice of a livelihood strategy (or a combination of several) is influenced by many factors such as the assets a household owns, constraints it faces, and the potential risks involved in a certain activity. The household livelihood strategies are closely related to the household types; the following results thus center on the comparison between these household types; distinction between community types and wealth groups are also briefly commented on.

5.2.1 Livelihood strategy—Capital-led specialization

Similar to agriculture intensification, capital-led specialization implies households concentrating on certain production activities, which are usually built upon large

¹³ Agricultural production in this particular agro-pastoral system plays a somewhat insignificant role in generating cash income, and thus livelihood strategies in this context mostly apply to the off-farm livelihoods, such as livestock husbandry and sideline jobs. Terminology of livelihood strategies is thus specific to the agro-pastoral system of Zhongdian; as a result these terms are different from the ones used in the Sustainable Livelihood (SL) framework.

investment of financial capital (see Scoones, 1998; Orr & Mwale, 2001). In this study, the livestock-oriented and the sideline-oriented households were using the capital-led specialization strategy: they both had large quantity of physical assets—many livestock or the possession of automobile(s) and other physical assets. All these physical assets require a considerable financial investment upfront.

Concerning animal husbandry, almost every household in the study area raised cattle, pigs and chicken, as these livestock provided important nutrition for the family.

Nevertheless, the households also feeding horses and/or sheep were mostly concentrated in the livestock-oriented household type (Table 8). A large portion (78%) of households in the irrigated communities fed horses too (Table 8).

As for the sideline jobs, the most profitable ones were “transport business” and “working for the government or a factory”. Most of the households having earnings from either or both sources were the sideline-oriented (Table 8).

More than half (55-60%) households having transport business or regular salary/pension belonged to the ‘rich’ type. Many poor households also had income from sources other than farming, livestock, or NTFP collection. These were mostly gifts from friends and relatives (in cash or kind), or welfare from the government (Table 5). These earnings are called sideline incomes in this study, to differentiate them from other sources.

Table 8: The percentage of household engaged in certain production activities*

| Production means | | Household types (% the group) | | | | Community types (% the group) | | |
|------------------|-------------------------------|-------------------------------|----------------------|--------------------------|--------------------|-------------------------------|------------------|----------------|
| | | Livestock oriented (n=16) | NTFP oriented (n=37) | Sideline oriented (n=57) | Diversified (n=49) | Highland (n=91) | Irrigated (n=20) | Dryland (n=48) |
| Livestock | Feeding horse(s) | 62.5 | 35.1 | 29.8 | 51.0 | 37.4 | 77.5 | 0.0 |
| | Feeding sheep | 18.8 | 2.7 | 1.8 | 4.1 | 7.7 | 0.0 | 0.0 |
| Sideline jobs | Temporary jobs | 43.8 | 10.8 | 24.6 | 38.8 | 39.6 | 10.0 | 14.3 |
| | Transport business | 18.8 | 10.8 | 38.6 | 14.3 | 22.0(i) | 25.0(i) | 21.4(i) |
| | Govnt/factory job | 12.5 | 0.0 | 36.8 | 10.2 | 13.2(i) | 20.0(i) | 28.6(i) |
| NTFP collection | Collecting <i>Matsutake</i> | 68.8 | 100.0 | 82.5 | 89.8 | 78.0 | 100.0 | 100.0 |
| | Collecting <i>Caterpillar</i> | 0.0 | 35.1 | 7.0 | 24.5 | 3.3 | 65.0 | 0.0 |
| | Collecting other herbs | 0.0 | 24.3 | 5.3 | 12.2 | 6.6 | 30.0 | 0.0 |

Note: *significance testing is based on Chi-square.

“(i)” indicates where the difference in means between groups is insignificant at 90% confidence level.

5.2.2 Livelihood strategy—Labourer-led specialization

“Labourer-led specialization” refers to the specialization of a certain production activity through the input of labourer instead of financial or physical capital investment. This livelihood strategy was mostly employed by the NTFP-oriented households, whose income depended on how many family members were collecting NTFP and how successful they were. Usually NTFP collection is a competitive business so that information about the location of NTFP is usually held within a household instead of shared with neighbours. Compared to other types of household, many NTFP-oriented households collected *caterpillar* and other herbs in addition to *matsutake* which was collected by all types (Table 8)¹⁴. Among the community types, the majority of households who collected *caterpillar* and other herbs were in the irrigated communities (Table 8).

5.2.3 Livelihood strategy—Diversification

The diversified households just as their name implies, diversified their income sources to the extent that they not only had a relatively even balance between their income sources (Figure 1), but also broadened their production activities. For instance, like all the three types of households, many diversified households fed horses and sheep, collected *caterpillar* and other herbs, as well as held temporary jobs at the same time (Table 8).

5.2.4 Livelihood portfolio

Under a certain livelihood strategy, a household usually chose and managed a portfolio of its production means based on many factors. Focus groups helped identify some of these factors and how much they influence a household’s choice in a particular production activity. Pretest FGs suggested that labour, capital and skill requirements, as well as profitability and stability in the next 5 years were the most important factors. In each hamlet, FG participants rated these five factors on the scale of 1-5 (1 being the lowest influence and 5 being the highest influence, Appendix B, Table B-2).

¹⁴ Households can collect NTFP in both community forest and national forest; they usually exploit different elevations for NTFP.

Overall, farming¹⁵ and some of the sideline jobs (such as “storekeeping”, “lodging services”, “charcoal making”, etc) were most labourer-demanding, followed by livestock husbandry. Most of the sideline jobs though required a considerable financial investment, such as purchasing and maintaining a truck, or purchasing and developing livestock, etc. NTFP collection didn’t require any financial capital input, consequently “as many as available” labourers were found in this cash-earning production. Regardless, NTFP collection enrolled only skilful labourers (those with “good memory”, “good eyesight”, “knowing where they are”—human capital). Many sideline jobs were also limited to specialized labourers (i.e. high-education personnel working for the government, and skilful drivers, etc). When measuring the cash-generation potential, farming and livestock husbandry which were practiced primarily for self-consumption, weren’t very profitable. Sideline jobs and NTFP collection were more economically viable, and also “riskier” than the traditional farming and livestock husbandry practices, as the risks involved were often unknown and harder to control. Nevertheless, risks were deeply imbedded in every income-generation source.

5.3 Risk presence and perception

A list of risks was identified in the pretest FGs that the agro-pastoral households throughout the study area commonly faced. These risks were grouped into idiosyncratic and covariant risk events based on their impact. In the analysis, the covariant risks are classified into environmental types (i.e. snow and floods) and non-environmental types (i.e. social conflicts), depending on whether they are environment related; they can also be natural and human-induced risks, based on their specific causes. Human-induced risks include all the non-environmental and some environmental risks (i.e. deforestation and shrinking NTFP resources—a result of over-harvesting).

In the survey and focus groups followed, respondents were asked whether their families (in the survey) or communities (in focus group) had encountered these single and covariant risks before, and how severe these risks were to their families/communities¹⁶.

¹⁵ Including the farming of the staple crops—barley, potato, turnip, rapeseed, as well as wheat and corn (in some places).

¹⁶ Respondents were asked to rate the perceived severity of a risk event on a 5-point scale, where 1 means not severe at all, 5 extremely severe and the mid-point 3 means somewhat severe.

Perceived severity of risk in this study is an experiential concept, with a multi-dimensional nature. This study chose five perception attributes to measure the “perceived severity”: 1) “coverage” and 2) “dreadfulness” (of the impact of the risks), 3) “frequency” (of the occurrence of the risks), 4) “controllability” (of the risks by the people who are exposed to them), and 5) “interventions” (from external sources, such as the government to help prevent the risks or mitigate the impact)¹⁷. These attributes were among the 19 factors that influence how people perceive risks (Bronfman & Cifuentes, 2003)¹⁸; these five attributes were chosen since in the pretest FGs they proved to be most easily-understandable and distinguishable from each other. To better understand how an agro-pastoral household perceived certain risks, respondents were asked to pick up the “severest” risk events (one individual risk and one covariant risk), and rate the risk events based on the five risk-perception attributes.

5.3.1 Presence and perception of the severest idiosyncratic risks

Except “theft” and “house fire”, more than half of the households surveyed had experienced the listed individual risk events. In general, all these individual risks were perceived more than “somewhat severe”; they were cited as the “severest” more than once, except “theft” which was only reported by a limited number of household living in the hamlets located by the major roads (Table 9). What these severest individual risks

¹⁷ Respondents rated these factors on a scale of 1-5 (1 represents ‘low’ and 5 represents ‘high’): ‘coverage of the impact of risk event’—‘1’ being ‘only affecting singular family’, and ‘5’ being ‘Affecting the whole township or/and county’; ‘dreadfulness of the impact’—‘1’ being ‘not likely to cause dreadful impacts at all’, and ‘5’ being ‘highly likely to cause dreadful impacts’; ‘frequency of the occurrence’—‘1’ being ‘occurred only once or twice (or limited times) in the history’, and ‘5’ being ‘Occurring at almost all the time’; ‘controllability of the risk event’—‘1’ being ‘Not controllable at all’, and ‘5’ being ‘highly controllable’; and ‘intervention involved’ (in reducing the risk or mitigating impacts)—‘1’ being ‘few prevention/ mitigation intervention’, and ‘5’ being ‘a great amount of prevention/ mitigation intervention’.

¹⁸ These factors include: newness, voluntariness, catastrophic potential, dreadfulness, immediacy, severity social knowledge, social control, social benefit, social risk, number of exposed people, personal knowledge, personal control, personal benefit, personal risk, personal effect, acceptability, current regulation status, and desired regulation. Besides these factors, a person’s personality and attitudes also affect how (s)he perceives a risk event. For example, most people are likely to overestimate the probability of the bad event and focus on the high loss when facing low probability, high loss risks (like nuclear accidents) (Ozdemir, 2000). Optimistic people tend to overestimate the probability that good things will happen to them (Muren, 2006). Some people will judge the probability of an event based on if and how much related information on the risk is available (The Center for Informed Decision Making, n.d.). Others have a tendency towards confirmation bias— looking for evidence that confirm their pre-existing beliefs (Klayman, 1995). These latter factors are not chosen as the study is mostly interested in the characteristics of risk events, instead of inter-personal differences.

shared in common is the low coverage of their impacts (Figure 4). At the same time, these severest individual risks also had their own special characteristics. For example, unlike other risks, “NTFP search failure”, could be easily controlled; “illness/death” and “house fire” apparently were more likely to cause dreadful effects (Figure 4).

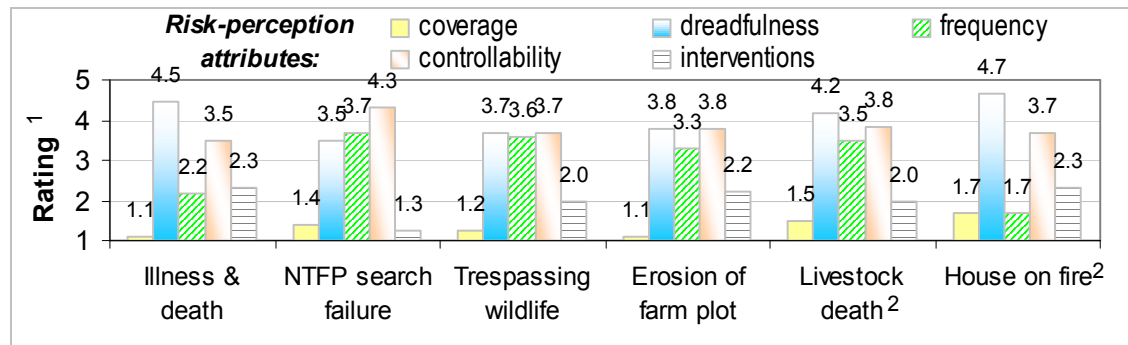
Table 9: The rated severity of the idiosyncratic risks and their frequency of being cited as severest

| | Idiosyncratic risk events | | | | | | |
|---|---------------------------|---------------------|-------------|----------------------|-----------------|------------------|-------|
| | Illness* | NTFP search failure | House fire* | Trespassing wildlife | Livestock death | Farmland erosion | Theft |
| Frequency of being cited as “severest” (% of the responses) | 35.6 | 11.3 | 3.8 | 3.8 | 30.0 | 15.6 | 0.0 |
| Average of rating- “severity” ¹ | 4.3 | 4.2 | 4.4 | 4.0 | 3.7 | 3.6 | 3.2 |

Note: ¹ see footnote 16 for the rating of the “severity”.

* some respondents whose households had never experienced such risks, cited these risks as “severest”.

Figure 4: The perception of the severest idiosyncratic risks by the HH survey respondents



Note: ¹ see footnote 17 for the rating of these attributes.

² the number of response is less than 8.

5.3.2 Presence and perception of the covariant risks

Similar to the individual risks, nearly all covariant risks were perceived as more than “somewhat severe”, with “price fluctuation” and “rain, frost or hail” rated as “severe” (Table 10). When asked to identify the severest covariant risk event, most respondents chose the events that their households had experienced before. Some also picked the events that had never occurred to them; and they thought the events would cause dreadful impacts should the risks occur; these events include “social conflicts” and “summer & winter grassland degradation”. In addition to the covariant risks listed in the

questionnaire, several respondents also added “growing numbers of wildlife (and the increased danger to livestock and human as a result)”, “(strong) wind” and “contamination of the drinking water” as the severest risks to their households (Table 10). Instead of choosing only one severest covariant risk event, 16.4% respondents thought two risk events as being equally severest to their households. Among these covariant severest risks, five of them were mentioned by 60% respondents; four of these five were environmental risks (Table 10).

Table 10: The rated severity of the covariant risks and their frequency of being cited as severest

| Covariant risk event | Non-environmental/ environmental | Natural /human-induced | Frequency of being cited as “severest” (% of the responses) ¹ | Rated severity |
|---|-------------------------------------|---------------------------|--|-------------------|
| price fluctuation | Non environmental | Human- induced | 14.47 | 4.03 |
| policy uncertainties | | | 5.66 | 3.47 |
| social conflicts | | | 5.03 | 2.89 |
| loss of development rights | | | 1.89 | 3.25 |
| destruction of forest | Environmental | | 8.81 | 3.89 |
| shrinking NTFP resource | | | 3.14 | * |
| contamination of drinking water source | | | 1.89 | * |
| summer-range degradation | | | 1.26 | 3.33 |
| winter-range degradation | | | 0.63 | 3.41 |
| growing number of wildlife ² | | | 0.63 | * |
| crop pests & diseases | | Natural | 18.24 | 3.92 |
| floods | | | 15.72 | 3.35 |
| rain, frost & hail | | | 15.72 | 4.07 |
| animal diseases | | | 15.09 | 3.87 |
| snowfall | | | 6.29 | 3.60 |
| drought | | | 1.89 | 3.29 |
| wind | 0.63 | | * | |

Note: ¹ Some respondents cited two risk events as equally severest to them, and thus the sum of the frequency of these risks exceeds 100.

² This is caused by the official ban on logging and hunting in the upper reaches of Yangtze River.

* These risks were mentioned by individual households so that their severity levels are not calculated for the whole respondent group.

Unlike the severest individual risks, the severest covariant risks affected a larger area and population (that is, a larger coverage of their impacts). Most of the severest covariant risks that respondents chose are environmental and human-induced risks (Table 10). Compared with the non environmental severest risks, the environmental severest risks occurred more frequently and often came with dreadful effects; they were also more difficult to control (Figure 5 & 6). Most of these characteristics of environmental severest

risks also occurred more frequently, and effects could be devastating compared with human-induced severest risks. Both environmental and natural severest risks often existed in a localized area and had attracted much intervention from the government and other sources in order to prevent their occurrence or mitigate the impacts (Figure 5 & 6).

Figure 5: The perception of the non-environmental severest risks

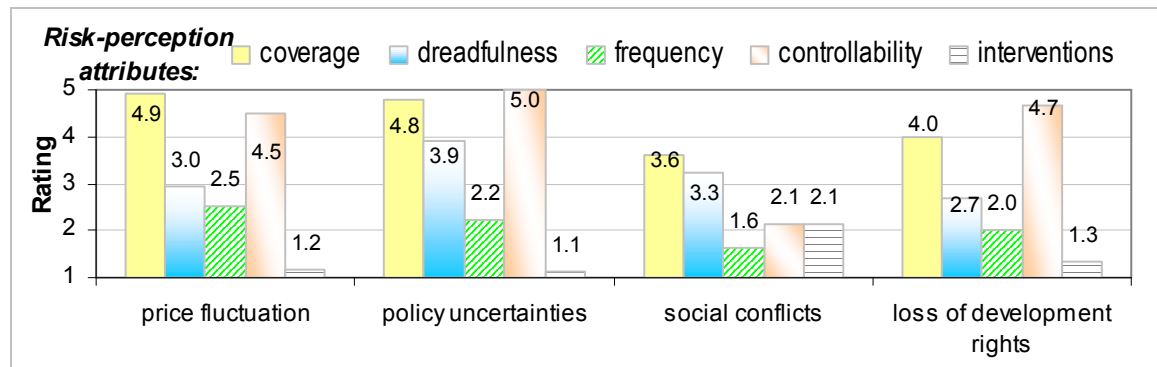
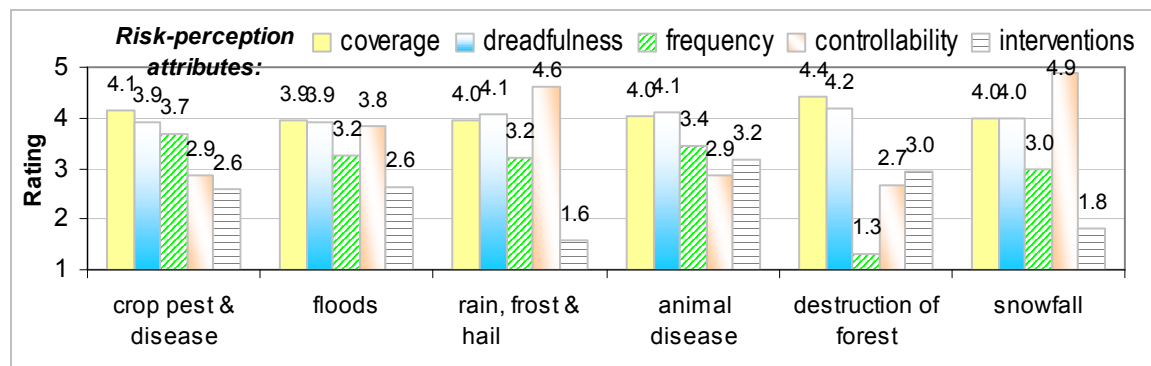


Figure 6: The perception of the environmental severest risks*



Note: * Only those environmental risks which were cited as severest by more than 6% of the respondents are listed in the figure.

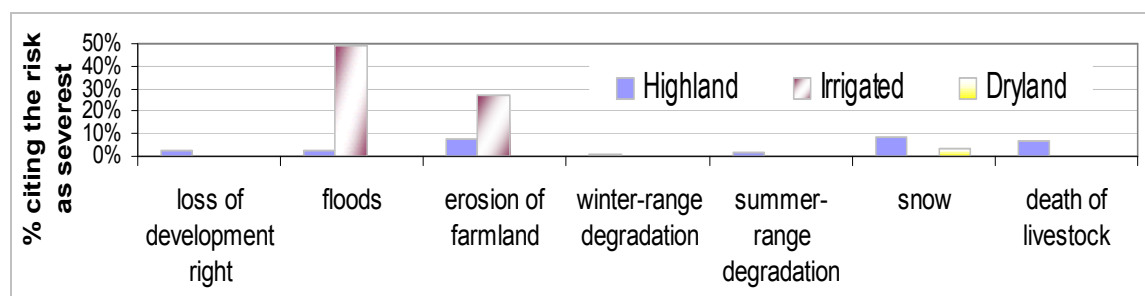
5.3.3 Comparison in risk-perception among various groups

5.3.3.1 Presence and perception of risks between the community types

Except very few risks that might affect everybody in the area (i.e. price fluctuation and policy uncertainties), most risks are only present in certain geographic locations. Floods and the erosion of farmland, for instance, were most common in irrigated communities located along river sides, and least common to dryland communities (Figure 7). Highland communities experienced grassland degradation and were subject to severe snow in winter; livestock death as a result thus became a big concern for households living in these communities. In addition, households in highland communities felt “loss of

development rights” (the right to manage and benefit from opening a tourism site or a mining project) a disturbing problem (Figure 7).

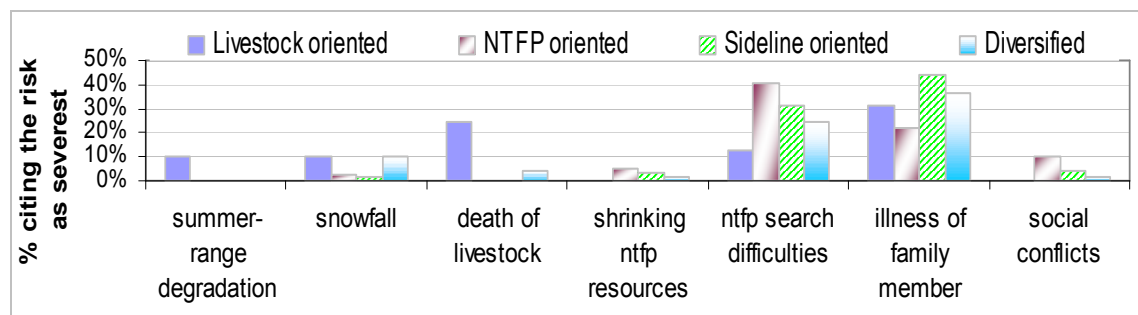
Figure 7: The selected idiosyncratic and covariant risks identified as severest by the community types



5.3.3.2 Presence and perception of risks between the household types

Different household types face notably different risks. Presumably, the livestock-oriented households mostly felt threatened by “snow” and “summer-range degradation” that might cause “death of (their) livestock” (Figure 8). Similarly the NTFP-oriented households were especially concerned about “NTFP search difficulties” their households occasionally experienced and the “shrinking NTFP resources” that has started to happen in their communities (Figure 8). For this type of household, “social conflicts” were another problem they faced. The sideline-oriented households especially worried about the potential “illness/death” (including the personal safety issues) that could occur to their family members, many of whom drove automobiles (Figure 8).

Figure 8: The selected idiosyncratic and covariant risks identified as severest by the household types



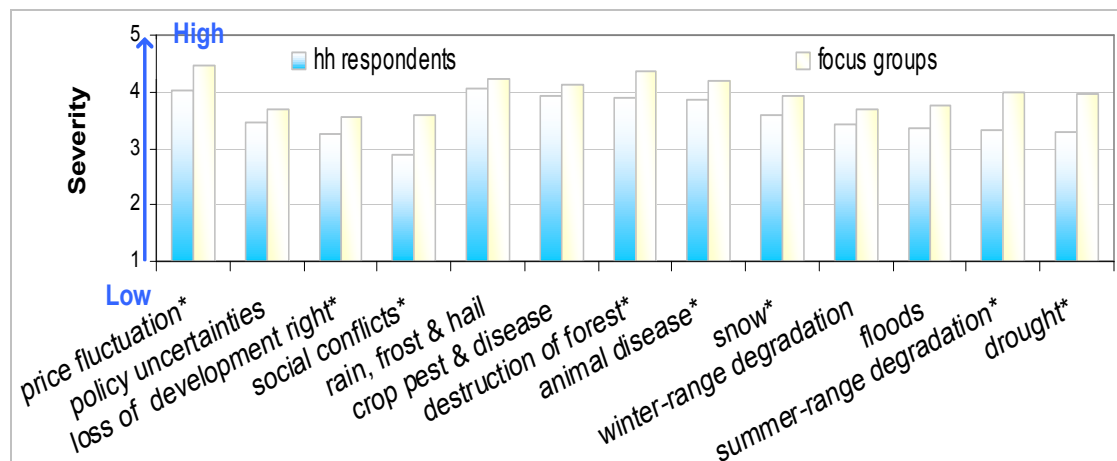
5.3.3.3 Presence and perception of risks between the wealth groups

Most risks were common to all wealth groups, except “theft” which was reported only by the rich households. Different wealth groups didn’t show different perception of most of the risks; the only difference existed in the perceived severity of the severest covariant risks: these risks were perceived more severe by the mid and poor households.

5.3.4 Comparison of risk-perception between the HH survey respondents and FGs

The same list of covariant risks was presented to the focus groups following the household questionnaire. Focus group participants rated the severity level of each risk and identified the severest risk that their community faced as a whole. All these covariant risks were felt to be more than “somewhat severe”, and a few such as “price fluctuation” and “destruction of forest” were regarded as “severe” (Figure 9). From a different viewpoint (FG’s as opposed to HH survey respondents), these covariant risks were considered more severe to a community than to individual households (Figure 9). In addition, focus groups had a different perspective on which risk was severest to their communities. “Destruction of forest” for example, was the severest environmental risk to most focus groups; and “summer grassland degradation” was considered the severest risk event to some communities, while it wasn’t much of a problem to individual households in these communities (Figure 9).

Figure 9: The severity level of the covariant risks to individual households and the focus groups



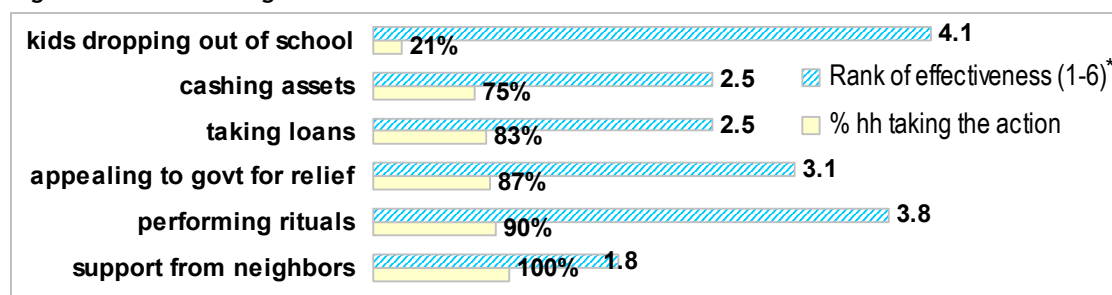
Note: * indicates where the rated severity level of the risk is different between household respondents and focus groups at 90% confidence level.

5.4 Risk mitigation

5.4.1 Stress-relief actions taken by individual households

After a risk event, individual households usually took specific actions to overcome the adversity and recover their livelihoods. Some stress-relief actions were both popular and effective. These actions include “(getting) support from neighbours”, “taking loans (from banks) or borrowing money from friends or relatives)” and “selling physical assets”. About 80% of the households sampled took these three actions (alone or in combination) when they were in hardship; and these actions were ranked as the top three most effective stress-relief actions (Figure 10)¹⁹. “Performing rituals” was common but not very useful to most households (Figure 10). “Appealing to the government for relief assistance” was often a collective action of a community (see **Section 5.4.2**); the effect varied depending on whether the relief fund or material was allocated to the community or individual households as well as how much was provided (since in order for a household to receive disaster-relief assistance, both the household and the hamlet it dwells in have to be identified as ‘severely impacted’ by the government officials, which can take a long time and involve judgemental decisions). Among these stress-relief actions, “having kids drop out of school (to help recover livelihoods)” was least common or effective (Figure 10).

Figure 10: Risk-mitigation actions and their effectiveness in stress-relief



Note: * see footnote 19 for the ranking of these actions.

5.4.2 Stress-relief actions taken by communities

According to the hamlet heads and focus groups, inter-household transfer in cash and kind (including labourers) within a community was a voluntary action to help those

¹⁹ These actions were ranked based on their effectiveness to reduce stress after a risk in relation to one another. Low-number rank stands for ‘most’ effective and high-number rank stands for ‘least’ effective.

individual households in trouble. When a covariant risk such as a natural hazard hits many (or all the) households in the community simultaneously, disaster relief largely depends on the government's assistance funds and material provided. Leaders of administrative villages also mentioned that other forms of mitigation measures were undertaken within the villages which might involve: 1) establishing a “disaster-relief fund” in ‘good’ times, 2) appropriating money from other funds and programs to support livelihood recovery of households in certain hamlets, 3) organizing cash/in-kind transfer between hamlets, 4) encouraging households to look for off-farm work after a risk event, and 5) organizing hamlets to take collective action, amidst the hazard to avoid further damage (i.e. consolidating river-banks at the time of floods).

5.4.3 Comparison in the risk mitigation actions among various groups

An agro-pastoral household's risk-mitigation action seemed to be closely related to its wealth status, instead of its community setting or livelihoods the household pursued. Compared between the wealth groups, more households of the rich and the mid groups took “loans” while the poor households relied on “neighbour support” and “government assistance” at the time of hardship (Table 11). For all groups, “neighbour support” became less useful when many households were under distress after a covariant risk event hit the community; nevertheless, 40% of the poor households still relied on their neighbours to survive the difficult time after such a covariant risk event (Table 11).

Table 11: Stress-relief actions taken by the households of different wealth groups

| | Wealth groups | | |
|---|----------------------|---------------|----------------|
| <i>HH taking the action¹</i> (% the group) | Rich (n=49) | Mid (n=77) | Poor (n=33) |
| Taking a loan ² | 79.6 | 87.0 | 60.6 |
| Neighbor support | 77.6 | 85.7 | 97.0 |
| <i>Rank of the action's effectiveness in stress-relief (1-6)³</i> | | | |
| Taking a loan | 2.3 | 2.4 | 3.1 |
| Neighbor support | 2.1 | 1.7 | 1.5 |
| Government assistance | 3.2 | 3.4 | 2.6 |
| <i>Neighbor support being “highly effective” in stress relief⁴ (% the group)</i> | | | |
| After an idiosyncratic risk | 55.1 | 57.1 | 78.8 |
| After a covariant risk | 4.1 | 11.7 | 39.4 |

Note: ¹ Chi-square significance testing indicates that a household's choice of certain actions and its wealth status ('rich', 'mid' or 'poor') are significantly inter-dependent at 90% confidence level.

² Chi-square significance testing indicates that a household's choice of 'taking a loan' in the time of crisis and its wealth status ('rich' or 'mid') are not inter-dependent at 90% confidence level.

³ ANOVA test of variance in means indicates that the ranks of these actions' effectiveness in stress-relief are significantly different between wealth groups at 90% confidence level.

⁴ Chi-square significance testing indicates that a household thinking of 'neighbour support' as highly effective (after both an idiosyncratic risk and covariant risk) and its wealth status ('rich', 'mid' or 'poor') are significantly inter-dependent at 90% confidence level.

5.5 Risk reduction

When asked if a household had purposively planned to prevent or reduce future risks, one third of respondents said their households didn't have such plans. Notwithstanding, almost all the respondents agreed that some strategies were especially helpful to protect them against future losses, such as "diversification of income sources". In addition, the majority of respondents also asserted that preparing for risks directly or indirectly was an integral part of their livelihood planning.

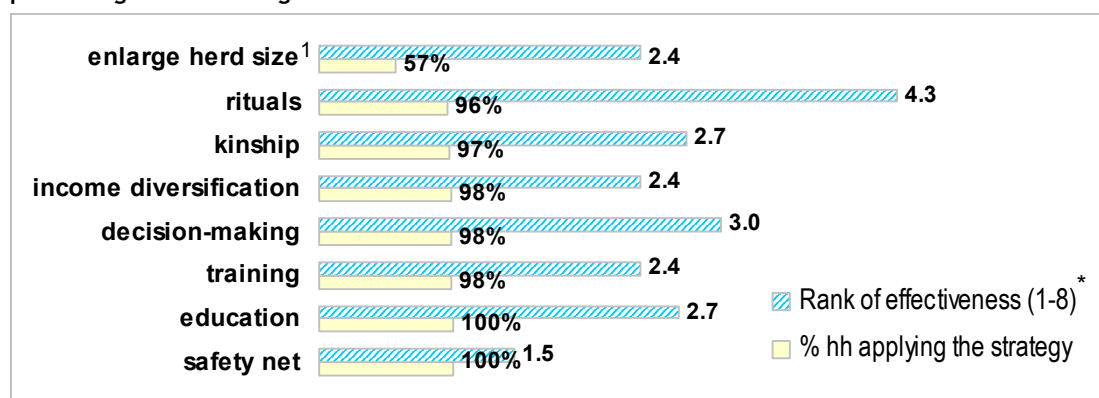
5.5.1 Risk-reduction strategies adopted by individual households

"Community safety-net building" through solidarity building was ranked most effective among all the risk-reduction strategies (Figure 11)²⁰. "Education of children" was an implicit risk-reduction strategy, as it would "benefit the family in the long-run". Similar to the above strategies, "acquiring training (of advanced farming techniques)", "(having better) communal decision-making" and "enlarging herd size"²¹ had indirect effects in reducing risks by building up individual and community's capacity to rebound from stresses in the long-run. The rest of the strategies such as "income diversification" and "(strengthening) kinship" were explicit and could protect households in the short-run. "Income diversification" and "acquiring training" were ranked second most effective in risk-reduction (Figure 11).

²⁰ These actions were ranked based on their effectiveness to protect the household from future risks in relation to one another. Low-number rank stands for 'most' effective and high-number rank stands for 'least' effective

²¹ Some respondents thought "increasing herd size" would mean adding more physical assets to their households and thus contribute to their wellbeing.

Figure 11: Risk-reduction strategies adopted by individual households and their effectiveness in protecting households against future shocks



Note: ¹ the rank of this strategy is calculated based on those respondents who thought the strategy could benefit the household and thus reduce its risk-exposure; the rank of other strategies are calculated based on all the respondents (except 'enlarge herd size', all respondents thought all the strategies are useful in risk-reduction).

* see footnote 19 for the ranking of these actions.

5.5.2 Comparison in risk-reduction actions between various groups

Household types showed distinctive preference only in “enlarging herd size”: it was especially favoured by sideline-oriented households (Table 12). Different wealth groups also had different ideas of which strategy was most effective to them. “Income diversification” was deemed much more effective by the rich households (Table 12). Poor households emphasized the importance that “community safety-net building” would have to protect them against shocks and stresses (Table 12).

Table 12: Ranking of the risk-reduction strategies in their effectiveness by households of different household types and wealth groups

| Risk-prevention strategies* | Rank among 8 risk reduction strategies (1-8) | | | | | | |
|-------------------------------|--|---------------|----------------|---------------------------------|----------------------------|--------------------------------|---------------------------|
| | Wealth groups | | | Household types | | | |
| | Rich (n=49) | Mid (n=77) | Poor (n=33) | Livestock oriented (n=16) | NTFP oriented (n=37) | Sideline oriented (n=57) | Diversi fied (n=49) |
| Income diversification | 2.2 | 2.6 | 2.8 | 2.7(i) | 2.5(i) | 2.3(i) | 2.5(i) |
| Community safety-net building | 1.9 | 1.4 | 1.0 | 1.8(i) | 1.2(i) | 1.4(i) | 1.6(i) |
| Enlarge herd size | 1.9(i) | 2.7(i) | 3.0(i) | 2.5 | 3.0 | 1.6 | 2.1 |

Note: * ANOVA test of variance in means indicates that the ranks of certain strategies are significantly different between the wealth groups and household types at 90% confidence level.

“(i)” indicates where significant difference is not found between the groups at 90% confidence level.

CHAPTER 6: Discussion

Built upon the previous sections, this chapter summarizes important findings, and goes further to explore 1) a household's assets and its well-being, 2) the interaction between household's assets and its livelihood strategies, 3) the characteristics of the cognitive process in a household's perception of its surrounding risks and 4) the factors affecting the mechanisms that a household relies on to cope with risks. Wherever applicable, the research findings are linked with Sustainable Livelihood Framework; and discussions are centered on how this research complements the Sustainable Livelihood (SL) framework and how it incorporates risk-management as an integral part of livelihood management. At the end of the chapter, some limitations of research are laid out to advise readers of where they should be cautious of using the research findings to make inference to a wider population.

6.1 Household assets and wellbeing

The possession of assets by a household reflects its wellbeing; and “poverty” is an expression of the “deprivation of essential assets and opportunities to which every human should be entitled” (UNDP, 2002, p.21; Maxwell, 1999; Asian Development Bank, 2005). In the study area, the rich households were characterized by a positive net cash income, a greater quantity and variety of physical assets they possessed, a larger family size, more labourers and a higher level of education, compared to the less wealthy groups.

More specific to financial capital, the rich households obtained higher earnings; at the same time they were able to cover all of their expenses without debt even though they also spent a lot more than other households. Viewing expenditure as the way a household allocated its financial assets, the rich apparently put more of their money in the areas that could yield a high return (i.e. transportation and livestock husbandry), rather than meeting needs only (i.e. food and medical). Sideline jobs were very profitable to all the

households; nevertheless a poorer household had a smaller portion of income coming from sideline jobs (Pearson correlation coefficient=-.159, sig=.045), and a bigger portion from NTFP collection (Pearson correlation coefficient= .248, sig=.000). A poorer household was more likely to experience income fluctuations from season to season (Pearson correlation coefficient = -.294, sig=.000) and year to year (Pearson correlation coefficient=-.311, sig=.000). In fact, the rich households had a larger income variation (compared between one-year earnings 2003-04 and three-year average 2001-04, Table 5). These considerations suggest that income fluctuations had a bigger impact on the poorer households. In other words, the poor were likely to be “risk averse” in the sense that they chose the production mode that entailed both lower variations and a lower mean (“income skewing strategy”). As will be illustrated in the following sections, household income variation is a better indicator for a household’s financial wellbeing than household net income, since 1) the former directly correlates to a household’s risk perception and coping behaviour; and 2) respondents might have under-reported their income and over-reported their expenditure, which makes net income calculation inaccurate.

The rich households also possessed more physical assets in quantity and variety. These include both the substances (i.e. cattle) that meet the basic needs (i.e. dairy products), and the luxuries that improve the standard of living (i.e. TV set) or contribute to production (i.e. automobiles and phone). In addition, a rich household was able to produce greater quantity of barley from their farmland. The amount of barley a household produces is highly correlated with the number of labourer available (Pearson correlation coefficient =.397, sig=.000). This relationship is further verified by the findings that the rich households had both larger family size and labour force. In reality, rich households often have the nuclear families; in contrast many of the poor households are the young couples leaving their parents and setting up their own new families. The lack of labourers also explains why the poor had most of its spending on items that meet basic needs, rather than investing in higher-return productive physical assets, such as cattle and automobile(s). Consequently, the poor earned less and had a smaller cash flow; at the same time most of its farming and livestock production went right into self consumption. In addition, ‘food-security first’ -reality also limited a poor household’s ability to extend

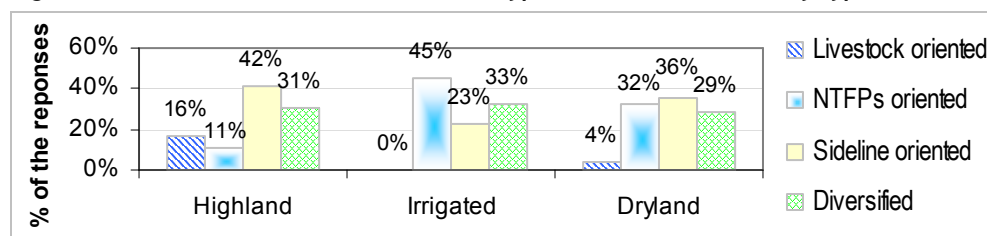
the education of its children when the parents of the family didn't have much (formal) schooling themselves (Table 7).

At the community level, social capital and natural capital were shared by individual households. The distinctions in these collective assets between wealth groups are found to be insignificant. The above characterization of an agro-pastoral household being “poor” or “better-off” also agrees with the focus-group discussion. A general conclusion is that a household's wellbeing is intricately tied to its assets, and thus deficiency in some (or all) of these assets indicates “poverty”. And therefore poverty-alleviation programs should target at those assets-poor households, especially small families.

6.2 Interaction between assets and livelihood strategies

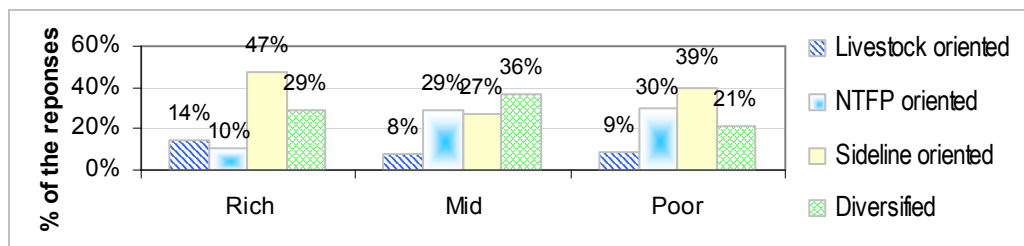
The various forms of assets interact mainly in two ways: 1) the accretion of some assets depends on the accumulation of others (“sequencing”), and 2) assets substitute for each other under certain circumstances (“substitution”). In this study, the interaction between the assets is most eminently exhibited in the distribution of household types across community types (Fisher's exact test, sig=.000). For example, although the sideline-oriented households outnumbered other types of household in nearly every community type (except the irrigated communities), the livestock-oriented households were mostly clustered in the highland communities and the NTFP-oriented in the irrigated communities; the diversified households were evenly distributed among these communities (Figure 12). From another angle, certain community types (i.e. highland communities) represent some critical natural capital (i.e. grassland). This assertion is further supported by how different assets influence how a household develops its specific livelihood strategy.

Figure 12: Distribution of the household types within the community types



The livestock-oriented households kept large herds (cattle, horse and sheep). These households usually had larger families than other groups (Table 7), so that they had more labourers available to tend a bigger herd and produce a great amount of barley to feed many livestock (Table 7). Compared to sideline jobs, livestock husbandry was less profitable (Figure 2); yet it didn't involve as much fluctuations as sideline jobs did between years and seasons (Table 5). Many rich households were livestock oriented (Figure 13), suggesting that financial capital is only one of the many wellbeing indicators; physical assets such as cattle (big animal) were a form of household savings (Verstralen, 2000), and also served an essential role in the traditional agro-pastoral livelihoods (see Appendix C). These livestock-oriented households thus can be called the 'traditional rich' families; they also had a closer relationship with traditional institutions in terms of how many of these households had members attending religious institutes compared with other types (Table 7). Presently no household in the irrigated communities was livestock oriented, even though a household of these communities on average had more cattle than households elsewhere (Table 4). This is not a surprising observation considering the fact that these communities are endowed with rich natural resources (Table 4). As a result, nearly half of these households were NTFP oriented in these communities, where climate was naturally favourable to the growth of NTFP and the market demand has been strong for over a decade (Yeh, 1998; Xu & Salas, 2003). This recognition suggests that a household is likely to take advantage of the readily exploitable natural capital, and chooses a certain livelihood strategy via valuing the 'opportunity cost' of not taking the alternatives.

Figure 13: Distribution of the household types within the wealth groups



The same rationale is found in the sideline-oriented households. One out of three of these households either had "temporary job(s)", "transport business", "government job(s)" alone or in combination (Table 8). Intuitively, the sideline-oriented households are most

common in the places where temporary jobs are available, or transportation is convenient for travellers and vehicles; and they usually started by catching an economic windfall from the development activities (i.e. massive logging in 1970-90's), or working for the government or a factory. For this reason, these sideline-oriented households were the fewest in the irrigated communities where mountains had kept the places relatively isolate for centuries (Figure 12). In this sense, community types embrace socio-economic factors (especially the history and development landscape, see **Section 1.2**), in addition to critical natural capital.

These sideline-oriented households were the 'contemporary rich', as the biggest proportion of 'rich' households was of this type (Figure 13). Unlike the 'traditional rich' households featured by large families and many livestock, the 'contemporary rich' sideline-oriented households were characterized by larger cash earnings and positive net income balance; in addition, their income was most stable compared to other types (Table 5). Most of these sideline-oriented households also had the highest education level (Table 7), and they also spent a lot more on education than other types (Table 5). There is however a special group within the sideline-oriented households distinct from the rest—those living upon gifts from friends/relatives or/and welfare from the government (Table 5). Contrary to most of the sideline-oriented households which were 'rich', this small group was the 'poorest of the poor', characterized by the smallest families that were not able to meet their basic needs.

Slightly richer than the poorest sideline-oriented households were the NTFP-oriented households. Most of the 'poor' households congregated in NTFP collection (Figure 13). These groups were usually the newly established small families (after leaving their nuclear families to begin their own households); this explains why these NTFP-oriented households didn't have many elders (Table 7). . These relatively poor households endeavoured to meet their food security (in the sense that for these households, the ratio between the cash equivalent of the self-produced and household's cash income was the highest among all the types). When many barriers hindered their entry into specialized businesses due to their insufficient asset levels, NTFP provided these households with financial help required for their survival. . However, their cash income from NTFP was naturally volatile and varied considerably, seasonally and yearly (Table 5). After

covering the expenses of foods and medical, these families didn't have much left for the education needs of their children (Table 5). The average education level of these households was thus the lowest among all household types (Table 7).

The last type—the diversified households, were by their nature, more diversified than the other types. These households had the characteristics similar to both the 'traditional rich' (the livestock-oriented) and the 'contemporary rich' (the sideline-oriented). For example, like the livestock-oriented, the diversified households also had relatively large families and many livestock; at the same time, they made considerable earnings and their average education level was the second highest next to the sideline-oriented. Many of these diversified households also belong to the 'rich' families and a smaller proportion of these households are the 'poor', making them the 'better-off'. Since NTFP collection accounted for about one third of the household's cash income, these households all show strong variations in their earnings yearly and seasonally (next to the NTFP-oriented, Table 5).

In summary, the above presents a general picture of how assets interact with each other in building up a household's livelihood. This study shows that some assets are the foundation for a certain livelihood and livelihood strategy's. For example, a large family (human capital) is necessary for producing enough fodder (highland barley) to feed a big herd (physical capital, the livestock-oriented strategy); financial windfall through development opportunities serves as the starting point for households to develop their sideline businesses (i.e. transport business); education, skills and experiences (human capital) pave the way for some family members to obtain salary-jobs (the sideline-oriented strategy); NTFP (natural capital) are the safety net for the survival of the poor households who are devoid of any other forms of capital (the NTFP-oriented strategy). These livelihoods when translated into livelihood strategies, suggest that adequate human capital (labourers) as well as abundant financial capital give rise to "capital-led specialization" of one's production. This is embodied in the 'traditional rich' livestock-oriented households (when a large family is translated into a large herd) and the 'temporary rich' sideline-oriented households (originally only those rich households who can afford to purchase a truck can start a profitable transport business, and/or can invest in the education of their children which could land the child a relatively stable

government or factory job). A lack of the above two forms of capital results in the “labourer-led specialization” of the poor NTFP-oriented households to allocate their “as many as available family members” in harvest activities (Appendix B, Table B-2 and Table B-3). A combination of the two forms of capital (human capital—labourer and financial capital) enables the most ‘better-off’ diversified households to ‘diversify’ their production and income sources.

The above reveals the important role human capital and financial capital have in establishing successful agro-pastoral livelihoods. The ‘clustering’ of the two is further supported by the strong correlation between the household cash income and educational level ($\text{sig}=.001$), and between the cash income and family size ($\text{sig}=.012$). At the same time, this ‘clustering’ tendency (between these two forms of capital) also exists in the household expenditure pattern—the way a household allocates its limited financial capital. The biggest distinction in spending between the rich and the poor is on food and education. The richer (including the livestock-oriented, the sideline-oriented and the diversified) is more able to reinvest its financial capital in building up the human capital (education in particular) and productive physical capital (i.e. livestock and transportation and communication); while the survival of the poor (the NTFP-oriented) relies solely on the natural capital (NTFP) collectively owned by a community. The ultimate ‘substitution’ between these two forms of capital implies two ‘extremes’ that a household can face: the ‘contemporary rich’ sideline-oriented households may lift themselves out of subsistence-production and integrate into the urban economy (by having themselves fully or self employed in the non-subsistence production, such as service and business); and on the other hand, cashing/depleting natural capital for survival purposes renders the subsistence-oriented poor households more vulnerable to stress and shocks.

The above focuses on the role of assets in determining a household’s choice of a certain livelihood. There are also many external factors having enormous impacts on a household’s production system; these factors include the risks associated with a particular production activity and the constraints that a household faces. The following section elaborates on these risks—the characteristics they have and the ways they affect agro-pastoral systems. The later part of the chapter talks about the constraints that are imposed by some major policies.

6.3 Households' perception of the surrounding risks

The comparison of the agro-pastoral production activities (according to labour, financial investment, skill required, profitability, stability, and risks involved (Appendix B, Table B-2 and Table B-3) concludes that agro-pastoral production systems are inherently risky in nature. Climatic variations such as excessive rain, frost, hail and floods pervasively affected almost all the production activities and sometimes even caused loss of life and property. Recently, market-related risks, such as price fluctuations have emerged and been amplified with the expansion of the local economy. Undeniably, market expansion has encouraged the exchange of goods and material, which could improve diet and nutrition of the local population. When food security was enhanced, dependence on imported grain and food increased at the same time. Consequently, a recent policy to officially lift the price of rice to increase revenue of rice producers has led to the decreased purchasing power of rice consumers, including the alpine agro-pastoral households of Zhongdian. Modern economic production in Zhongdian has also brought about many new forms of stress and problems, such as contamination of drinking water (cause by the release of untreated urban sewage), etc. On the other hand, as market and commoditization of natural resources (*matsutake* in particular) continue to expand, access to this particular market and the price fluctuation in these natural goods has become an important and sensitive issue for the locals largely relying on these natural resources. In addition, many development projects (mostly the opening and extension of tourism business) have emerged in the whole region. Although they provided many new job opportunities for local people, the participation in decision-making and benefiting from these development projects were often not in the hands of the locals. This lack of participation of the local population can be helped through an increased exchange of information and knowledge (through media, education or other sources) allowing locals to be more aware of the importance of their participation in the decision-making on the issues that matter to them, such as retaining partial rights to manage the natural resources they have utilized for centuries.

The presence of the above covariant risks was subject to geographic variations. For example, floods and so-caused family farmland erosion occurred exclusively in the

irrigated communities. Snow and the resulting livestock deaths were never a problem for households residing in the dry and hot valleys (the dryland communities). Winter-grassland degradation was mostly observed by households of the highland communities that had vast alpine grassland. Similar to the above environmental risks, some of the non-environmental risks tend to have limited geographic scope as well. For instance, social conflicts over certain natural resources arose in the places where natural resources were scarce (such as irrigated communities) and external forces (such as market demand) stressed the extraction of the resource (such as *matsutake*) between the communities. In some other places where development projects boomed (such as in the highland communities), local people felt underprivileged when their land was converted into tourist-attraction sites and most revenue went to someone from outside of the communities, county or province through a government contract (Figure 7; BBC, 2004).

In addition to the geographic variations, risks were also specific to the livelihoods that households were engaged in. The livestock-oriented households dreaded severe snowfall that could cause the death of their livestock (Figure 8); the NTFP-oriented worried about NTFP search failure which they had frequently experienced (Figure 8); and many sideline-oriented households had concerns about the safety of their members (Figure 8), since sideline jobs usually required considerable traveling away from one's family (either by driving a vehicle or taking seasonal jobs elsewhere).

By and large, all risks can be viewed as covariant as the potential victim is never a single household (or an individual). A risk event can affect individual households in a community, or threaten many households who are engaged in the same production means across the communities. The differentiation between idiosyncratic and covariant risks is meaningful only when the victims are specified. Notwithstanding, the differentiation of risks is important when considering the perceived severity of a risk. Households throughout the study area were generally worried about a possible "severe winter and heavy snowfall" (Table 9), yet they wouldn't feel frightened until their livestock die due to the winter/snow (Table 10). "Floods" were a common threat to the irrigated communities (Table 9), however, households were more concerned about the consequences of the risk event—"erosion of the family farmland" (Table 10). In the same rationality, many places had problems such as "shrinking NTFP (*matsutake* in particular)

resources”, yet the consequences were most significant for those who experienced “search failure” due to the depletion of NTFP (Table 9). These examples illustrate why idiosyncratic risks are regarded as more severe than covariant risks (Table 9 and 10; World Bank, 2005), even though they are from the same sources. These conclude that the perceived severity increases when a person feels more likely to be affected by the risk.

Furthermore, groups can have a very different perception of the same risk than individual households. Almost all the risks were viewed more severe by focus groups than household respondents (Figure 11). This observation has two implications: 1) risk-communication between agro-pastoral households helps individual households see all the potential impacts; and 2) people tend to put their community in a more important place than their own households in a group environment. Furthermore, group-individual differences also exist in how severe a risk was compared with other risks. To the majority of groups, risks such as “social conflicts” and “deforestation” were more severe than all the other risks—many of which were ranked the severest by households. This observation suggests that communities as a whole were more concerned about those risks that affect the collective-owned capital (such as forestland and trust & relationship), while individual households worry more about the risks that impact on their private property (such as livestock and farmland).

The comparison in risk-perception attributes also supports the above assertion that idiosyncratic risks are generally perceived more severe than covariant risks. Looking at the severest risk events, it’s apparent that the severest covariant risks have a wider coverage than the severest idiosyncratic risks; nevertheless, the impact of the severest idiosyncratic risks is much more dreadful than that of the severest covariant risks (Figure 6, 7 and 8). Compared between different severest covariant risks, the environmental risks and natural risks occur more frequently and cause more dreadful effects than the non-environmental risks and human-caused risks (ANOVA, sig=.016 and ANOVA, sig=.016)—once again affirming the reality that the physical environment of the agro-pastoral systems is inherently risky and coping with climatic variations is part of everyday life (Figure 7 & 8). These severest risks were also more localized, and had received much attention and intervention from the government (Figure 7 & 8).

Breaking risk perception into perception attributes helps reveal the most important factors that influence this cognitive process. Presumably, the experiential concept—“perceived severity” is the sum of these attributes: the larger coverage, the more dreadful impacts, the more frequent occurrence, the smaller controllability, and the less intervention, alone or all would increase the “perceived severity” of a risk event; or any change in one attribute would affect another, and vice versa. Correlation analysis suggests the “perceived severity” of a risk event (both for idiosyncratic and covariant risks) is directly related to the “dreadfulness” of the risk-impacts—that is, when risk- “severity” was mentioned, “dreadfulness” of risk-impacts was the first and only image that occurred to the respondents. This observation agrees with the cultural theorist’ view of risk that risk perception has a culture element (Furedi, 1997). Among all these perception attributes, only “intervention” and “controllability” of the risk are closely connected—the less controllable the risk was perceived, the more intervention it had received. Compared with environmental and natural risks, the non-environmental and human-caused risks are generally easier to control, and thus the government has not put much effort into controlling these risks.

The household characteristics also affect a household’s perception of risks. A general trend is that a poor household tends to feel that all risks are more severe than a rich or mid household would feel (**Section 5.3.3.3**), especially among those having larger income variations between seasons, for both an idiosyncratic risk (Pearson correlation coefficient=-.210, sig=.000), or covariant risk (Pearson correlation coefficient= -.208, sig=.005). In addition, an idiosyncratic risk is more likely to cause dreadful impacts to those small families (Pearson correlation coefficient= -.141, sig=.075), with fewer labourers in the family (Pearson correlation coefficient = -.195, sig=.014), fewer trustworthy people in the hamlet (Pearson correlation coefficient= -.167, sig =.036), and being the poorest living on neighbours support and welfare from the government (ANOVA, sig=.003). These poorest households tend to experience the severest covariant risks more frequently (ANOVA, sig=.003). And higher controllability of any risk are usually perceived among those households that have more trustworthy neighbours (Pearson correlation coefficient=.184, sig=.012), attend communal meetings more often (Pearson correlation coefficient=.263, sig=.000).

6.4 Agro-pastoral households' management of the risks

Dwelling within the naturally-risky environment, agro-pastoral households had developed a diversity of strategies to cope with the risks. These risk coping behaviours included working to overcome distress after a shock and acting beforehand to prevent a risk or reduce the potential losses. The following elaborates on these risk-coping strategies and identifies the factors influencing a household's choice of a certain strategy. Finally the possible consequences of adopting these strategies are discussed.

6.4.1 *Ex-post* stress relief actions

In the study area, giving and receiving support in cash, kinds and/or labourer from neighbours (including friends and relatives) was very common and had taken place on a voluntary basis. In fact to many rural households, giving is a form of savings, since the households that give will receive reciprocal help when they need so (Campos, 2000). Next to “neighbour support”, “taking loans (from credit unions, banks, and mostly friends and relatives)” and “cashing assets (mostly livestock)” at the time of crisis also worked well to mitigate the dreadful impact after a shock. Collectively, communities always “appealed to the local government for disaster relief assistance” for the badly-affected families, although the process can be sophisticated and time-consuming (both the household and its hamlet have to be identified as ‘severely impacted’ by government officials).

To a household, the choice of a certain stress-relief action was affected by factors such as the constraints the family faces and most importantly the assets it possesses. For example, the action of “taking loans” was directly related to a household's financial assets—the effectiveness of the action was ranked higher (among all stress-relief actions) by those households having higher cash income per capita (Pearson correlation coefficient=.171, sig=.031), and smaller income fluctuations between years (Pearson correlation coefficient=.183, sig=.021) and seasons (Pearson correlation coefficient=.209, sig=.008). It is thus a small wonder that “taking loans” was least common to the poor (Table 11). Apparently, the rich and mid households were not affected by these requirements therefore they could “cash (physical) assets” in the time of crisis. However, unlike the rich or mid households who had available choices of many stress-relief actions, the poor had no other alternatives

when they faced constraints to borrowing. These constraints further rendered the poor households highly dependent on the support from their neighbours (Table 11); as a matter of fact, the poorest households in every community lived upon neighbour support and the welfare from the government in both ‘good days’ and ‘bad days’. Within a community, neighbour support was also more important to those households having a bigger share of their cash income from NTFP collection (Pearson correlation coefficient=.197, sig=.013), as many of NTFP oriented households are ‘poor’ households. Surprisingly, neighbour support is equally important to all the needy families, regardless how large the household’s social network (no. of relative family) is, or how many trustworthy neighbours the household has. “Performing rituals” was regarded as more helpful by those who had family member(s) attending religious institutes (ANOVA, sig=.000)

6.4.2 *Ex-ante* risk reduction strategies

Acting to prevent or reduce future risks before any adverse effects can be a subconscious behaviour, mainly because the natural environment is changeable and hard to predict by the households. As a result there was hardly any action taken specifically to target, prevent or reduce a certain risk associated with a production activity. Subconsciously the agro-pastoral households more often built their assets in every way they can, and by so doing they unintentionally became more resilient to future shocks or stresses, and reduce the overall risk associate with singular production activities. The choice of a particular strategy is once again influenced by many factors, including the assets of a household and the production the household pursues.

“Safety-net building” was ranked most helpful by the poor households (ANOVA, sig=.008), especially the poorest living on the support from neighbours and welfare from the government (ANOVA, sig=.047); it’s also important to the smaller families (Pearson correlation coefficient =-.162, sig=.041). On the contrary, “income diversification” was deemed as more helpful to the richer households, predominantly those with higher cash income per capita (Pearson correlation coefficient =-.162, sig=.040), whose cash income is rather “constant” (Pearson correlation coefficient =.227, sig=.006) and not very “seasonal” (Pearson correlation coefficient =.223, sig=.005), as well. “Education of children” was helpful to enhance stability of the household by 1) member(s) moving out

of the risky environment to avoid risks, so that 2) member(s) outsourcing help from external sources (i.e. borrowing institutions or social network). The households having higher education level generally ranked the strategy more useful (Pearson correlation coefficient = .227, sig=.014) than other strategies. The other informal short-term education—“acquiring training” was also deemed more helpful to the households with higher education level (Pearson correlation coefficient = .199, sig=.012) and many family members (Pearson correlation coefficient = .154, sig=.052). “Rituals” were presumably closely related to traditions, and have been performed during climatic events that affected the traditional farming and livestock husbandry. Hence the households who had a larger farming income percentage (Pearson correlation coefficient = .143, sig=.073) or having member(s) attending religious institutes (ANOVA, sig=.078) regarded such practices more important for them to wish for less hazards and bring bumper harvests.

Unlike the above strategies, whether or not “increasing herd size” could protect the household against shocks, was debatable among respondents. Among the 57% respondents who thought the strategy was helpful, some saw “increasing herd size” a good way to build up physical assets for the household in the long-run; some also agreed that having more livestock in good time gave a higher chance for the survival of a minimum number of livestock so that herd could recover after the shock. These views somehow express the diversification rationale—as it is ranked highly effective by the sideline-oriented households (Table 11), especially those who had a bigger portion of their income from sideline jobs (Pearson correlation coefficient= -.366, sig=.002). All these households have already had abundant financial capital, and would love to accumulate more physical assets as well. On the other side of the debate, 43% of household respondents thought “increasing herd size” before a shock would simply put more livestock into danger, especially when the shock could impact livestock directly, such as animal diseases and feed production failure.

The above illustrates the fact that a household always relies on more than one strategy to strengthen itself and prepare against risks based on the assets it has. To rich households, “income diversification” is very helpful when they have sufficient assets to allocate to multiple production means. Income diversification reduces the risk(s) associated with singular production means, yet it is likely to result in a wide range of income variations.

(Table 5). The poorer households simply don't have the assets to invest in other productions; in addition their 'risk aversion' in perspective (preference in low variation production which is accompanied by a lower yield) also prevents them from pursuing new production practices. "Education" and "acquiring training" also require financial and human capital investment, which becomes inapplicable to these poor households which neither have abundant financial capital to finance their children's education nor have sufficient labourers to attend training while limited labourers are intensively engaged in the limited means of productions. Conclusively "safety-net solidarity building within a community" becomes the most important means for the poor to reduce negative effects from a future shock or stress.

Looking at both risk-mitigation actions and risk-reduction strategies, suggests a consistent pattern of households behaves *ex-ante* and *ex-post* of shocks or stresses. And what links a household's risk-mitigation actions and risk-reduction strategies is the household assets. For instance, those households who thought "cashing physical assets" very helpful to overcome adversity, also valued "increasing the size of their herds" as a useful way to extend their livelihoods and strengthen themselves (Pearson correlation coefficient=.238, sig=.001). It is accumulating and owning abundant physical assets, mostly livestock in agro-pastoral systems, makes the "cashing assets" strategy available and applicable to households. Many households that largely relied on "neighbour support", a form of social capital to endure hardship, also regarded "safety-net" (social capital) building as the most important strategy to ensure their survival when facing disastrous uncertainties (Pearson correlation coefficient=.473, sig=.000). Needless to say, households who deemed "practicing religious rituals" very useful to protect themselves against misfortune, had the same belief about the strategy's effectiveness in pulling themselves out of bad luck (Pearson correlation coefficient=.814, sig=.000). Having members attending religious institutes (a form of human capital) provides resources and makes rituals easier to perform.

6.4.3 Consequences of the risk management behaviours

The above discussion forms a picture about how agro-pastoral households cope with their surrounding risk-environment. Yet the picture is static and incomplete in the sense that in

the study up to now, households are isolated from the world outside their communities. Taking a more holistic view, risk management always involves dynamic, on-going interactions between individual households and the extended agents or institutions (such as credit union and markets) that are external to the households' production system and communities. In addition, the potential consequences of a household's risk-coping behaviours can affect its livelihood and choices of risk management strategy in the longer term. The following discussion adds spatial and time spectra into a household's risk management.

Suppose the study area has encountered a covariant risk event, such as the excessive long-lasting rain in the summer that could ruin crops, cause floods and erosion and even lead to a loss of property. Many stress-relief actions that most individual households take to handle idiosyncratic risks, become less effective during such a hazard. For instance, "borrowing money" from relatives and friends would be less applicable, as many households are in need of cash to endure the same difficulties. Even "taking a loan" from credit unions or banks can be competitive when a great many qualified households try to take loans at the same time. In meantime, a household's physical assets might be undervalued when many households attempt to sell them in the market, augmenting supply. "Neighbour support" also becomes less helpful while all neighbours are in trouble. In order to protect oneself against distress, sharing with extended families through "strengthened kinship" outside of the community or the region can be vital. When a natural hazard hits the whole region, the relief assistance from the government also becomes stringent. Under these circumstances, the relief assistance that a household receives might not be enough for the family to recover its livelihood. These considerations accentuate the need for expanding formal risk-mitigation network in the local area; for example, the government needs to provide a larger fund for humanitarian assistance, make loans available to more households, facilitate and ease access to the market and probably establish a temporary price-floor for some valuable physical assets (such as cattle).

Putting the analysis in a longer timeframe, working to cope with the future risks can have far-reaching outcomes that are neither expected nor intended by the households. When both rich and poor households try to trade their assets to help with livelihoods at the time

of crisis, the consequences for the two wealth groups can be shockingly distinct— the rich are able to recover its physical assets afterwards, while the poor households are likely to encounter more difficulties in the future after losing their limited productive assets (such as cattle), or forgoing the education of their children by pulling them out of school. Thus for the poor, the cost of applying such risk-coping strategy would outweigh benefits in the long-run. In addition, their risk-averse attitudes and “being subsistence-oriented ” also make “income source diversification” less affordable and applicable, which traps them in the risky environment associated with relying on only one production means. All these factors broaden the wealth gap between the rich and poor households.

From a more dynamic view, it’s foreseeable that the poor households are less likely to remain poor as they add new family members and more labourers. But growing into a large family doesn’t necessarily change a household’s vulnerability context and lead to stronger resilience to the surrounding risks, since lacking sufficient education and skill-building of the family members implies entry barriers to more profitable productions or businesses. These households thus are likely to continue the labourer-led specialization strategy in NTFP collection, which can be greatly affected by natural variations and the similar behaviours by other competing households in the community.

A household’s vulnerability context can be altered by the way a household manages its livelihood (including coping with risks). This sheds lights on if a specific agro-pastoral livelihood is sustainable or not. Developing livestock husbandry would presumably bring more income and physical assets to the household. Lacking available labourers however prohibits tending a big herd and producing a large quantity of fodder; and thus the livestock-oriented households might forsake transhumant herding pattern and concentrate their livestock in grazing the collectively-owned winter-grassland. Their success depends on their negotiation between other households in using the winter-grassland and how they manage their livestock production in accordance to natural capacity of the grassland. Similarly, the NTFP-oriented households make a living by exploiting the collectively-owned NTFP resources. Unless they have an interest in sustaining NTFP collection in the long-term, their current collection practices are likely to deplete NTFP resources. However, for these households (most of them belong to the ‘poor’ category), meeting the survival needs first as well as facing the uncertainties associated with the future NTFP

market, make them less motivated in slowing the extraction of NTFP at present. A lack of available labourers and investment in productive assets (such as cattle and their children's education), in addition, hinders these NTFP-oriented households from diversifying their productions. As a result they are likely to be trapped in the risk-environment associated with NTFP collection. While the previous types of households heavily rely on the natural capital, the sideline-oriented households (except the 'poorest') thrive to meet their 'development' needs instead of the 'survival' needs, and they are less affected by natural variations. For the time being, they are the financially wealthiest and resistant to stresses and shocks; and they may be least interested in the community-level common resource (such as NTFP and grassland) management. As mentioned before, these households might integrate themselves into urban economy, and face new forms of risk such as being laid-off, and having difficulties in finding a job, etc. The diversified households are considered the most resilient to shocks and stresses since they manage to lower the overall risk associated with all their production means; at the same time they have enough capital to invest in productive assets. They are likely to be most interested in the CPR management since much of their production still depends on exploiting the natural capital, and therefore successful CPR management would be most beneficial to them. In summary, all production modes are important as they satisfy the special needs of the households at the different places of the development cycle. A combination of these production modes (as in the case of the diversified households) can lower the overall risks, and the sustainable livelihood of a household depends on a sufficient investment in the productive assets as well as the effective CPR management at the community level.

The 'net livelihood effects' on a community from individuals' risk coping behaviour and livelihood management can be far-reaching. Normally, reducing vulnerability of its members will increase the overall stability of the community. Some risk reduction strategies may even have "positive externality" when the community benefits indirectly from the individuals' actions. "Safety-net building" within the hamlet adds social capital, and is most beneficial to the poorer households. Promoting more transparent and participatory communal decision-making processes is another way to augment social-capital. Such processes also encourage collective learning from experience dealing with

crisis, and thus increase the community's capacity to cope with future shocks (Olsson *et al.*, 2004).

The effect of social capital building can be undermined by individual households exploiting natural capital of the community. In a community where common resource management is missing, NTFP collection leads to the depletion of the NTFP resources, and thus inter-household sharing within a community would no longer be possible if the community mostly consists of the NTFP-oriented households. This consideration suggests a whole community is more stable and resistant to its particular risk environment when it has households pursuing more diversified livelihoods. “Enlarging herd size” is another way households utilize the collectively-owned natural capital. So far few communities have experienced severe grassland degradation; and “overgrazing” was deemed a less likely case given the limited fodder production and labour availability. To protect the important natural capital, compulsory measures such as establishing natural-resource (i.e. NTFP) conservation areas, and enforcing regulations (i.e. prohibiting the trading of immature *matsutake*) can be effective at the policy-level. From a community's perspective, communal CPR management institutions could calibrate the temporary individual behaviour with the collective interest, and thus attain the long-term well-being of the community. Promoting multi-level governance is therefore an important way the government could intervene to effectively prevent and reduce future risks (especially the human-induced risks) that are usually poorly addressed by individual households (Section 5.3.2).

6.5 Implications for the Sustainable Livelihood (SL) framework

This research presents a case study for using the Sustainable Livelihood (SL) framework to understand how subsistence-producers' in the agro-pastoral systems cope with risks. Where risks are included as an important element, this study enriches the SL framework by 1) establishing important feedback between assets, livelihood strategies and livelihood outcomes, 2) contributing to the state of knowledge about how subsistence-oriented households perceive and cope with risks, and 3) complementing the vulnerability context by embracing risk-perception and risk-specification.

This study proves that risks are imbedded within every production activity; managing agro-pastoral livelihoods also means coping with the risks at large and the particular ones associated with a certain production activity. In this new SL framework with the risk-element, the risks are specified according to their coverage, nature and causes (idiosyncratic and covariant risks, environment and non-environmental risks, as well as human-induced and natural risks). The factors that shape the cognitive processes of risk-perception are also identified (how risk perception attributes interact with each other). The specification of these risk characteristics is important since a household chooses its production activities and manages its livelihood based on its available assets as well as how it perceives the surrounding risks.

This study examines the risk-mitigation and risk-reduction actions explicitly, and makes the link between these two types of actions. A household's assets are the most important factors determining how it behaves consistently before and after a risk event. This study goes further to explore the possible consequences of a household's risk-coping and livelihood management, from the perspective of individual households and the community. It shows that the wellbeing of natural capital and social capital (both as assets and outcomes) is essential for both households and a community to prosper and become resilient to shocks and stresses.

6.6 Limitations

Error and bias could enter a study through research design, sampling and measurement. The following describes the types of error and bias, as well as their impacts on the results; areas to be further explored are also outlined.

1. Every study has its limited scope and thus not all related issues can be covered. In this research, agro-pastoral households are the study units. Information about households was collected and the analysis focuses on the inter-household differences, instead of inter-personal differences within a household. Therefore, the study didn't consider specific household members and their interaction between one another. The differences could be important in a heterogeneous population where decision-making, assets-holding and labour division vary significantly across households. This situation is not likely to occur in the study, as the sample was taken from a relatively homogeneous population, since

study units share the same culture and region, pursue similar livelihoods (agro-pastoral livelihoods), and have been closely connected by trade, marriage and resource use for generations. In the same way, the study didn't give special attention to the interaction between focus group participants. At the community level, interaction of its members determines how communal decisions are made and how collectively owned resources are allocated. These decisions will influence inter-household transfer arrangement, and determine if the collective capital would be enhanced or depleted. These issues are beyond the scope of this study, and need to be explored in the further research.

2. The second bias comes from 'non-probability sampling' of the hamlets and households (**Section 4.2**). For example, hamlets chosen had access to dirt roads in rainy season; and thus those extremely remote villages were excluded from the study. These somewhat isolated communities tend to have traditional livelihoods which are affected by climatic variations more than market-related risks; and they are likely to rely on traditional mechanisms to cope with uncertainties and solve problems. The 'main road bias' might result in a false image that the sample sites are well-developed (Chambers, 1997). Therefore assistance programs targeting these readily-accessible communities are likely to broaden the wealth gap between the well-development communities and those remote ones. The use of non-probability sampling undermines the generalizability of the results (external validity). Therefore readers should not assume that the sample fully represents the population. Nevertheless, the results are best used for comparing the differences between (the community, household and wealth) groups. These differences provide insights in understanding well-being indicators, and devising assistance programs targeting households at different development cycle.
3. Measurement error enters through the data collection process (Groves, 1989), which is closely related to the form of the method used. A common problem of the survey and interview in general, is the 'self-report' form of the responses. A general conclusion is that misreporting is associated with the extent of perceived threat (Northrup, 1996). In this study, respondents had under-reported their income and over-reported their expenses. The pretest HH survey indicated that other questions were regarded as non-threatening and thus misreporting-phenomena were not likely. Besides, the language barrier might have caused misunderstanding of some questions (or answers) and thus introduced the measurement error. In order to remedy the problem, the study hired one native-speaking

research assistant and several interpreters in each hamlet. As for focus groups, overlooking the interaction between group members could also cause problems in interpreting the collective response, especially if questions are in choice-form and don't allow variation. In this study most of the FG questions are in the quantitative form, so that the collective views represent those of the individual group-participants when it is the average of the individual answers. An integration of multiple methods helps increase the internal validity of the research by cross-checking each method and combining their strengths.

Chapter 7: Policy appraisal and opportunities

In the analysis, much focus is placed on the internal factors that affect the ways a household perceives and copes with risk. The ambient policy environment can't be overlooked—the impact of policies can be a direct cause of uncertainties; and policies can act to remove or impose constraints on the households applying strategies to manage their livelihoods under risks. Based on the above discussion, the following briefly evaluates several major policies, and policy recommendations are presented accordingly.

1. A logging and hunting ban (1998) was imposed to protect forests and wildlife of the upper reach of the Yangtze River. Increased cases of trespassing animals (such as black bear, wolf, weasel and hedgehog) have become an important concern in many communities. Resuming hunting is not seen as beneficial to these communities. In fact, it is in the difficulties of claiming compensations through the government for livestock-loss or crop-destruction due to the ban that worsens the problem (due to limited funds, burden of proof, and misunderstandings concerning the application process and qualifications needed for reimbursement). Therefore a more timely compensation mechanism (with fewer burdens of proof) would be helpful in reducing the risk of “trespassing animals”.
2. Related to the logging ban is the “grain-for-green” policy (2000), which encourages conversion of cropland to forest by paying the households a certain amount of cash and grain (often rice). Normally the government would provide two kinds of tree-seedlings: economic trees (such as walnut) and ecological trees (such as pine). Economic trees are allowed to be harvested (and replanted) periodically, but ecological trees can no longer be cut down. The choice of trees is often made by a combination of the government's recommendation (to fit local conditions) and the preference of the community itself. This policy is widely recognized as beneficial to local environmental rehabilitation as well as contributing to diet and nutrition. It becomes even more important when rice, imported and indispensable to the diet of the local people, is subject to market price fluctuations. The termination of the policy (in the next 10 years or so) means the loss of an important grain source to the participant communities, especially those who converted their

croplands into ecological forest (as in Hala Hamlet). People in these communities strongly expressed their concerns; they wish the benefits (grain and cash payment) could be extended in these areas after the policy ends, as this would give them time for developing alternative livelihoods other than farming. After all, this policy intends to restore natural forests of the upper reaches of the Yangtze River, so that the lower reaches would face fewer natural hazards (such as floods, wind and dust storm) where the economy is well developed and more tax money are available to the (centralized) government. Therefore, the possible benefit-sharing between the upper reaches (nature-restoration cost-bearers) and the lower reaches (beneficiaries) will be important to maintain a long-term environment protection program and bridge the ever-growing inequity between the West (the upper reaches) and the East (the lower reaches). At the same time, it is suggested that the government should also help the ‘West’ local communities (especially those who planted ecological trees) develop alternative livelihoods that should be strongly sustainable (in the sense that other forms of natural resource wouldn’t be destroyed).

3. The two-child policy for rural households and ethnic groups (1996) has been effective in controlling population growth in China. There are two main implications: 1) good health of family members becomes vital for the survival of rural households (lacking labourer), and 2) farming production in the long-run may become less viable for new generations. Under the policy, families normally would do their best to help their only children gain competitiveness in their future career (or livelihood)—through extending children’s education. The educated youth are likely to choose cities and non-farming production activities, and thus forsake their families’ traditional livelihoods. On the other hand, rural agriculture production would be reduced as labourers become scarce. Ultimately as a result, farmers need to look for non-farming options; and in the future they would become migratory labourers migrating between cities. Yet whether or not two-child policy will transform rural economy to urban economy (dualism) is unknown and needs further research.
4. By the same rationale, China’s compulsory education system could facilitate the transformation of peasants to urban labourers. The policy was legislated as a law in 1986; this system requires children (9-12 years old in rural area) to attend school. Households failing to fulfill this responsibility are subject to a penalty. Education of the youth

enhances their intelligence, awareness and mental power (to pursue new opportunities not available to them prior to their education); nevertheless hands are taken away from rural productions. The lack of labourer, with respect to risk management, causes households to become less insured when they need workers to support the production and recover from adversity. On the other hand, education of children also involves risks for households. The opportunity cost of education could be high when the job market is stagnant, or there are restrictions to the migration of labourers. This cost is increased when education incurs larger expenses (although tuition fees are waived, books, supplies and other expenses continue to grow). Also the extended education makes it easier to obtain a non-rural job; and the rich households are more likely to afford extending the education of their children. In this way, inequity between the rich and the poor is aggravated. Given the above analysis, it is argued that as a complement to the compulsory education policy, the government should provide assistance to poor households when they are in trouble, and need to cover related expenses. Yet any program targeting a specific group might have difficulties in delivering the assistance to the real needy, and a transparent subject-identification process is needed. At the same time, the government should remove or reduce constraints of labour migration to cities, in such a way to reduce inequity between the rural and the urban areas.

5. The privatization of grassland in Tibetan plateau (accompanied by the household responsibility system—HRS, initiated in early 1980's), is seen to have boosted herders' incentives to better manage their grassland and livestock. Yet an unintended outcome is that the collectively owned grassland is overgrazed when individuals try to maximize their own profit and protect their own grassland. So far, grassland has remained collective-owned in Zhongdian (and Diqing Prefecture). Many communities in this study would welcome the government to provide funding for fencing some of their hamlets' collectively-owned winter grassland, so that households could enclose their animals to protect them from grazing on croplands. Fencing (to enclose livestock) was thought as helpful since herders would no longer need to tend their livestock and thus they are free to work on other productions. According to these communities, “fencing” isn't “privatization”, as in the former case, the winter grassland will not be divided among individual households so that communities can retain their collective management- rights. There are many difficulties associated with its implementation: for instance, how many

animals a household shall bring into the enclosure, and if a household is allowed to bring all its livestock, those with less livestock will benefit less from exploiting the grassland; or if an equal number of livestock is agreed among households, those with more livestock would feel less interested in doing so, since for them the marginal benefits from putting an extra animal in the enclosure is smaller than those with fewer number of livestock, especially when the households need to contribute to the collective fencing-funding. Fencing can cause localized grassland degradation and there requires a rotation of winter-grassland to be fenced as well as the protection of the fenced grassland from over-grazing. Fencing could also block wildlife migration routes, yet this will not be a serious problem if fencing is near low-elevation human settlement where wildlife is fewer in number. These issues should be addressed by the government if it's interested in promoting livestock production while encouraging economic efficiency; community-level common property management once-again would be crucial to look over the well-being of its member households and ensure the sustainable use of the common resources.

6. Acting before risks for self-protection does not occur frequently among the agro-pastoral households in the study area. This creates an opportunity for government intervention. Concerning natural risks, especially common natural hazards (i.e. floods and snowfall), new technology such as early warning systems could provide households with valuable information about the upcoming risks. At the same time, better communication of risks between the technical experts and households is indispensable. Tackling human-induced risks on the other hand can involve more diverse and creative approaches. Market-regulation, such as 1) reducing fluctuations in the prices of subsistence foods (i.e. rice), and 2) prohibiting trading of immature *masutake*, can directly reduce or prevent market-related risks and NTFP depletion. Promoting community-level CPR management is the other important way to prevent human-induced risks that have localized impacts. This also includes acknowledging and consulting the traditional ecological knowledge of the agro-pastoral communities (such as the mobile herding pattern), to encourage sustainable practices in accordance with natural variations. In addition, environmental monitoring and conservation programs would be vital to protect important natural capital from destruction due to human activities.

CHAPTER 8: Conclusions

This study applies the Sustainable Livelihood (SL) framework to explore the dynamic relationship between a household's assets, its livelihood and strategies in managing the surrounding risks in the agro-pastoral systems of Zhongdian County. The study enriches the SL framework by including risk-coping as an objective of livelihood management; it also complements vulnerability context by adding risk-perception and risk-specification.

This study finds that the individually-owned assets—financial, physical and human capital directly determine a household's wellbeing. Social and natural capital is usually owned collectively; they are important to the wellbeing of the whole community. Based on its available assets, a household chooses a certain livelihood strategy and develops its livelihood. A household having considerable financial capital usually follows capital-led specialization and grows into the livestock-oriented or the sideline-oriented household. Households lacking financial capital can only concentrate their limited labourer force in collecting NTFP, the most readily-exploitable natural capital. In order to maintain a large herd, and set up a transportation business or obtain a regularly-paid job, there usually requires many labourers, or some labourers have to be skilful and/or well-educated. In this sense, human capital is the foundation for developing every production system and accumulating physical and financial capital. Different livelihoods also imply variable wellbeing level of the households.

A household's livelihood is greatly affected by its surrounding risks. Idiosyncratic risks usually impact a limited number of people, while covariant risks can have a wide coverage. Climatic variations are eminently geographically specific, suggesting risks are a part of a household's physical environment. Some risks (i.e. severe snowfall) exist in a particular production means (i.e. livestock husbandry of the highland herders). There are also new emergent forms of risks that are caused by human activities which are closely related to the expansion of the local market and the modern economy.

Idiosyncratic risks are in general regarded more severe than covariant risks, as idiosyncratic risks usually imply a higher probability that the household will be affected. Among the covariant risks, environment-related risks and natural risks happen more frequently, and cause more dreadful effects than non-environmental and human-caused risks. A household's perception of a certain risk event is shaped by how much assets are in its disposal. Risks in general are perceived as more severe by the poorer households who have fewer assets.

Coping with risks includes taking action *ex-post* a risk event to mitigate impacts, and employing strategies *ex-ante* the event to prevent or reduce the future loss. A household's assets determine the way it behaves consistently before and after a risk event. The financially wealthy households usually diversify their assets-holding or productions, so that they 1) reduce risks associated with a particular production, and 2) have more means to overcome difficulties (i.e. trading physical assets). The poor households are more 'risk-averse', and thus reluctant to diversify their production, which lowers their average return. Besides they lack sufficient financial and human capital to put into multiple productions when food security is still the biggest concern. In the time of crisis, these poor households face many constraints (i.e. barrier to borrowing) to take effective stress-relief actions. As a result, "community safety-net or solidarity building" and "enhancing communal decision-making" are the only ways that the poor households can protect themselves against risks and survival adversity.

The consequences of risk management are reflected in the changes of the households and community's assets. In 'good times', better-off households build productive physical assets, extend the education of their children (human capital), and diversify their productions to lower their overall risks. During difficulties, they can easily take loans or cash their assets to help with livelihood recovery. All these actions add stability and make them more resilient to future risks. In contrast, the poorer households are engaged in low-variation and low-return productions ("income skewing"), which makes them incapable to invest in productive-asset building (including education) or diversify their assets. A lack of these productive assets also hinders their ability to 'buffer' adversity. As a result, these families greatly rely on the collectively owned natural and social capital to make a living and ensure against distress.

When the rich become richer and the poor are made worse-off due to financial shortcomings, the wealth gap undermines the stability of a community and its social capital (Eames & Adebawale, 2002). Situations could become even worse when NTFP resources (natural capital) are depleted as a result of the market demand; the NTFP-oriented households are likely to lose their entire livelihood, if they lack productive-assets to develop alternative productions. Therefore it's important to protect and enhance social and natural capital within a community, especially when the community is mainly comprised of the NTFP-oriented households. This observation calls for revitalizing CPR institutions (including risk management) and promoting multi-level governance of local communities.

In addition, a comprehensive policy-appraisal of effects of several major policies on special populations by the policy specialists is required, as they can become potential forms of risk (i.e. price fluctuations), especially to the poorer households. Mechanisms (i.e. wildlife damage compensation) are needed accordingly to mitigate the undesirable impacts of these events on different groups. On the other hand, the government should also remove or reduce constraints which the poor rural households face, for example, reducing tuition fees for the poorer households, lowering the interest charge when these households apply for loans, and allowing free movements of labourers from rural to urban areas. New regulations are also needed to tackle problems associated with modern economic activities (i.e. waste and sewage management) and the depletion of the critical natural resources (i.e. establishing conservation areas for NTFP).

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APPENDICES

Appendix A: Agro-pastoral Household Questionnaire

Date: _____ **Respondent's gender:** ☐ Male ☐ Female
Name of the respondent's household: _____ **Name of the township:** _____
Name of the administrative village: _____ **Name of the hamlet:** _____
Household classification number: _____

[*INTERVIEW*: before starting the questionnaire, please make sure that the respondent is the family member who dwells in the household for more 6 months one year]

SECTION A. BACKGROUND INFORMATION

To begin with, I would like to ask you a few questions about yourself and your family.

A1. Are you the head of this family?

- ☐ Yes [IF YES, GO TO A3]
☐ No

A2. [IF ANSWERED NO in A1] What is your relation to the head of your family? _____

A3. How old are you?

- ☐ 6 - 15 years
☐ 16 - 25 years
☐ 26 - 55 years
☐ 56 and over

A4. What ethnic group do you belong to?

- ☐ Tibetan
☐ Yi
☐ Naxi
☐ Han
☐ Other _____

A5. How many families in the hamlet are your relatives? _____; and how many people are in these families in total _____?

A6. Can you read or write?

- ☐ Read
☐ Write
☐ Neither

A7. Did you learn any craftsmanship or skills (from outside of school)?

- ☐ Yes

[IF YES] What skill did you learn and where and how did you learn this skill? _____

- ☐ No

A8. Have any of your family members attended school?

- ☐ Yes
☐ Never [IF NEVER, GO TO A13]

A9. What is the highest level of schooling you have attained, but not necessarily completed?

- ☐ I never attended school [GO TO A11]
☐ Monastery/ religious institutions
☐ Primary
☐ Secondary
☐ College
☐ Army

A10. Are you the one who has attained the highest schooling among your family members?

- ☐ Yes [IF YES, GO TO A13]
☐ No

A11. Excluding yourself, what is the highest level of schooling attained by any of your family members, but not necessarily completed?

- ☐ None
☐ Monastery/ religious institutions
☐ Primary
☐ Secondary
☐ College
☐ Army

A12. The family member who attained the highest level of schooling in your family is

- ☐ Female
☐ Male

A13. If you got the chance to promote the education of your family member, would you do so?

- ☐ Yes
☐ No

[IF NO] why don't you want to further promote the education of your family_____?

A14. Including yourself, what are the ages and gender of household members that normally live (say more than 6 months each year) in this residence?

| | <i>Male</i> | <i>Female</i> |
|---------------|-------------|---------------|
| 0 - 5 years | _____ | _____ |
| 6 - 15 years | _____ | _____ |
| 16 - 25 years | _____ | _____ |
| 26 - 55 years | _____ | _____ |
| 56 and over | _____ | _____ |

SECTION B. COMMUNITY INVOLVEMENT AND SOCIAL CAPITAL

I would like to ask you some questions about your community and your involvement in your community.

B1. Have you lived in this hamlet for all your life?

- ☐ Yes
☐ No [IF NO] How many years have you lived in this hamlet? _ years

B2. How frequently do you or any of your family members participate in community meetings?

- ☐ Never [IF NEVER, GO TO B4]
☐ Rarely
☐ Sometimes
☐ Usually
☐ Always

B3. If you disagree with any of these community decisions, how frequently do you feel free to speak out?

- ☐ Never
☐ Rarely
☐ Sometimes

- ☐ Usually
☐ Always

B4. Are there any voluntary groups or organizations in your hamlet?

[INTERVIEWER: do not include family-only type of gathering as voluntary groups or organizations]

- ☐ Yes [IF YES] What are these groups (please name them)?
☐ No [IF NO GO TO B7]

B5. Do you or any of your family members participate in any of these voluntary groups or organizations in the hamlet?

- ☐ No
☐ Yes IF YES] How many voluntary groups or organizations do you or your family members regularly participate in? groups/organizations

B6. Are you or any of your family members on a management or organising committee for any of the above groups?

- ☐ Yes
☐ No
☐ Everybody in the group/organization is equal

B7. In the past 12 months, what were the major festivals or events that were organized by or held in your village and township (such as the Tibetan New Year, Mountain pilgrimage on 15th January, and May horse-racing festival, etc)?

B8. In the last 12 months, did people in your hamlet gather for any of the following events? (please choose as many as apply)

- ☐ Marriage
☐ Birth of child
☐ Having operation
☐ Funeral
☐ Religious rituals (such as invite monks to give blessings)
☐ Else (please specify _____)

B9. How many of the above festivals, events or community gatherings did your family members attend in the past 12 months?

- ☐ None [IF NONE] Why didn't you attend these festivals?_____
☐ Some [IF SOME] Which major

- ☐ festivals/events have you attended?
☐ All of them
- B10. How many people within the hamlet do you feel trustworthy?
- ☐ Almost no one
☐ A few people
☐ Half of people
☐ Most people
☐ Almost everyone
- B11. How many people within the administrative village do you feel trustworthy?
- ☐ Almost no one
☐ Depends on whom
- ☐ A few people
☐ Half of people
☐ Most people
☐ Almost everyone
- B12. How many people from outside of the village (except your relatives) do you feel trustworthy?
- ☐ Almost no one
☐ A few people
☐ Half of people
☐ Most people
☐ Almost everyone

SECTION C. HOUSEHOLD SOCIO-ECONOMIC STATUS AND SPECIAL NEEDS

C1. Currently how much holding does your family have in the following asset?

| No. | Asset | Quantity | | |
|-----|----------------------------------|----------|--|--|
| 1 | FARM EQUIPMENT | (Unit) | | |
| | Tractor | | | |
| | Water pump | | | |
| 2 | ENERGY EQUIPMENT | (Unit) | | |
| | Biomass stove | | | |
| | Solar stove | | | |
| | Coal gas and liquefied gas stove | | | |
| 3 | HOME ELECTRICAL APPLIANCE | (Unit) | | |
| | Colour TV/Black-white TV | | | |
| | Telephone/Cell phone | | | |
| 4 | TRANSPORTATION MEANS | (Unit) | | |
| | Minivan | | | |
| | Truck | | | |
| | Jeep | | | |
| | Motorcycle | | | |
| 5 | LIVESTOCK | (Head) | | |
| | Yak/Pianniu/Ox or cow | | | |
| | Goat/Sheep | | | |
| | Horse/ Donkey/Mule | | | |
| | Pig | | | |
| | Chicken/Duck/Goose | | | |
| 6 | GRASSLAND | (Mu) | | |
| | Fenced grassland | | | |
| | Unfenced grassland | | | |
| 7 | ELSE | (Unit) | | |

C2. By what means did your family acquire the following grain and fodder in the past 12 months?

C3. In the past 12 months, how much of these grain and fodder did your family stock?

C4. How much of them are still left current?

C5. If the leftover is insufficient, how much of them do you plan to buy shortly?

| Grain and fodder | Means of acquisition □Planted□bought□exchanged, given□'grain-for-green'□ | Stock□1/2 kg□ | Currently leftover□1/2 kg□ | If insufficient, how much needed to buy□1/2 kg□ |
|-----------------------|--|---------------|----------------------------------|---|
| Rice | | | | |
| Wheat and/oat (flour) | | | | |
| Corn | | | | |
| Highland barley | | | | |
| Potato | | | | |
| rapeseed | | | | |
| Else□please specify□ | | | | |

C6. How much did your family spend in the following items of family expenditure?

| No. | Expenditure | Amount Yuan□ |
|-----|--|--------------|
| 1 | FARM PRODUCTION RELATED EXPENDITURE | |
| | Chemical fertilizer, pesticide, farm equipment | |
| | Purchasing livestock | |
| | Livestock fodder and medicine | |
| 2 | LIVING EXPENDITURE | |
| | Grain, meat, vegetable, non-staple foodstuffs | |
| | Clothing and bedclothes | |
| | Building new, renewing houses | |
| | Clinic and medicine | |
| | Tuition, books, living expenses for school | |
| | Energy (electricity, solar, biomass gas, coal, liquefied gas) | |
| | Communication (Cable and phone) | |
| | Transportation (trip ticket, gas and other fees) | |
| 3 | OTHER FORM OF EXPENDITURE | |
| | Rituals, expenditure in religious festivals | |
| | Holding feast and giving out gifts | |
| | Penalty and fines (i.e. due to the violation of the communal rules, etc) | |
| 4 | ELSE (please specify) | |
| SUM | | |

C7. Did your family use the following means to generate cash income in the past 12 months?

C8. How much cash did your family earn by pursuing these means of production in the past 12 month?

C9. How much quantity of the agriculture and livestock produces did your family consume in the past 12 months? How much quantity did your family receive as gift, and how much did your family send others as gift or donate?

| No. | Income source | Applicable YES/NO | Cash □Yuan□ | | | Non-cash□Yuan□ | | | | |
|-----|---|----------------------|-------------------|---------------|--------|----------------------|---------|------|---------------|----------------------|
| | | | Sales quantity | Unit price | Amount | Self- consumption | receive | give | Unit price | Equivalent Amount |
| 1 | AGRICULTURE | | unit | | (yuan) | unit | | | | □Yuan□ |
| | Wheat/oat | | | | | | | | | |
| | Highland barley | | | | | | | | | |
| | Corn | | | | | | | | | |
| | Potato | | | | | | | | | |
| | turnip | | | | | | | | | |
| | Bean | | | | | | | | | |
| | Vegetable□ □ | | | | | | | | | |
| | Fruit□ □ | | | | | | | | | |
| | rapeseed | | | | | | | | | |
| | Walnuts | | | | | | | | | |
| 2 | LIVESTOCK | | □Yuan□ | | (yuan) | | | | | □Yuan□ |
| | Cattle (yak, hybrid, cow) | | | | | | | | | |
| | Horse/donkey/mule | | | | | | | | | |
| | Pig | | | | | | | | | |
| | Goat/Sheep | | | | | | | | | |
| | Chicken/Duck/goose | | | | | | | | | |
| | Fish | | | | | | | | | |
| | Yak butter | | | | | | | | | |
| | Milk sediment | | | | | | | | | |
| | Else(please specify□ | | | | | | | | | |
| 3 | NTFP COLLECTION | | | | □Yuan□ | | | | | □Yuan□ |
| | Matsutake | | | | | | | | | |
| | Cordyceps | | | | | | | | | |
| | Herbal medicine () | | | | | | | | | |
| 4 | SIDELINE | | | | (yuan) | | | | | |
| | Compensation for 'grain-for-green' | | | | | | | | | |
| | Handicraft | | | | | | | | | |
| | Transportation/ Pottering (non-tourism) | | | | | | | | | |
| | Tourism□lodging, food, guide□ | | | | | | | | | |
| | Trading | | | | | | | | | |
| | Working for gov or a factory | | | | | | | | | |
| | Wine brewing | | | | | | | | | |
| | Remittance | | | | | | | | | |
| 8 | ELSE () | | | | □Yuan□ | | | | | □Yuan□ |
| SUM | | | | | □Yuan□ | | | | | □Yuan□ |

C10. What has been the average annual cash income for your family from all sources over the past 3 years?

C11. How constant has your family's cash income been from one year to the next during each of the past 3 years?

☐ Not at all constant

☐ Somewhat constant

☐ Highly constant

C12. During each of the past 3 years, how seasonal was your family's income from season to season?

- ☐ Not at all seasonal ☐ Somewhat seasonal ☐ Highly seasonal

C13. Typically, which months do you might feel the available supply of household labour is not sufficient to meet the demand (in Han's calendar)? [INTERVIEW: please circle the appropriate month(s) accordingly]

C14. If your family does experience labour shortage, how do you typically deal with the problem?

- ☐ Asking for help from neighbors and friends in the hamlet
☐ Asking for help from relatives living outside of the hamlet
☐ Contracting labours within the hamlet
☐ Contracting labours from outside of the hamlet
☐ Taking children out of school

Just then, we were talking about what assets your family has, and if your family had experienced labour shortage, etc. Right now, let's talk about the concerns and needs of your family.

C15. Compared to 10 years ago, to what extent has the priority of the following issues changed in your family's agenda? Please tell me for each of the following issues, has it become more important or less important? Or the importance of the issue remains unchanged in your family's agenda over time?

| Issue | Change of importance | | |
|---|----------------------|----------------------|----------------|
| | Less important | Importance unchanged | More important |
| Food supply | | | |
| Herd size | | | |
| House | | | |
| Health of the family member | | | |
| Education of family members | | | |
| Fuel source supply | | | |
| Cultural and religious practices | | | |
| Environment protection in neighbourhoods | | | |
| Local road/transportation | | | |
| Media and communication in the local area | | | |
| Other (please specify) | | | |

C16. Among the above issues, what are the three foremost issues in your family's agenda presently? Please rank these three issues according to the degree of their importance to your family.

| Rank | ① Most important | ② Second important | ③ Third important |
|-------|------------------|--------------------|-------------------|
| Issue | | | |

Let's move to the discussion about social services in the community.

C17. At what lever does your family access and use the following social services?

C18. For each of the following social services that you or your family members ever used, how satisfactory is the service to your family in general?

C19. Can your family afford these services?

| | The place you access the service | Satisfactoriness | | | | | Affordability | | |
|------------------------------------|-----------------------------------|-----------------------|----------------|------------------------|--------------|---------------------|---------------------|----------------------|----------------|
| | Hamlet, village, township, county | Highly unsatisfactory | Unsatisfactory | Some what satisfactory | Satisfactory | Highly satisfactory | Can't afford at all | Can afford partially | Can afford all |
| Social services | | | | | | | | | |
| Clinic, health and doctor | | | | | | | | | |
| Veterinary services | | | | | | | | | |
| Schools | | | | | | | | | |
| Shopping for goods and commodities | | | | | | | | | |
| Agriculture extension program | | | | | | | | | |
| Else (please specify) | | | | | | | | | |

SECTION D. PERCEPTION OF RISKS THREATENING HOUSEHOLDS

Starting from now on, I would like to ask you a few questions about your feelings of certain risk events that threaten the wellbeing of your family and the community as a whole.

D1. Families face many different potential risks. Some of these risks might affect only your family or limited number of households in your hamlet. Examples include illness of the family member, and theft, etc. Has your family ever experienced the following risk events?

D2. How severe are these risk events to your family?

| Risk Event that might only affect a small number of families in the hamlet | Ever experienced | Severity | | | | |
|--|------------------|-------------------|-----------------|-----------------|--------|---------------|
| | YES or NO | Not severe at all | Slightly severe | Somewhat severe | Severe | Highly severe |
| Illness or/and loss of family members | | | | | | |
| (Due to insufficient fodder and the lack of warm-shed for livestock to over-winter) death of livestock | | | | | | |
| Theft and robbery | | | | | | |
| Soil erosion on household plots | | | | | | |
| Failure in searching for NFTP (i.e. <i>Matsutake</i> , <i>Cordyceps</i> , etc) | | | | | | |
| Wildlife depredating on livestock and crops | | | | | | |
| House on fire | | | | | | |
| Else (please specify) | | | | | | |

D3. Among the risk events listed above, which one do you regard as the biggest threat to your family currently? _____

D4. Has your family ever experienced this risk event (D3) you regard as the most severe to your family?

☐ Yes [IF YES, GO TO D6]

☐ No

D5. [IF NO in D4] Among the above-listed risk events that your family have experienced before, which risk event do you view as most severe to your family at present time _____?

D6. How do you think of the risk event that your family ever experienced and regard as most severe presently?

| Characteristics of the risk event | Scale | | | | |
|---|---|---|---|---|--|
| The number of households that the risk event is likely to affect, should it occur | Only affecting singular family <input type="checkbox"/> | Affecting limited number of families in the hamlet <input type="checkbox"/> | Affecting many families in the hamlet <input type="checkbox"/> | Affecting the whole hamlet <input type="checkbox"/> | Affecting the whole township or/and county <input type="checkbox"/> |
| The likelihood of the risk event to cause dreadful impacts (e.g. injure or loss of family members, majority herd killed, family economy greatly impaired) | Highly unlikely cause dreadful impacts <input type="checkbox"/> | Not likely to cause dreadful impacts <input type="checkbox"/> | Might or might not cause dreadful impacts <input type="checkbox"/> | Likely to cause dreadful impacts <input type="checkbox"/> | Highly likely to cause dreadful impacts <input type="checkbox"/> |
| The frequency of the occurrence of the risk event | Occurred only once or twice (or limited times) in the history <input type="checkbox"/> | Occurring once in a long while <input type="checkbox"/> | Occurring once in a while <input type="checkbox"/> | Frequently occurring <input type="checkbox"/> | Occurring at almost all the time <input type="checkbox"/> |
| The controllability of the risk event | Not controllable at all <input type="checkbox"/> | Uncontrollable to a large extent <input type="checkbox"/> | Somewhat controllable <input type="checkbox"/> | Controllable to a large extent <input type="checkbox"/> | Highly controllable <input type="checkbox"/> |
| The amount of the risk mitigation/prevention interventions from government and other organizations | Few prevention/mitigation intervention <input type="checkbox"/> | Very limited amount of prevention/mitigation intervention <input type="checkbox"/> | Some prevention/mitigation intervention <input type="checkbox"/> | Many prevention/mitigation intervention <input type="checkbox"/> | A great amount of prevention/mitigation intervention <input type="checkbox"/> |

D7. Besides the above risks that only impact few families, there are also some other risks that would affect all families in your hamlet or even the whole region to a greater or lesser degree. Examples include animal disease epidemics, bad weather, etc. Has your family ever experienced the following risk events?

D8. How severe are these risk events to your family?

| Risk Event that might affect many families | Ever experienced | Severity | | | | |
|---|------------------|-------------------|-----------------|-----------------|--------|---------------|
| | YES or NO | Not severe at all | Slightly severe | Somewhat severe | Severe | Highly severe |
| Epidemic animal diseases | | | | | | |
| Extreme/abnormal climatic events (such as excessive coldness in fall and heat in summer, etc) | | | | | | |
| Fluctuation of the produce price at markets | | | | | | |
| Uncertain impacts resulted from the change of government policies | | | | | | |
| The deprivation of the right of development from locals (i.e. local government contracting the land and natural resources of the local area to outside developer instead of locals) | | | | | | |

| | | | | | | |
|---|--|--|--|--|--|--|
| Prevalence of crop disease and pest disaster | | | | | | |
| Conflicts between groups within and across the communities | | | | | | |
| Floods and mud flow (due to heavy rain) | | | | | | |
| Grassland degradation nearby the hamlet (degradation of winter pasture) | | | | | | |
| Grassland degradation at high mountains (degradation of summer pasture) | | | | | | |
| (Due to various reasons) destruction of the forest | | | | | | |
| Drought | | | | | | |
| Disaster of rain, frost, wind and hail | | | | | | |
| Disaster of snow | | | | | | |
| Invasive species | | | | | | |
| The contamination and remain of pesticide and herbicide in the plot | | | | | | |
| Else (please specify) | | | | | | |

D9. Among the risk events listed above, which one do you regard as the biggest threat to your household currently? ____

D10. Has your family ever experienced the risk event (D9) you regard as the most severe to your family?

☐ Yes [IF YES, GO TO D12]

☐ No

D11. [IF NO in D10] Among the above-listed risk events that your family experienced in the past, which risk event do you view as the biggest threat to your family at present time _____?

D12. How do you think of the risk event that your family regards as most severe?

| Characteristics of the risk event | Scale | | | | |
|---|---|--|---|--|--|
| The number of households that the risk event is likely to affect, should it occur | Only affecting singular family <input type="checkbox"/> | Affecting limited number of families in the hamlet <input type="checkbox"/> | Affecting many families in the hamlet <input type="checkbox"/> | Affecting the whole hamlet <input type="checkbox"/> | Affecting the whole township or/and county <input type="checkbox"/> |
| The likelihood of the risk event to cause dreadful impacts (e.g. injure or loss of family members, majority herd killed, family economy greatly impaired) | Not likely to cause dreadful impacts at all <input type="checkbox"/> | Not likely to cause dreadful impacts <input type="checkbox"/> | Might or might not cause dreadful impacts <input type="checkbox"/> | Likely to cause dreadful impacts <input type="checkbox"/> | Highly likely to cause dreadful impacts <input type="checkbox"/> |
| The frequency of the occurrence of the risk event | Occurred only once or twice (or limited times) in the history <input type="checkbox"/> | Occurring once in a long while <input type="checkbox"/> | Occurring once in a while <input type="checkbox"/> | Frequently occurring <input type="checkbox"/> | Occurring at almost all the time <input type="checkbox"/> |
| The controllability of the risk event | Not controllable at all <input type="checkbox"/> | Uncontrollable to a large extent <input type="checkbox"/> | Somewhat controllable <input type="checkbox"/> | Controllable to a large extent <input type="checkbox"/> | Highly controllable <input type="checkbox"/> |

| | | | | | |
|--|---|--|--|--|---|
| The amount of the risk mitigation/prevention interventions from government and other organizations | Few prevention/ mitigation intervention <input type="checkbox"/> | Very limited amount of prevention/ mitigation intervention <input type="checkbox"/> | Some prevention/ mitigation intervention <input type="checkbox"/> | Many prevention/ mitigation intervention <input type="checkbox"/> | A great amount of prevention/ mitigation intervention <input type="checkbox"/> |
|--|---|--|--|--|---|

[INTERVIEWER: If the respondent selected a risk event that was environment related (i.e. epidemic animal diseases, extreme/abnormal climatic events, prevalence of crop disease and pest disaster, floods and mud flow, winter/ summer grassland degradation, destruction of the forest, drought, disaster of snow, rain, frost, wind and hail, Invasive species, and the contamination and remain of pesticide and herbicide), GO TO E1. Otherwise GO TO D13]

D13. Now I would like to ask you specifically about risks related to environmental events. Examples include extreme climatic events and grassland degradation. Which of the following environmental risks do you think is the biggest threat to your family at the present time?

- ☐ Epidemic animal diseases ☐ Extreme/abnormal climatic events
☐ Prevalence of crop disease and pest disaster ☐ Floods and mud flow (due to heavy rain)
☐ Grassland degradation nearby the hamlet ☐ Snowfall
☐ Grassland degradation at high mountains (summer pasture) ☐ Drought
☐ The contamination and remain of pesticide and herbicide
☐ Disaster of rain, frost, wind and hail ☐ Other (specify)_____

D14. For this risky event (D13), please tell me how you think of it, according to the following characteristics.

| Characteristics of the risk event | Scale | | | | |
|---|--|--|---|--|---|
| The number of households that the risk event is likely to affect, should it occur | Only affecting singular family <input type="checkbox"/> | Affecting limited number of families in the hamlet <input type="checkbox"/> | Affecting many families in the hamlet <input type="checkbox"/> | Affecting the whole hamlet <input type="checkbox"/> | Affecting the whole township or/and county <input type="checkbox"/> |
| The likelihood of the risk event to cause dreadful impacts (e.g. injure or loss of family members, majority herd killed, family economy greatly impaired) | Not likely to cause dreadful impacts at all <input type="checkbox"/> | Not likely to cause dreadful impacts <input type="checkbox"/> | Might or might not cause dreadful impacts <input type="checkbox"/> | Likely to cause dreadful impacts <input type="checkbox"/> | Highly likely to cause dreadful impacts <input type="checkbox"/> |
| The frequency of the occurrence of the risk event | Occurred only once or twice (limited times) in the history <input type="checkbox"/> | Occurring once in a long while <input type="checkbox"/> | Occurring once in a while <input type="checkbox"/> | Frequently occurring <input type="checkbox"/> | Occurring at almost all the time <input type="checkbox"/> |
| The controllability of the risk event | Not controllable at all <input type="checkbox"/> | Uncontrollable to a large extent <input type="checkbox"/> | Somewhat controllable <input type="checkbox"/> | Controllable to a large extent <input type="checkbox"/> | Highly controllable <input type="checkbox"/> |
| The amount of the risk mitigation/prevention interventions from government and other organizations | Few prevention/ mitigation intervention <input type="checkbox"/> | Very limited amount of prevention/ mitigation intervention <input type="checkbox"/> | Some prevention/ mitigation intervention <input type="checkbox"/> | Many prevention/ mitigation intervention <input type="checkbox"/> | A great amount of prevention/ mitigation intervention <input type="checkbox"/> |

SECTION E. RISK PREVENTION, COPING STRATEGIES AND CONSTRAINTS

E1. Generally speaking, has your family ever taken the following actions to mitigate the impacts exerted by the risk event after it strikes?

E2. How effective are these actions for your family to alleviate the negative impacts of the risk event?

E3. [OPTIONAL] How does each of the following risk coping actions help your family alleviate the loss or negative impacts after the risk event occurred?

| Ex-post risk coping strategies | Applicable | Effectiveness | | | How does the coping strategy help you |
|---|-------------------|----------------------|--------------------|----------------|--|
| | YES or NO | Not effective | Somewhat effective | Very effective | |
| Covert assets into cash | | | | | |
| Borrow loan from banks and other credit sources | | | | | |
| Undertake religious rituals ^a i.e. inviting monks to give blessings ^a | | | | | |
| Have kids drop off school to help with the livelihoods restoration | | | | | |
| Wait for relief subsistence from outside of the community (i.e. from governments) | | | | | |
| Else (please specify) | | | | | |

E4. Suppose the risk event only impacts your family, does your family ever consider ‘receiving support (either in cash, in-kind or mental comfort) from other families in the hamlet to help us’ a risk coping measurement, after the risk event?

E5. How effective is this risk-coping measurement—receiving support from other families in the hamlet to help us—in helping your family alleviate the negative impacts and recover the livelihood?

E6. [OPTIONAL] How does ‘receiving support from other families in the hamlet’ help your family alleviate the loss or negative impacts?

| Ex-post risk coping strategy in case of a risk event only affecting my family, | Applicable | Effectiveness | | | How does the coping strategy help you |
|---|-------------------|----------------------|--------------------|----------------|--|
| | YES or NO | Not effective | Somewhat effective | Very effective | |
| Receive support from other families in the hamlet | | | | | |

E7. Now suppose the risk event affects many or all families in the hamlet, does your family ever consider ‘receiving support from other families in the hamlet to help us’ a risk coping strategy, after the risk event?

E8. How effective is this risk-coping strategy in helping your family alleviate the negative impacts under such circumstance?

E9. [OPTIONAL] How does ‘support from other families in the hamlet’ help your family to alleviate the loss or negative impacts in this case?

| Ex-post risk coping strategy after a risk event affecting many or all families | Applicable | Effectiveness | | | How does it help you |
|---|-------------------|----------------------|--------------------|----------------|-----------------------------|
| | YES or NO | Not effective | Somewhat effective | Very effective | |
| Receive support from other families in the hamlet | | | | | |

E10. Please rank the above risk coping actions/strategies, according to their effectiveness to help your family alleviate the negative impacts after a risk event takes place (now consider the risk event as a general term; that is, don't differentiate if it would affect only your family or the whole hamlet).

[INTERVIEW: please remind the respondent that in ranking, strategy 7 and 8 shouldn't be viewed as different, and thus only ONE of them could enter the following rank-table]

| Rank | ① Most effective | ② | ③ | ④ | ⑤ | ⑥ Least effective |
|----------|------------------|---|---|---|---|-------------------|
| Strategy | | | | | | |

E11. Instead of acting to cope with the negative consequences of a risk event after it occurs, it might be more important for your family and the whole community to develop some strategies before the risk events occur, to make yourselves more resilient to these risk events, or to alleviate the magnitude of loss due to the risk events once they hit your family and the community. In the face of a potential risk event, has your family ever taken the following measurements to enhance the resilience of yourselves and/or reduce the potential negative impacts once the event takes place?

E12. How helpful are these *ex-ante* measurements/strategies for your family to grow more resistant to the risks, or to reduce the potential magnitude of loss once the risk event occurs?

E13. Please rank the 'very helpful *ex-ante* risk prevention/mitigation strategies' according to their helpfulness for your family to reduce your risk-exposure, and/or the potential loss before the risk event ever occurs.

| Ex-ante risk prevention or reduction strategies | Applicable | Helpfulness | | | Rank |
|---|-------------------|--------------------|----------|--------------|-------------|
| | YES or NO | Not helpful | Somewhat | Very helpful | |
| Enlarge herd size (if possible) | | | | | |
| Diversify income sources locally | | | | | |
| Serve for communal decision making/ administrative level to enhance community capacity to cope with risks | | | | | |
| Work towards establishing 'safety nets' within the community by building ties with others | | | | | |
| Strengthen kinship with someone outside of the community | | | | | |
| Attend agriculture technique/skill training | | | | | |
| Promote children's education | | | | | |
| Undertake religious rituals (i.e. inviting living Buddha and monks to give blessing) | | | | | |
| Else (please specify) | | | | | |

E14. In reality, governments, non-governmental organizations and private sponsors might be willing to take measurements/interventions to help you reduce your risk-exposure and/or mitigate the impacts of the risks once they occur. Some of these measurements have already been undertaken, while others might be fulfilled in the future. In your opinion, are the following interventions helpful or not for your family to prevent risk events and/or reduce impacts once they occur?

E15. How helpful are these interventions and measurements for your family to reduce your risk-exposure and/or impacts brought about by the risk after it occurs?

E16. [OPTIONAL] Why do you think the intervention isn't helpful? Or if it's helpful, how does it work to protect you against future shocks and/or to mitigate the impacts after the a risk event?

| Policies, interventions or measurements | Helpful | Helpfulness | | | Why is it un-/helpful |
|---|---------|----------------|------------------|--------------|-----------------------|
| | YES/NO | Little helpful | Somewhat helpful | Very helpful | |
| Agriculture extension programs | | | | | |
| Developing or improving communal mutual support system within the hamlet | | | | | |
| Governments and other outside sources providing risk-relief substance | | | | | |
| Governments lifting the entry barrier for households to the various credit programs, or reducing interest rate for borrowing loan | | | | | |
| Support to build a local school or improve the conditions of the existing school | | | | | |
| Outside support to improve the local health care facilities and equipment | | | | | |
| Exempted or reduced taxation | | | | | |
| Removal of the ban on logging and hunting in specific area | | | | | |
| Development of alternative energy sources | | | | | |
| Introduction of better crop and fodder species | | | | | |
| Renovation of the current grassland tenure(extension of grassland contractorship in the whole region) | | | | | |
| Improvement of local transportation and communication | | | | | |
| Clear differentiation of the boundary of the grassland between the State-owned and the Communal and between communities | | | | | |
| Improvement of the drinking-water system | | | | | |
| Development of tourism in the local area | | | | | |
| Else (please specify) | | | | | |

E17. Please rank among the 'very helpful policies, interventions and measurement' by their abilities and desirability to help your family reduce your risk-exposure and/or impacts brought about by the risk after it occurs. Please rank at most five policies/interventions/measurements.

| Rank | ① Most desirable | ② | ③ | ④ | ⑤ Least desirable |
|----------|------------------|---|---|---|-------------------|
| Strategy | | | | | |

After talking about risks that your family or the community faces as a whole, different prevention and coping strategies, let's move to the concluding part of the interview.

E18. Do you have any suggestions or comments as for how to alleviate poverty, enhance the resilience of your family and your community to risks and develop strategies, in order to secure the long-term well-being of your family and your community as a whole?

[INTERVIEWER : Please thank the respondent for his/her time and conclude the interview]

Appendix B: Figure and Tables

Figure B- 1: The Sustainable Livelihood Framework (DFID)

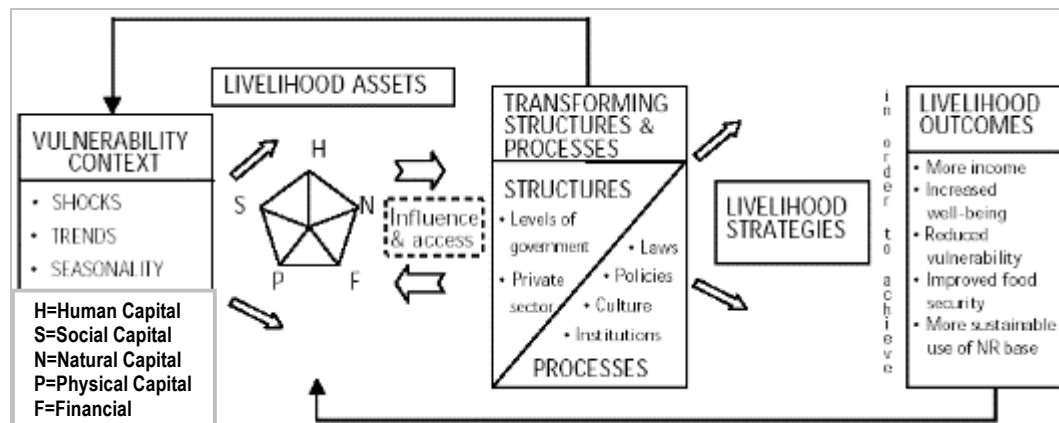


Table B- 1: Focus groups' opinion about the manifestation of a household being 'better-off'

| <i>Indicators of household well-being</i> | <i>% of responses (FGs)</i> | <i>Indicators of household well-being</i> | <i>% of responses (FGs)</i> |
|---|-----------------------------|---|-----------------------------|
| <i>Physical capital related</i> | | <i>Financial capital related</i> | |
| a beautiful house | 87.5 | ability to collect many <i>matsutake</i> | 43.8 |
| a big house | 21.9 | working for the government | 34.4 |
| a house built of stones & bricks (rather than wood) | 6.3 | self-employed business | 21.9 |
| many cattle | 81.3 | cash & deposit in bank | 15.6 |
| horse(s) | 3.1 | family member having stable wages | 12.5 |
| automobile(s) | 53.1 | diversified income sources | 9.4 |
| large crop land | 21.9 | being able to finance kids' education | 25.0 |
| expensive jewellery(ies) | 18.8 | not lacking food and clothes | 6.3 |
| clean and beautiful clothes | 15.6 | <i>Human capital related</i> | % |
| many antique | 15.6 | good health | 15.6 |
| telephone & electronic appliance | 9.4 | making beautiful handicrafts | 6.3 |
| <i>Social capital related</i> | % | skilful | 6.3 |
| having <i>guangxi</i> (external network) | 34.4 | many labourer | 6.3 |
| member serving in high-position in govnt | 15.6 | age & gender balance | 3.1 |
| a good relationship with neighbours | 15.6 | no serious or chronic illness | 3.1 |
| many extended families | 3.1 | industrious | 3.1 |
| solidarity of the family | 15.6 | resistant to natural hazards | 3.1 |

Table B- 2: Rating of the agro-pastoral production activities by the labourer, capital and skill required, profitability, stability and the degree of risk involved

| Livelihood type | Income sources | Labourers- intensity (1-5) ² | Capital- intensity (1-5) ³ | Skillfulness (1-5) ⁴ | Profitability (1-5) ⁵ | Stability (1-5) ⁶ | Riskiness (1-5) ⁷ |
|--|--|---|---------------------------------------|---------------------------------|----------------------------------|------------------------------|------------------------------|
| 1 Farming | <i>Wheat</i> | 3.5 | 2.2 | 2.1 | 2.1 | 4.1 | 2.8 |
| | <i>Barley</i> | 4.3 | 2.7 | 3.0 | 2.9 | 4.6 | 3.4 |
| | <i>Corn</i> | 3.9 | 2.8 | 2.8 | 2.8 | 4.6 | 3.1 |
| | <i>Potato</i> | 4.1 | 2.3 | 2.4 | 2.9 | 4.6 | 3.2 |
| | <i>Turnip</i> | 3.1 | 2.1 | 2.2 | 1.9 | 4.6 | 3.0 |
| | <i>Rapeseed</i> | 3.0 | 2.2 | 2.4 | 2.4 | 4.4 | 2.6 |
| | <i>Fruit</i> | 1.8 | 2.0 | 2.0 | 2.1 | 4.3 | 2.8 |
| | <i>Walnut</i> | 1.0 | 1.0 | 1.0 | 2.0 | 5.0 | 0.0 |
| Average (ex.. fruit and walnut) | | 3.6 | 2.4 | 2.5 | 2.5 | 4.5 | 3.0 |
| 2 Livestock husbandry | <i>Cattle</i> | 2.7 | 4.0 | 3.6 | 3.9 | 4.7 | 3.9 |
| | <i>Horse</i> | 1.6 | 2.5 | 2.3 | 2.6 | 4.1 | 3.0 |
| | <i>Pig</i> | 1.6 | 2.8 | 2.5 | 2.5 | 4.6 | 3.8 |
| | <i>Sheep</i> | 1.9 | 2.4 | 2.1 | 2.5 | 3.5 | 3.1 |
| | <i>Chicken</i> | 1.2 | 1.6 | 1.6 | 2.2 | 4.5 | 3.6 |
| Average (ex .chicken) | | 2.0 | 2.9 | 2.6 | 2.9 | 4.2 | 3.4 |
| 3 NTFP collection | <i>Matsutake</i> | As many as available | 1.1 | 4.5 | 4.3 | 3.5 | 3.3 |
| | <i>Caterpillar</i> | | 1.0 | 3.8 | 3.5 | 2.7 | 3.1 |
| | <i>Herbs</i> | | 0.9 | 3.0 | 2.5 | 3.1 | 2.8 |
| | Average | | 1.0 | 3.8 | 3.5 | 3.1 | 3.1 |
| 4 Sidelines jobs | <i>Transport</i> | 1.5 | 4.8 | 4.8 | 4.1 | 3.2 | 4.9 |
| | <i>Working for the govt or a factory</i> | 1.0 | 0.8 | 3.0 | 5.0 | 4.8 | 0.5 |
| | <i>Storekeeping</i> | 2.7 | 3.3 | 3.0 | 2.3 | 4.7 | 2.3 |
| | <i>Lodging services</i> | 4.0 | 4.5 | 2.5 | 3.0 | 5.0 | 2.5 |
| | <i>Trade</i> | 1.3 | 3.3 | 4.1 | 3.6 | 2.8 | 4.0 |
| | <i>Culture of mushroom</i> | 5.0 | 5.0 | 4.5 | 3.5 | 2.5 | 5.0 |
| | Average | 2.6 | 3.6 | 3.7 | 3.6 | 3.8 | 3.2 |
| | <i>Tour-guide, horse riding service</i> | 1.3 | 2.0 | 2.3 | 2.8 | 3.5 | 4.0 |
| | <i>Temporary job</i> | 1.6 | 2.2 | 3.5 | 2.8 | 3.0 | 3.7 |
| | <i>Charcoal making</i> | 4.0 | 3.0 | 2.0 | 3.0 | 3.0 | 2.0 |
| | <i>Carpentry</i> | 1.0 | 1.0 | 3.5 | 3.3 | 4.5 | 2.3 |
| | <i>Wine brewing</i> | 1.4 | 1.6 | 3.6 | 2.2 | 4.6 | 1.8 |
| | <i>Craft making</i> | 2.1 | 2.1 | 4.5 | 1.7 | 4.5 | 1.7 |
| | Average | 1.9 | 2.0 | 3.2 | 2.6 | 3.9 | 2.6 |

1. Not every hamlet adopts all of these production modes. The groups only identify these production modes when they think these modes are adopted by sufficiently many people or/and important for the community.
2. “Labourer intensity” is rated on the scale: “1” being “few labourers needed”, and “5” being “a great many labourer needed”.
3. “Capital intensity” is rated on the scale: “1” being “little capital investment required”, and “5” being “a great amount of capital investment required”.
4. “Skillfulness” is rated on the scale: “1” being “highly un-technical/almost no skill needed”, and “5” being “highly technical/having to be highly skillful”.
5. “Profitability” is rated on the scale: “1” being “highly un-profitable”, and “5” being “highly profitable”.
6. “Stability” is rated on the scale: “1” being “highly instable in the next 5 years”, and “5” being “highly stable in the next 5 years”.
7. “Riskiness” is rated on the scale: “1” being “highly un-risky”, and “5” being “highly risk”.

Table B- 3: Description of the agro-pastoral production activities by the labour, capital and skill required, profitability, stability and the risks involved

| Livelihood type | Income sources | Labourer needed | Capital investment | Skill needed | Profitability | Stability | Risks involved |
|-----------------------|----------------|--|---|--|---|--|---|
| 1 Farming | Wheat | sowing, planting, weeding, collecting manure and making fertilizer, spraying pesticide, watering, and harvesting crops | Time of labourer | Skills needed for mixing and making spray-pesticide, and insemination (drill sowing or broadcast sowing) | Self consumption, animal feed | Maybe switch to other crops in the future | Climatic variations |
| | Barley | | Time of labourer, (sometimes) agro-chemicals | | Main cattle feed, self consumption, occasionally sold for cash, gifts to others | Stable-exist with livestock husbandry | Climatic variation, pests, market price fluctuation |
| | Corn | | Time of labourer, (sometimes) purchase of seeds and mulching plastic film | | Pig feed | Stable-suitable to the climate | Climatic variation, disease |
| | Potato | | Time of labourer | | Pig feed, exchange for rice | Stable-income (or grain) source | Climatic variation, pests, disease, wildlife eating, market price of rice affecting exchange rate |
| | Turnip | | | | Cattle and pig feed | Stable-exist with animal husbandry | Climatic variation |
| | Rapeseed | | | | Time of labourer, (sometimes) seed purchase | Self consumption, gifts to others | Stable-a promising income source |
| | Fruit | watering, harvesting | Time of labourer | | Self consumption, occasional income | Stable-live for a long time | Pests and diseases |
| | Walnut | harvesting | No considerable investment needed | No particular skills needed | Self consumption occasional income | | Not many (resistant to pests and disease) |
| 2 Livestock husbandry | Cattle | feeding and milking cattle | Cattle feed, cattle purchase, (full) time of labourer | Feeding and fattening cattle, milking and helping with birth-delivery | Self consumption, income, draught force, gifts to others | Stable-traditional lifestyle production | Illness, wildlife depredation, price fluctuations, theft |
| | Horse | herding (along with cattle) | Horse feed | Helping with birth-delivery | Draught force, income source (horseback riding for tourists) | Not sure—yes if tourism is developed locally | Wildlife depredation (on colt) |

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| | | <i>Pig</i> | feeding | Purchase of piglings, feed and vet injection | Giving vet injection | self consumption, yak feed supplement (lard), occasional income | Very stable-main source of meat for self consumption | (highly infectious) diseases |
| | | <i>Sheep</i> | herding and guarding against wolves & bears | Sheep/goats purchase, time of labourer in guarding against wolves | Helping with birth, delivery, sheering | Self consumption (wool), sold for cash | Not sure—yes only if market price is high | Wildlife (wolf) depredation |
| | | <i>Chicken</i> | feeding | No considerable capital investment needed | No particular skill needed | Self consumption, occasional income | Stable in most areas | (highly infectious) disease, wildlife (weasel & hawk) depredation |
| | 3 NTFP collection | <i>Matsutake</i> | Collecting NTFP | Time of labourer | Sharp-eye sight, good physical strength, good memory, knowledge about the habit and good luck | Valuable source of income | Stable-medicinal use and the market is strong | Encountering wildlife (bears), price fluctuations, searching failure (waste of labourer) |
| | | <i>Caterpillar fungus</i> | | | | Valuable source of income (but less abundant than mat.) | | |
| | | <i>Herbs</i> | | | | Medicine, occasional income | | Encountering wildlife (bears), price fluctuation |
| | 4 Sidelines jobs | <i>Transport</i> | Driving, maintaining | Purchasing/maintaining vehicles, taxes and charges | Driving & vehicle maintenance & repair | Usually high return | Not sure—given the ever rising expenses and competition | Personal safety, seasonal availability of transport-business contract |
| | | <i>Seasonal job</i> | Individual labourers | (Sometimes) transportation and living expenses | Depending on what type of job—sometimes particular skills are needed | Highly variable (in average, medium payment) | Not sure—depending on seasons and opportunities | Difficulty in finding temporary job (a waste of time and money), subject to injury, unfulfilled payment |
| | | <i>Specialized trade</i> | | Transportation expenses (sometimes vehicles purchase and expenses on business networks) | Doing business, accounting and bargaining | Depending on the price of the commodity | Not sure-yes if market margin is high | Price fluctuations |
| | | <i>Tour-guide & horse riding services</i> | guiding, tending tourist and the horse | Horses and time of labourer | Tending horses and tourists | Relatively good return | Not sure-yes if there is market or the govnt requires so | Tourists falling down from horseback—asking for huge compensation, seasonal fluctuation of the number of tourists |
| | | <i>Working for Government or a factory</i> | Individual labourer(s) | Expenses in education or training | (mostly) high education level or specified skills | Wages are usually very high | Govt job-very stable; factor work-depends on the factor | No risk, or being laid off |

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| <i>Carpentry</i> | carpentry | Time of labourer | Carpentry skill | Medium payment | Stable—as new houses are built in every a few years | (mostly being away from home) subject to injury, unfulfilled payment |
| <i>Storekeeping</i> | managing, maintaining | Infrastructure investment, purchase of goods and commodities | Bookkeeping | Medium to high return | Very stable—there is always the need for purchasing goods and products locally | Market price fluctuations, experiencing bad-quality goods and products |
| <i>Lodging services</i> | managing, maintaining | Infrastructure investment, (sometimes) hiring labourer | Running lodging business, bookkeeping, etc | Medium to high return | Very stable—transport conditions being improved, and tourism developed in many places | Seasonal fluctuations of tourists and passengers |
| <i>Charcoal making</i> | collecting fuelwood, charcoal making | Time of labourer | Knowledge and skill of managing temperature of charcoal making | Depending on the market price (medium) | Not sure, as long as the govnt doesn't prohibit fuelwood collecting | Forest fire (and related personal safety), health damage, price fluctuations, policies prohibiting cutting trees and making charcol in winter |
| <i>Culture of mushroom</i> | collecting fuelwood, building warm-house, monitoring temperature and moisture, etc | Special warm-house, intensive care (of labourer) | Knowledge about time and temperature management in each step, very sophisticated | Not sure yet (since it is the first time trial) | Not sure—as long as it's is profitable | not sure, but very likely to experience production failure given the sophisticated skills and knowledge needed |

Appendix C: Agro-pastoral traditional productions

Despite the fact that farming and animal husbandry are labour intensive and less profitable, they were regarded as most stable in the next 5 years. In fact 94% of the focus groups would not forsake farming and livestock husbandry even if the other alternatives were more attractive. Farming and livestock husbandry were still preferred to other productions, since 1) the entry constraints to off-farm activities were usually high and required specific skills or considerable financial investment; 2) alternatives were too risky, and usually involved large variations in earnings; and 3) farming and livestock husbandry were important “tradition”—the agro-pastoral lifestyle and productions were still preferred.

The traditional farming, livestock husbandry and NTFP collection (mostly for self-consumption) were practiced to use natural resources in response to the seasonal and altitudinal natural variations. As indicated in many community maps, growing crops and collecting NTFP took place in certain months; collecting NTFP at different locations and moving livestock between winter and summer pasture, gave the natural resources time to replenish themselves (Figure B-1). When taking these into consideration, the agro-pastoral production of Zhongdian is a viable, meaningful and productive livelihood.

Figure C- 1: Community seasonal trend diagram: use-pattern of natural resources in response to seasonal and altitudinal variations

