

# **Cash Crops and Climate Shocks: Flexible Livelihoods and Food Security in Southeast Yunnan, China**

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## **Abstract**

Farmers in southeast Yunnan, China historically maintained semi-subsistence livelihoods. From the 1950s these livelihoods underwent profound changes, shifting to collectives, returning to semi-subsistence approaches, before a recent move to cash cropping, encouraged or financially supported by the Chinese state. This paper explores the impacts on Han and ethnic minority farmer livelihoods and food security of deciding to engage incash-cropping. We argue that switching to cash crops in these Sino-Vietnamese borderlands, combined with having to cope and adapt to extreme weather events is not necessarily increasing livelihood sustainability and food security. Farmers' vulnerability is rooted in specific temporal and spatial variables, interlaced with socio-cultural elements, many of which have not been acknowledged by state officials during interventions.

**Keywords:** cash crops, climate change, food security, farmers livelihoods, Southeast Yunnan

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## I. Introduction

Across the Southeast Asian Massif, the vast highlands southeast of the Himalayan Plateau shared today among eight countries, over 70 million ethnic minority individuals, as well as relatively recent migrants from lowland majority groups, are coming face to face with modernisation and global market integration (Michaud 2010). Tens of thousands of these individuals, many belonging to geographically dispersed, politically fragmented and lineage-based minority populations, reside in the Sino-Vietnamese borderlands (Turner 2010). In their attempts to build and maintain sustainable livelihoods, these farmers make use of endogenous knowledge of food systems and local agricultural limits while encountering and adapting to state-sponsored trajectories of agricultural change and market integration. These trajectories involve strong state-support for newly introduced cash crops. Concurrently, increasing food security concerns, in conjunction with land-use and land-cover changes and rising climate variability impact daily on the local dynamics of food systems for millions of individuals. Yet, very little is known about these complex interfaces.

The rural landscape in the southeast borderlands of the People's Republic of China has changed dramatically from land collectivization in the 1950s to the decollectivization reforms initiated by Deng Xiaoping in 1979. By the mid-1980s individual rural households become responsible again for their own agricultural production and food security began to improve, even within the most remote areas (Hart, Turton, and White 1992; Ho 2001; Pandey, Bhandari, and Hardy 2007; Vogel et al. 2007). To further this agrarian transition (Bernstein and Byres 2001; Lohmar 2009; Spoor 2007), in the late 1990s the central state devised the Western Development Strategy to advance its "less developed" western regions, encouraging subsidised cash crops (Goodman 2004; Grewal and Ahmed 2011). As such, in the past two decades ethnic minority and Han farmers in Yunnan's borderlands have experienced important livelihood changes via agricultural intensification, market integration, strengthening of regulations and urbanisation coupled with industrialization. These closely related transformations have had substantial social and political impacts on rural livelihoods.

Added to this complex mix of agrarian change, in recent years extreme weather events have begun to seriously affect local farmer livelihoods and well-being, as a small

number of articles are beginning to report for Yunnan and elsewhere in rural China (Fan et al. 2011; Huang 2009; Li et al. 2012; Li, Gupta, and Van Dijk 2013; Su et al. 2009; Su et al. 2012). Yet, we know little about the agro-ecological knowledge of Han and ethnic minority farmers in the Sino-Vietnamese borderlands, and to what degree extreme weather events, combined with a shift to cash cropping, are increasing farmer livelihood vulnerability and impacting food security. This is the focus of our paper, drawing on a case study in Honghe Hani-Yi Autonomous Prefecture (*Honghe Hanizu Yizu zizhizhou* 紅河哈尼族彝族自治州).

We next outline our conceptual framework incorporating key elements from sustainable livelihoods studies, vulnerability and resilience to climate shocks and food security literatures. We then focus upon the importance of cash crops and related subsidies for Han and minority nationality farmer households in Honghe prefecture, analysing the core components of their current day livelihoods. We assess how extreme weather events affect these livelihoods, and investigate the coping and adapting mechanisms farmers employ. We conclude by briefly examining state directives regarding extreme weather events in the region, and how these policies help or hinder farmer efforts to maintain viable livelihoods.

Ethnographic fieldwork for this study was undertaken in 13 villages in four townships: Lengquan (冷泉) and Xibeile (西北勒) townships in Mengzi County (蒙自縣), and Yaoshan (瑤山) and Nanxi (南溪) townships in Hekou County (河口縣), all in the southeast of Yunnan province (Figure 1). Fieldwork was completed during three months in 2011 by the first author who speaks Chinese, with the aid of a local research assistant. Sixty-three interviews were conducted to understand local livelihoods and discuss coping and adapting strategies in times of extreme weather events. Interviewees were Han, Yi, Yao, Dai, Zhuang and Hmong (Miao) farming household members, among whom one fourth were female, 18 were village chiefs, and three were off-farm workers. The majority of fieldwork villages (10 out of 13) were inhabited by Yi, Miao (mostly Hmong) and Yao minority nationalities (*shaoshu minzu* 少數民族), located in remote areas of upland Mengzi and Hekou counties. In addition, semi-structured interviews were completed with 16 local government officials by both authors in 2010 and 2011 regarding agrarian reforms, specific cultivation programmes and relief strategies developed by the government for local populations in times of

severe weather events, namely droughts, cold spells and floods.<sup>1</sup> Participant observation was used to collect data on land use, crop cultivation, water resources and management, and general village life. All names are pseudonyms.

## **II. Conceptualizing Sustainable Livelihoods, Vulnerability and Resilience to Climate Shocks and Food Security in the Yunnan Borderlands**

The sustainable livelihoods literature is particularly helpful for our focus on how farmers in these borderlands negotiate and sustain their daily lives. According to Chambers and Conway (1992:7–8), “livelihoods can be considered as sustainable if they can cope with and recover from stress and shocks, maintain or enhance capabilities and assets, provide sustainable livelihood opportunities for the next generation; and contribute net benefits to other livelihoods at the local and global levels and in the short and long-term.” The assets or “capitals” noted here, either tangible or intangible, are commonly identified as natural, physical, financial, human and social (Ellis 2000).

Briefly, natural capital refers to the environmental resource base, including land, water and trees (Bebbington 1999; Ellis 2000). Natural capital can be further divided between renewable resources, such as irrigated soils, and non-renewable resources, such as extractive resources including metals and oil (Bury 2004; Ellis 2000). Physical capital includes human-produced equipment and infrastructure, such as irrigation systems dedicated to agricultural intensification (Ellis 2000). Livestock, such as buffalo can also be considered physical capital when used to plough fields, but can also become a source of financial capital when sold. Other financial capital sources include stocks of money (savings, income or loans) (ibid.). Human capital focuses on the quality and quantity of the labour force, education, skills and health status of a population. Finally, social capital refers to the “rules, norms, obligations, reciprocity and trust embedded in social relations, social structures and society’s institutional arrangements, which

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1. Quantitative analyses were conducted to reveal extremes in precipitation and temperature data at yearly, monthly and daily periods from 1973 to 2011 and specific events in 2010 and 2011. While our quantitative results forms the basis of a different article, they supported farmer comments regarding the increased variability and more frequent occurrence of droughts, floods and cold spells.

enable its members to achieve their individual and community objectives” (Narayan-Parker and Pritchett 1997:50).<sup>2</sup> The sustainable livelihoods approach suggests that these capitals are mediated by social, economic and political power relations among actors and may be exposed to external shocks and trends that constitute a households’ vulnerability (de Haan and Zoomers 2005; DfID 2002; Ellis 2000). As Rigg notes (2007:92) “individual livelihoods are always shifting and dynamic, never still. Floods and droughts are the more obvious forces of livelihood change along with tsunami, war and economic reforms”.

Strategies to gain sustainable livelihoods and food security in the Global South frequently need to adapt to climate variability, as individual farmers and households cope with shocks, changes in weather trends and new patterns in seasonality. This adaptation often occurs through livelihood diversification, notably “distress” diversification for survival. Less frequent, in the context of extreme weather events, are “progressive” diversification routes, voluntary strategies to increase economic expansion (Bouahom, Douangsavanh, and Rigg 2004). How people react to climate shocks with regard to food security can also be very specific temporally. In the short term, people respond in precise ways to cope with immediate or short-term declines in access to food. Over the long term, they might adapt using quite different strategies to attempt to improve food security (Davies et al. 2009). Moreover, specific events create different scenarios. Short-term and sudden events with fast onset rates, such as cold spells and floods, trigger more distress diversification, while slow rates of onset events, such as prolonged droughts, can make way for longer-term progressive diversification (Cutter et al. 2008).

Literature on livelihood vulnerability and resilience to climate shocks also informs this study. Vulnerability refers to the degree to which a system is susceptible to damage

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2. We differentiate between three types of social capital: bonding social capital involves an individual's closed network of relatives and friends with networks within a homogeneous group. Bridging social capital includes extended opportunities that bridge different communities, yet still within relatively homogeneous socio-economic conditions. Linking social capital refers to ties between different economic classes and those of different social status that allow individuals to lever themselves to gain better access to resources and further economic development. Negative aspects to social capital also exist, including “the exclusion of outsiders, excess claims on group members, restrictions on individual freedoms, and downward levelling norms” (Hawkins and Maurer 2010; Portes and Landolt 2000:532; Putnam 2001; Turner and Nguyen 2005; Woolcock and Narayan 2000).

caused by a crisis, while resilience pertains to the degree to which a system is able to overcome such damage (Olmos 2001). Within the literature on natural hazards, Manyena (2006) argues that resilience may be seen as the outcome of an event. Resilience is thus considered as reactive, occurring after the disturbance occurred. More specifically, Cutter et al. (2008) see resilience as a continuous learning process involving better decision-making and a higher capacity to handle disasters. Cutter et al. refer to vulnerability and resilience as pre- and post-event or non-crisis and crisis-time respectively, adding a dynamic and temporal dimension (ibid.). In this sense, resilience may be seen as a continuous process, while vulnerability may be seen as both the antecedent conditions and the outcome of this on-going resilience (ibid.). Therefore, the more resilient a household or a community is, the less vulnerable it is.

As achieving food security is part of one's livelihood outcomes, it is consequently part of the dynamic context and the long-term flexibility embedded in sustainable livelihood strategies (Capaldo et al. 2010; Rigg 2006; Scaramozzino 2006). Food security was defined at the 1996 World Food Summit, as "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Barrett 2010:825). Four commonly cited dimensions of food security are food availability, economic and physical access to food, food utilization and the stability of these three dimensions over time (Lovendal 2004; Schmidhuber and Tubiello 2007). We argue that natural, physical, human, social and financial capitals are all intertwined with food access, production and distribution. A recent FAO (Food and Agriculture Organization of the United Nations) annual report on global food insecurity recommends the adoption of a holistic approach to livelihood strategies, vulnerability, and the causes and consequences of food insecurity (FAO 2012). This is mirrored in our conceptual approach.

### **III. Contextualizing Rural Livelihoods in Honghe Prefecture, Yunnan**

Yunnan province, located in southwest China (Figure 1), is a landlocked province sharing international borders with Burma, Laos and Vietnam. Ninety-four per cent of

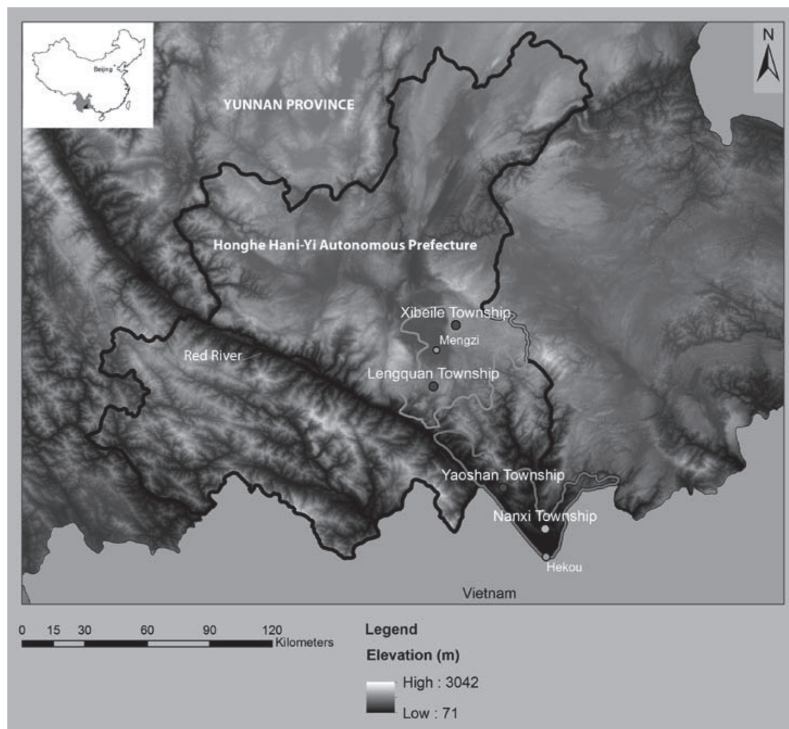


Figure 1 The Four Townships Where Fieldwork was Undertaken, Honghe Prefecture, Yunnan

Source: Authors.

its landscape is mountainous. Yunnan has 16 prefectures with the southeast prefecture of Honghe, located on the Vietnam border, being the site for our fieldwork.<sup>3</sup> Within the prefecture, we focused on Mengzi City and Hekou County because these are upland regions with a diversity of Han and ethnic minorities recently affected by extreme weather events.<sup>4</sup>

Honghe prefecture's population of 4.1 million is composed of a diversity of minority nationality groups, of whom the most numerous are 973,000 Yi, 274,000 Miao, 99,000 Zhuang, 98,000 Dai and 77,000 Yao; as well as 1.8 million Han (China

3. China's hierarchical administrative units operate from the central to the provincial, prefecture, county/city, township and village committee levels.

4. To avoid confusion between rural and urban areas, we refer to Mengzi City's administrative zone as "Mengzi County," because Mengzi is both the capital city of Honghe prefecture and one of Honghe prefecture's counties.

Data Online 2000). Our interviewees were from each of these groups. As Michaud, Turner and Roche (2002) state, the complex topography found in the Southeast Asian Massif, as well as this specific political locale on an international border, has had important roles in shaping the livelihoods of rural inhabitants living here. While Han and Zhuang farmers we interviewed live in the lowlands of Honghe prefecture, Yi, Hmong and Yao are located in the prefecture's uplands. Uplanders arrived from northern parts of China several centuries ago (Michaud 2006), while Han and Zhuang lowlanders migrated from the coastal provinces in more recent centuries, attracted by abundant natural resources in the western provinces.

## **IV. Results**

### **A. Agrarian Transition: From Subsistence to Cash Crops**

Situated within the broader agrarian transition sweeping across mainland Asia, important land use changes are occurring in the four rural townships studied here (Bernstein and Byres, 2001; Hart, Turton, and White 1992; Rigg 2001). We find that livelihoods are being drastically altered as farmers increasingly move from subsistence and semi-subsistence agriculture to cash crop production. Across southeast Yunnan, this process began with rubber and banana crops in the late 1980s and tobacco crops in the late 1990s.

It is worth noting that after 1980, when the provincial government started to provide incentives for farmers to switch to cash crops, Honghe prefecture saw a 40 per cent decline in food crop production, specifically between 1997 and 2001. This was paralleled by a 12 per cent increase in cash crop production (Honghe Yearbooks 1998-2002). With the aim of improving rural development and reinforcing agricultural industrialization, most drivers to switch to cash crops involved financial incentives (Du, Sun, and Fang 2011). These included subsidies to purchase agricultural inputs, for instance to grow apples, walnuts, sugarcane, bananas, rubber, watermelon, or mulberry trees for silk production. Subsidies were also provided to build water reservoirs near agricultural land and homes, and curing barns for tobacco. Subsidies were also available for opening up new areas of land and price protection. These incentives continue to facilitate farmers' access to financial capital and provide new livelihood opportunities.

In return for these multiple subsidies, farmers are required to use certain fertilizers and pesticides to guarantee a minimum quality set by state companies purchasing their crops. Among farmers who succeed in growing state-sponsored cash crops, some have also started to diversify their cash crops portfolio by engaging in non-state sponsored cash crops such as potato, soybean, pomegranate, peach, and lily flowers, for which farmers must take care of purchasing inputs and finding buyers.

The agricultural practices that are visible today in Honghe prefecture and the initial dates of cash cropping conversion vary among our four field sites (Table 1). Of the 63 farming households interviewed, only four (two Yao, one Yi and one Han) reported subsistence farming to be their sole livelihood strategy in 2011, with rice and maize being their staple crop only. All four have very limited access to arable land, from as little as 0.2 to 10 *mu* (亩) per household (0.01 to 0.6 hectares), and are located in upland areas where irrigation is difficult.<sup>5</sup> Of the remaining 59 households, over two-thirds engage in state-sponsored cash crop cultivation, among which half also undertake *non*-state-sponsored cash crops to diversify their income. The other third engage in *non*-state sponsored cash crops only. All cash crop farmers tend to keep a small plot of land near their house to cultivate food crops for household consumption.

Table 1 Changes in Agricultural Practices Over the Past 20 Years in Honghe Prefecture

Field sites		Subsistence crops		Cash crops	
		1990-2000	2000-2011	1990-2000	2000-2011
Hekou County	Nanxi (early 90s)*	paddy rice, maize	vegetables, maize, paddy rice in small amounts, vegetables	pineapple, banana in small amounts	banana, rubber, watermelon
	Yaoshan (late 90s)*	paddy rice, maize	Maize, vegetables	pineapple, banana in small amounts	banana, rubber, watermelon
Mengzi City	Lenguan (1998)*	paddy rice & upland dry rice, maize, buckwheat	potato, maize, dry rice, some vegetables	none	tobacco, sericulture, sugarcane, walnut
	Xibeile (2007)*	upland dry rice, maize	potato, maize, upland dry rice, some vegetables	none	tobacco, apple, walnut

\*Dates below each township refer to the years cash crops were first introduced in the area.

5. Average land area per capita ranges from 1.95 *mu* to 2.14 *mu* in the four townships (0.13 ha to 0.14 ha).

Across our field sites, cash crops were initially introduced to Nanxi Township, in Hekou County. Located at a far lower elevation (130 to 260 meters) than the three other townships, Han, Zhuang, and Hmong households in Nanxi contend with a very humid climate. Before the early 1990s, all farming households in Nanxi grew paddy rice, maize and vegetables as well as upland dry rice in mountainous areas, while wild edible herbs and medicinal herbs were gathered in the forest by Hmong as part of their diet. In the early 1990s, pineapples, rubber trees, cedar trees and banana plants were introduced on a small scale. Today, all households in the township grow bananas, a few also cultivate rubber, while most still cultivate maize for food and livestock feed, along with vegetables for subsistence. However, watermelon cultivation in greenhouses promises higher profits than bananas, and local farmers suggested that watermelon will soon replace bananas as the dominant cash crop, despite watermelon cultivation being more labour intensive.

Also in Hekou County, the remote township of Yaoshan lies at altitudes ranging from 426 to 1,246 meters above sea level. Here, Yao farmers have converted from growing paddy rice and maize for subsistence purposes, to cash crops of pineapples and rubber, introduced by the local government since the late 1990s, ten years after Nanxi. Over time, banana plants -- highly water-reliant, especially in the early stage of growth -- have replaced almost all drought-resistant pineapple crops due to higher profit potential. Today, a few households still grow paddy rice while almost all continue to cultivate maize for subsistence and livestock feed.

Further to the north, in the late 1990s Yi, Hmong and Han farmers in Lengquan Township (1,630 to 1,766 meters) cultivated maize, upland dry rice, garden peas and buckwheat. Now replacing some of these food crops are state-sponsored cash crops including tobacco, mulberry trees and sugarcane, initiated in 1998, 2002 and 2009 respectively. In the mountainous township of Xibeile (1,800 to 2,400 meters), Yi farmers used to cultivate upland dry rice and maize as subsistence crops. It is only in 2007 that Xibeile's local government introduced tobacco, apples, and later walnuts, as cash crops, likely due to its remote location from information and supply sources. While the majority of households in Xibeile and Lengquan still cultivate maize and a small number continue to grow upland dry rice, most now grow tobacco as their main cash crop.

In sum, the switch to cash cropping first occurred in these borderlands in the early 1990s, starting in the most accessible, lowland areas of Nanxi, where Zhuang and Han farmers dwell. Yaoshan and Lengquan townships, located in the uplands and inhabited by Yao and Yi farmers respectively, only saw cash crops introduced in the late 1990s. Recently these two townships have been connected to the Kunming-Hanoi expressway, which now facilitates wider accessibility to markets. In the more remote and financially poorer upland township of Xibeile, Yi farmers were only introduced to cash crops in 2007. Thus, although all four townships are situated within the same prefecture, temporal gaps in switching to cash crops are evident.

Government officials explained that the specific cash crops supported by local governments have varied over time for three reasons: first, local officials have been informed of new opportunities by provincial-level officials at different times; second, different climate conditions led to some crops being more successful than others, and third, due to the degree of farmer willingness to try a new crop, face pest problems, find input needs, and cope with pure trial and error. The distance between farmers' villages and the closest township -- where the local government providing these subsidies and extension services is located -- also influences access to cash cropping opportunities. This highlights that access to physical, financial and human capitals, forms a core part of local livelihood equations.

## **B. Cash Crop Impacts on Livelihood Capitals**

Local officials were emphatic that switching from subsistence or semi-subsistence farming to cash cropping is synonymous with becoming involved in intensive or "conventional" agriculture, leading to higher production yields per hectare, greater financial profits and more sustainable livelihoods for farmers. However positive this may appear at first glance, interviews with farmers revealed that this switch creates both positive and negative impacts on capital portfolios at the household and village levels, in turn affecting livelihood vulnerabilities.

At the household level the immediate impacts of cash crop expansion on natural capital appear to be positive, due to government grants to improve access to water and land resources. In Lengquan, farmers Ms. Xiao and Mr. Hu explained that their

new water reservoirs are far superior than having to walk back and forth to the lake or pond of the main village to collect water in buckets. However, over a longer time frame, farmers and local governments have begun to observe and experience the negative impacts of over-exploiting local ecosystems, resulting in land and water resource degradation, as noted by Mr. Sheng, an official from Nanxi: “the main factor that dried the water sources is the vegetation and forest destruction that is quite serious here.” Concurrently, the physical capital of many households has increased due to cash flows from cash crop sales. For some this has meant new agricultural implements, improvements to homes and the purchase of motorcycles. However not all households have been able to reach this level of consumption, and others remain focused on more immediate needs such as food, cooking oil and covering emergency health costs.

When switching to cash crop cultivation, farmers have a guaranteed purchaser of their tobacco, silk, sugarcane or rubber -- the state-owned company, which constitutes a reliable source of income if farmers grow the crops according to the company’s requirements. Yet to reach this stage, farmers cannot rely on state subsidies alone; they must also make private investments, impacting on household levels of financial capital. First, as noted above, farmers must not only invest in agricultural inputs, but also need to buy the food they no longer cultivate. Second, the funds for initial cash-crop conversions come from either high interest rate loans (six to nine per cent) from the Rural Credit Cooperative, or interest-free rate loans from local governments or the Women’s Federation. Frequently, farmers become trapped in a cycle of rotating debt, so much so that by the second year, they take out a new loan to pay back the initial one. As Mr. Yu, a farmer from Nanxi Town, investing in banana plants explained: “To pay back the loan, I borrow more money from friends or from the bank. Every year since 2003, I deal with reimbursement this way.” Therefore, as farmers depend on a successful harvest as their main source of income and for food security, they are more vulnerable to crop failures and to market instability. Third, regardless of state-subsidies, the high initial investments for agricultural inputs mean that farmers usually invest in only one cash crop at a time, two at most, thus considerably reducing their agricultural diversity and livelihood options and increasing their vulnerability to climate shocks. Mr. Tang, a Zhuang farmer from Nanxi explained: “Everyone shouldn’t get together to grow one same crop, because if everyone grows the same crops together, they will lose together, so it’s not good.”

Turning to human capital, at the village level, cash crops have encouraged farmers to invest in further agricultural expansion. To do so, some farmers have taken up off-farm employment, because of the financial capital required for agricultural inputs and to purchase food they no longer grow. In some locales, this need for financial capital is causing out-migration of younger workers, leaving the elderly alone to take care of households, crops and often grandchildren. On the farm, cash crops have allowed access to new skills, but have also diminished the intergenerational transfer of traditional ecological knowledge. Increased access to financial capital has also indirectly increased levels of education for the next generation, with many farmer parents gradually able to afford school education and accommodation in nearby cities for their children. It is yet unknown if more educated generations will decide to stay in rural areas and develop their parents' cash crop cultivation further or if they will prefer to migrate to urban areas, further fuelling China's urbanization.

Investing in cash crops requires that a farming household has initially heard of the given opportunity through social networks from friends and relatives (bonding social capital) or from local authorities (bridging and linking social capital). We find that engaging in cash cropping reinforces social ties among farmers as they not only share their respective experiences regarding cultivation techniques, government subsidies and company expectations, but they also ask each other to be guarantors for loans or borrow money from each other. While social networks were previously organised around family, ethnicity, common traditions and farmers' collectives, the recent switch to cash crops has extended networks to local authorities. Nonetheless, switching to cash cropping also highlights the potential dark side of social capital (Portes and Landolt 2000). Farmers living in isolated, remote areas, with few social ties beyond immediate family, are now relatively excluded from these new livelihood options. Furthermore, farmers with whom we talked who have low levels of social capital have tended to fail when switching to cash crops, lacking social ties or trust to share knowledge and resources with other farmers.

All told, for farmers already able to access a moderate degree of financial, human and social capitals, switching to cash crops has increased their access to all five capital forms. However, for farmers who did not begin with viable access to these capitals, switching to cash crops often triggers a loss of financial capital, through a cycle of

rotating debt. From our four field sites, Nanxi farmers, mainly Han and Zhuang, have the best initial access, due to their close proximity to the local government for information and supplies. In contrast, farmers from the other three townships have to trade-off access to different types of capitals in order to successfully maintain livelihood resilience. These farmers are most often ethnic minorities, located in remote mountain areas, far from the government offices that organize cash cropping schemes. Government institutions therefore mediate access to cash crops subsidies, influencing rural livelihood outcomes, such as farmers' vulnerability, food security and overall well-being.

### C. Impacts of Extreme Weather Events on Honghe's Rural Livelihoods

On top of the increased vulnerability being experienced by many farmers due to switching to cash cropping, these households are increasingly affected by extreme weather events, putting their resilience to the test and increasing vulnerability.<sup>6</sup> These weather events hinder farmers' access to different capitals that help comprise a sustainable livelihood and oftentimes reduce food security. A focus on droughts, cold spells and floods reveals the degree to which farmers have become vulnerable to climate variability in recent years. For all three types of events, limited food stocks cause price increases in local markets, as Ms. Cui, a farmer selling potatoes in Mengzi market explained, "during the 2010 drought, half a kilogram of potatoes sold for RMB2-3 (USD 0.31-0.47), this year [2011] it's worth a few *mao* (毛) (USD 0.016 cent)."

#### 1. Drought Impacts

A severe drought impacted many regions of Yunnan in 2010 (Chen, S. 2010; china.org.cn 2010; Chen, H. 2010; InKunming.com 2010; Porter 2010). Farmer interviewees reported four specific direct impacts from resultant water shortages, namely lower yields or the death of cash crops, as well as crops for household consumption, a decline in the health of livestock, and a lack of water for domestic use (Figure 2). As Mr. Xie, a Yao farmer in Yaoshan lamented: "In the past, before 2010, there was some extreme temperature and drought, but the impacts were not so serious."

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6. Although we focus on climate variability impacts, we acknowledge that farmers' livelihoods may be affected by other external pressures and shocks, such as population pressure, land holding size due to inheritance patterns, or land appropriated for state infrastructure projects.

A lack of rainfall and abnormally high temperatures lasted for seven consecutive months during the 2009-2010 drought, resulting in reduced crop yields. As crops are mostly rain fed in this region, both subsistence and cash crops planted between August and April, including maize, rice, lily flower, soybean, tobacco in Mengzi and banana plants in Hekou, were negatively affected. In Lengquan, Hmong farmer Mr. Kim reported, “during the 2010 drought, all maize and upland dry rice crops died and we had to buy rice to eat.” Not being able to harvest their own household food crops reduced farmers’ ability to stay food-secure until the following harvest season. Subsistence farmers now needing to buy food because their crops had withered, also faced inflated food prices due to lower local supplies, further increasing difficulties to access food.

While a reduction in food crop yields for household consumption posed direct threats to food availability, reduced cash crops considerably lowered financial capital, resulting in overall unstable access to food. Mr. Hu in Lengquan, who plants lily flowers from August to December, harvesting them the following June, lost 70 per cent of his planned harvest and income and could only just feed his family. In Yaoshan, Yao farmer Mr. Ding explained that young rubber trees in his village were severely affected by the drought during the trees’ growth years before the first possible harvest, reducing the amount of rubber to tap. Likewise, in Nanxi, banana plants were badly affected.

In addition to soil moisture deficit, farmers in Lengquan reported that water supplies usually dedicated to livestock were insufficient, increasing the loss of

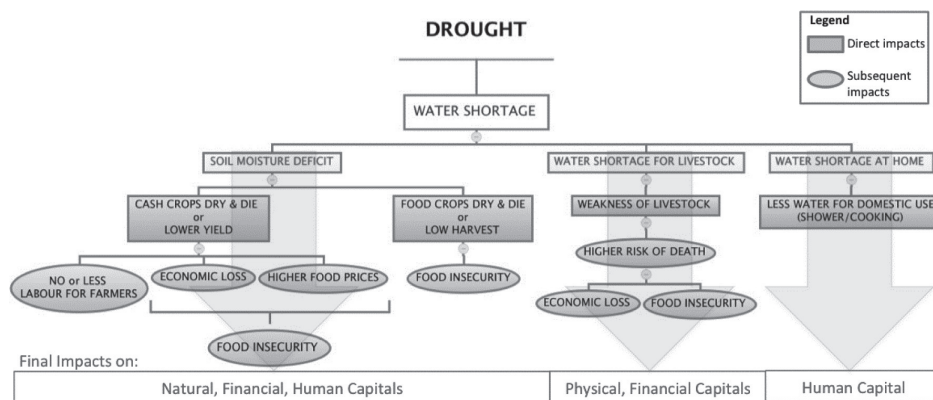


Figure 2 Direct and Subsequent Impacts from Drought in Honghe Prefecture, as Explained by Interviewee Farmers

Source: Authors.

livestock, a physical and financial livelihood asset. Moreover, farmers from Yaoshan explained that in some villages, water stress was not only experienced with regards to farming activities, but also for daily household needs. Indeed, individual household water reservoirs that store water for daily use, do not hold enough water for seven dry consecutive months. In sum, prolonged drought conditions experienced by Honghe prefecture farmers in 2010 reduced access to four of the five livelihood capitals (Figure 2) while undermining access to food.

## **2. Cold Spell Impacts**

Farmers in Hekou County reported that since 2008 low temperatures and cold spells have become far more of a concern for agriculture, causing reduced crop yields or totally destroying crops. Mr. Hu from Lengquan, reported that the cold spell of 2010 killed one of his two batches of silkworm he had been raising, worth RMB 2,000 (USD 315) in 2011, but spared his lilies as it was not during their growing season. In Yaoshan, Yao farmer Mr. Pang explained that in 2010, instead of normal winter weather patterns from November through February, the cold weather lasted until April. This prolonged winter prevented many farmers from harvesting bananas as crops had died. Mr. Pang explained: “because banana plants are a tropical crop, they do not tolerate extreme cold, snow or frost; they just die.” In Nanxi, impacts from cold temperature were also felt, even in low elevation areas, such as in Maduoyi village (131 meters above sea level). In 2011, the unusual cold temperature hit rubber plantations located around the village, so much so that “most of the trees froze to death.”

In short, like drought events, periods marked by low temperature directly impact farmers' livelihoods, especially at the household level. Cold spells reduce crop yields or kill crops completely, resulting in uncertain access to food via direct consumption or profits. Although cold spells impacted Yi, Miao, Yao, Han and Zhuang farmers equally, location is an important factor. Located at a higher elevation, one would assume that farmers in Mengzi County would bear more of the brunt from cold spells than those living in the lower elevated county of Hekou, however we found the opposite, as farmers at lower elevations had turned more completely to cash crops. The fact that farmers cultivating bananas in Hekou County were the most affected by the cold spell may reveal that banana plants may no longer be suitable for the supposedly tropical climate of the area due to changes in local weather patterns.

### 3. Flood Impacts

Within Honghe prefecture, farming location plays a role in the shape and magnitude of impacts from flood events. Not surprisingly, crops grown near rivers are impacted by river floods (*hongshui* 洪水), while mountain torrents (*shanhong* 山洪) can destroy crops at the foot of a mountain or in a valley, as well as causing landslides. Mr. Shao, a Zhuang farmer living in Nanxi explained: “In July 2011, the Maduoyi river rose and flooded our entire greenhouse. It affected the growth of watermelon, we lost about RMB 6,000 (USD 950).” “In Hekou county’s mountainous area, during summer 2007, Nanxi’s Gehua village was hit by ‘heavy rain, which triggered landslides. Farmland was buried under the landslide and the mud, and the houses stricken by cracks and fissures, still visible today,’ explained Mr. Cao, a Dai farmer.”

Floods reduce farmers’ access to natural capital, putting their land out of use and destroying crops, while also decreasing access to physical capital like roads and houses that are damaged or destroyed. Mr. Tang, a Zhuang farmer living in another village in Nanxi Township, recalled heavy precipitation in 2008 that “flooded the cement road, water kept flowing from the top of the mountain down to the road and below,” blocking access to Hekou city. Impassable roads mean farmers from remote villages are stranded, losing opportunities to sell their cash crops (if not destroyed) at markets.

Overall, farmers reported that extreme weather events have been increasing over the past decade in both severity and variety. Impacts from drought were the main concern for farmers living in Mengzi County, while farmers in Hekou County were equally concerned with drought, cold spells and floods, revealing Hekou’s vulnerable environment to climate shocks. The fast rate of onset of cold spells and floods means their impacts are far more sudden than a drought. Economic losses due to reduced crop yield or destroyed crops manifest immediately and trigger unstable access to food. In addition to crop yield reduction, flooding events also trigger broader impacts, including destruction of public infrastructure. Therefore, location, farming activity, as well as timing of an event influence farmers’ vulnerability to climate shocks, but also their ability to cope and adapt to these shocks -- analysed next.

## D. Farmer Livelihood Coping and Adapting Strategies

### 1. Coping Strategies

In the face of extreme weather events, coping is synonymous with surviving, saving resources and minimising losses (Morton 2007). The ability of farmers to implement a range of coping strategies when faced with extreme weather events differs across locations, ethnicities, and the extent to which farmers are semi-subsistence or cash-cropping. Figures 3 and 4 outline the numerous coping and adapting strategies utilised by interviewed farmers in the wake of drought, floods and cold spells.

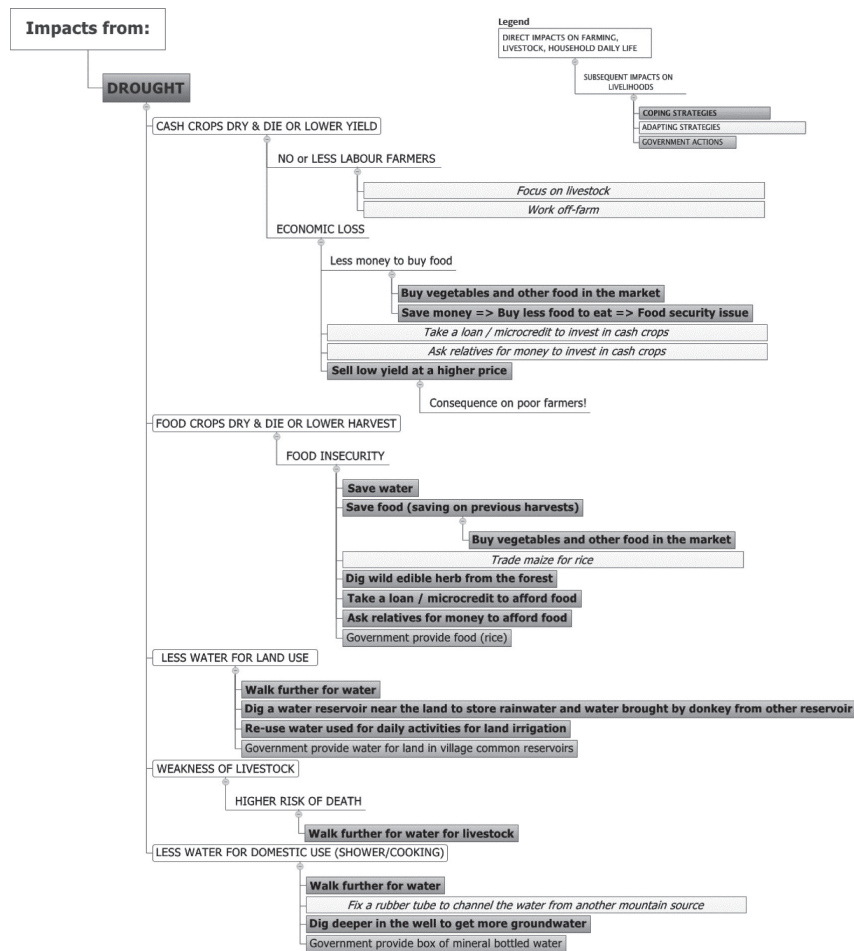


Figure 3 Farmers' Coping and Adapting Strategies When Facing Drought

Source: Authors.

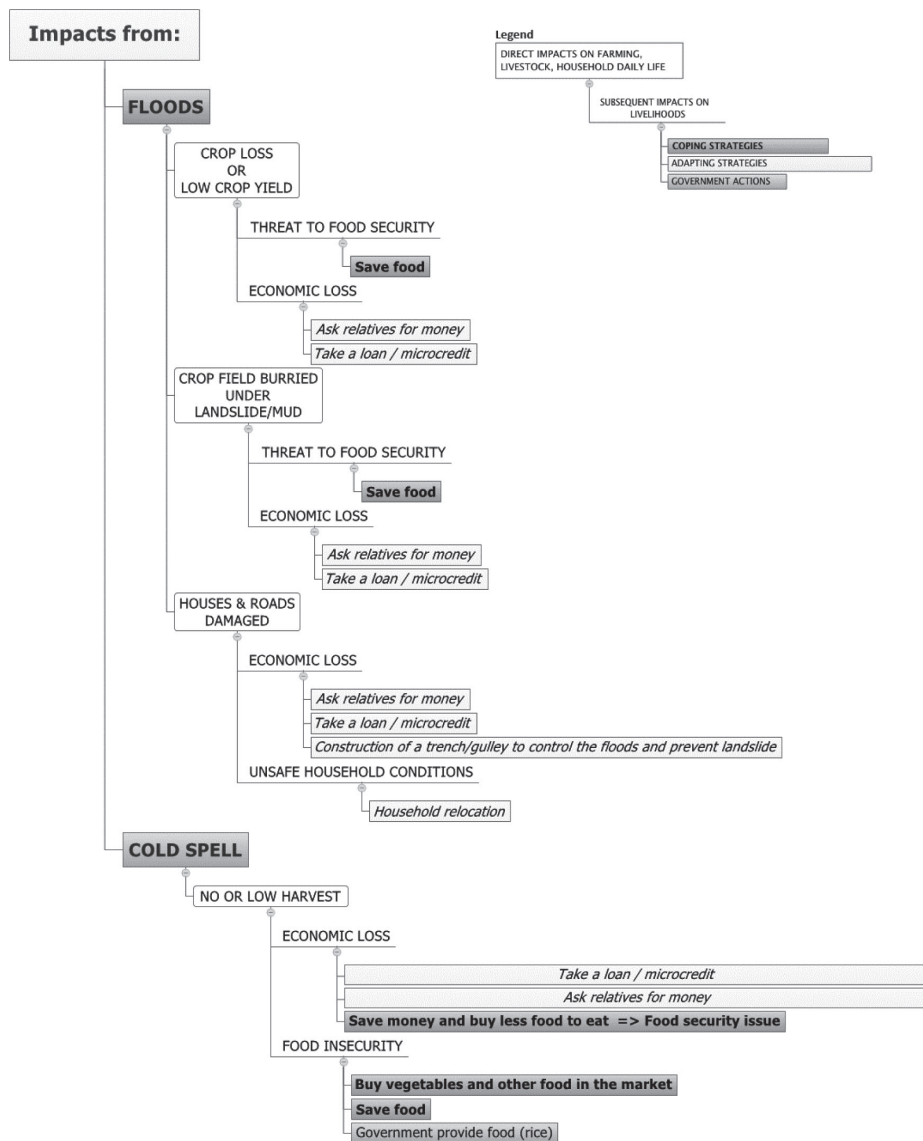


Figure 4 Farmers' Coping and Adapting Strategies When Facing Floods and Cold Spells

Source: Authors.

When facing water shortages, the first coping strategy all farmers reported was to save and re-use water. As Mr. Ping, a Yi farmer from mountainous Xibeile explained “during the drought, the government provided water, but it was not enough, so we still had to save and re-use water to have enough at home and for livestock.” Also in Xibeile

Township, farmers from Taqikou Village complained that there was nothing to do but focus on livestock; saving water was their main concern to minimise livestock deaths. As a second coping strategy regarding water shortages, farmers from Lengquan, Xibeile and Yaoshan walked further to collect water carried on a donkey or in a buffalo cart. In 2010, Mr. Mu, a Yi farmer from Lengquan saw farmers from five nearby villages come to his village to collect water from the only reservoir that had water remaining of the usual four reservoirs in the surrounding area. In order to fulfil these coping strategies, farmers make use of their physical and human capital, and while competing access to a scarce resource can create conflicts, farmers asserted that this had not occurred, potentially revealing the close ties and positive bonding social capital among nearby communities.

As noted earlier, both drought and cold spells can reduce food security triggering a threat to farmers' sustainable livelihoods. Farmers must purchase food that they no longer cultivate and rely on income to do so. Oftentimes, these farmers reported having to cut back on food, complaining that food relief provided by their local government was insufficient. Alternatively, during the 2009-2010 drought semi-subsistence farmers like Mr Lin, a Yao farmer from Pojiao village in Yaoshan Township who still cultivates household food crops, were able to rely on stocks from previous harvests. Others turned to sharing food stocks, such as farmers from the same community in Lengquan.

Farmers also use their indigenous knowledge to find wild edible herbs in the forest to compensate for food shortages. In Xibeile, a Yi farmer selling apples and garden peas at the local market explained that his family collects wild edible herbs from the mountains to replace vegetables that they cannot cultivate because of the mountainous land. Yi, Hmong and Yao farmers in the remote village of Lengquan, Xibeile and Yaoshan, all reported doing likewise when faced with prolonged drought and/or cold spells. Other farmers -- usually Han and Zhuang cash crop farmers located closer to township villages -- access bank or microcredit loans, or use savings to purchase food. Hence, when faced with food shortages, semi-subsistence ethnic minority farmers in remote areas often turned to saved food stocks and forest plants, while farmers who only grew cash crops and who lived close to government centres relied on financial avenues. These strategies reveal clear distinctions in access to different resources between upland dwelling minority nationalities and Han and Zhuang farmers.

Since one of the outcomes of any natural disaster is an increase in commodity prices as supplies run short, this can have positive and negative impacts on cash-cropping farmers. During and after the 2009-2010 drought, cash crop farmers from Mengzi and Hekou who had sufficient harvest reported earning equal or greater profits, receiving higher prices for their crops than during a year without extreme weather events. Others who experienced reduced crop harvests had to rely on other sources of income. Alternatively, farmers sometimes benefitted from remittances from children working in the city during these crisis periods. In addition, with maize being a relatively low water-reliant crop and the main feed for livestock, semi-subsistence farmers raising pigs could rely on income from selling livestock. These farmers thus prioritised providing feed and water, ensuring that animals could be sold at a reasonable price to offset losses incurred by the death of other cash crops. Selling crops at a higher price, receiving remittances and focusing on livestock to offset farmers' economic losses on a short-term basis were the three most commonly implemented coping strategies to deal with extreme weather-induced economic loss.

## **2. Adapting Strategies**

In addition to coping on the short-term, adapting to extreme weather events is vital to sustaining farmers' livelihoods, maintaining food security and reinforcing resilience to climate extremes (Morton 2007). In this borderland region we find that farmers' adapting strategies (Figures 3 and 4) are characterised by livelihood diversification that varies according to local context and takes the form of self-originating or state-supported strategies. The former are decisions taken by households themselves such as income diversification, while the latter are implemented with institutional help, such as structural improvements (World Bank 2010).

In terms of self-originating adaptations, during the drought of 2009-2010, some farmers we interviewed decided to work off-farm. In Yaoshan Township's Pojiao village, the village chief Mr. Lin explained: "Forty people went to work off-farm in Hekou city and other nearby cities, such as Mengzi" representing 22 per cent of the local labour force. Working off-farm allowed farmers to gain crucial financial income to provide food for their households. Over time, this access to funds also increased natural, physical and human capitals for farmers who were able to invest in replanting their crops and pay for other expenses, such as a motorbike or education for children.

Another self-originating adaptation was observed in Nanxi Town, where banana growers decided to change crops to overcome excessive price fluctuations. In 2011, farmers complained that in the previous five years, banana crops had suffered from drought, cold spells and landslides, resulting in prices oscillating wildly. Mr. Tang, a Zhuang banana grower in Nanxi explained “the price of bananas is not stable, today I can sell half a kilogram for RMB 2 (USD 0.31) but tomorrow for only RMB 0.2 (USD 0.03)!” He further noted “I am gradually converting all my banana plots to greenhouses to grow watermelons, introduced with subsidies by the local government, because the price is more stable and they are not as vulnerable to climate as banana plants.”<sup>7</sup> Mr. Tang’s decision highlights that while borrowing money is an immediate coping strategy to cover food shortages, it is also an adaptive strategy. Often, drawing on bonding social capital, farmers like Mr. Tang borrow money through informal channels to contribute to building higher resilience to climate shocks through purchasing better building and irrigation infrastructure and agricultural inputs.

State-organised adaptive strategies also vary. When borrowing money from relatives is not possible, farmers turn to a bank or other formal institutions that can provide microcredit or loans, such as the Women’s Federation or the Rural Credit Cooperative. Although the Women’s Federation offers interest-free loans, farmers and government officials alike explained that these are only granted to farmers undertaking agricultural entrepreneurial projects. As explained above, Han and Zhuang officials from local governments in Mengzi and Hekou counties noted that interest rates for microcredit offered by the Rural Credit Cooperatives are very high. Another type of loan distributed by the Rural Credit Cooperative comes in the form of poverty alleviation loans, which carry a two per cent interest rate, yet none of the farmers interviewed had gained access to these. Instead, most Han farmers relied on high interest rate loans, which -- as also occurred when they accessed such loans to invest in cash cropping -- resulted in farmers entering a cycle of rotating debt.

Other state-organised adaptive strategies were more functional. In one village in Yaoshan Township, located in a high-risk area for landslides and mud-rock flows, the

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7. Experimenting with new crops with shorter seasons as an adapting strategy is also occurring across the border in Ha Giang Province, Vietnam, where upland communities were impacted by the same lingering drought (World Bank 2010).

rainy season oftentimes creates a violent mountain torrent damaging fields and houses. In 2011, the village chief, Mr He, took the initiative to dig a gully with the help of villagers, to regulate the flow of future surges and prevent heavy rains from triggering landslides. Structural improvements were also implemented during the 2009-2010 drought in the same village; as water reservoirs supplying the village went dry, villagers set up a rubber tube to divert water from a mountain spring.

As these examples show, farmers' coping and adapting strategies vary according to the type of event, farmers' livelihood options as well as their location and culturally-rooted ecological knowledge. Droughts, flooding and landslides result in both coping and adapting strategies, while cold spells, due to their immediate impacts, only result in coping strategies. The more remote farmers are -- such as minority nationality farmers in Lengquan, Xibeile and Yaoshan townships -- the more likely they are to cope and/or adapt on their own and the more ingenious their strategies. In contrast, Han and Zhuang farmers close to Nanxi Town have more "room for manoeuvre," with greater access to government support. These farmers tended to develop fewer coping/adapting strategies of their own, relying on the government's relief operations.

## **E. Government Relief Operations**

Turning from farmer responses to those of the state, disaster relief operations during the 2009-2010 drought consisted of both short-term help and long-term infrastructural improvements. In Lengquan, the local government's head, Mr. Ji, explained that it was of utmost importance to ensure that there was enough person-power to deliver material resources, such as water and food in the villages most affected by water shortages. Specific drought relief funds were distributed to disabled farmers and the poorest households. Xibeile's government also received goods donated by private companies and redistributed them within villages. Alongside providing food, water and material resources, the local government of Xibeile also encouraged farmers to save water. Mr Ji further explained that in addition to food and water distribution, Nanxi's government also implemented a post-disaster subsidy to help farmers recover the loss of banana plants, providing farmers with half the price of seedlings.

In 2010, these short-term measures were complemented by longer-term actions to help improve farmers' resilience to longer dry seasons and future droughts. Prevention measures organised by the local government mostly concern infrastructural improvements, but also involve prevention campaigns: knowledge transfers regarding disaster impacts, mitigation and awareness. In Lengquan, infrastructural measures include the construction of 1,000 water reservoirs for houses, subsidised by the local government and 15 dikes to facilitate livestock's access to water. The local government also plans to build ponds in areas above 1,700 meters to enable water distribution to two or three villages, meeting crop and daily household needs. Local government agencies are also experimenting with new crops. Mr. Sheng, an official at Nanxi Government, explained that the Agricultural Department plans to implement new drought-resistant cash crops to avoid future climate shock-induced crop failures. The Department is also searching for further water sources; albeit whether these will be sustainable remains to be seen.

Despite the local governments' efforts to provide relief to farmers affected by extreme weather events, provisions of food and water were not always sufficient. Farmers explained that each household member eats at least 10 kilograms of rice per month. With the government providing from 2.5 to 25 kilograms of rice per household during or after an extreme weather event, most farmers complained of food shortages, and having to save food and/or rely on loans to purchase food. While some farmers suffered from severe water shortages at home and for crop irrigation, others explained they had received boxes of mineral water although no severe water shortages were occurring in their area. These critiques from farmers reveal weaknesses in the coordination of the government's relief operations and point to the need for farmers to be highly self-reliant or draw on social ties to fend for themselves. Furthermore, these inadequacies in local governments' relief confirm some of Li et al.'s (2013:1) suggestions from rural areas along the Mekong River in western Yunnan regarding enhancing the "decentralization of policymaking as local governments can make context-relevant comprehensive policies more easily and are less hierarchical in their relationships." We also agree with his proposal that "involving farmers or other stakeholders in decision making" should be prioritised.

## **V. Concluding Thoughts: Flexible Livelihoods and Food Security in Southeast Yunnan?**

Agrarian change is rapidly altering farmers' livelihood options and their food security in Yunnan's south-eastern borderlands. The majority of ethnic minority and Han farmers have recently made a switch from primarily cultivating subsistence food crops to cultivating state-sponsored and non-state sponsored cash crops to some degree. This is occurring concurrently with an increase in extreme weather events, putting farmers' resilience to the test. Building on our conceptual framework bringing together literatures on sustainable livelihoods, vulnerability and resilience to climate shocks and food security, we argue that spatial variables such as location and farming activity, alongside social variables including ethnicity have influenced the vulnerability (pre-event; non-crisis) and resilience (post-event; crisis and post-crisis) of rural livelihoods in Honghe prefecture. Furthermore, temporal variables, including an extreme weather event's rate of onset, timing and duration are influencing post-event strategies (Cutter et al. 2008).

Among the farmers interviewed, we find that combining several activities within one household is beneficial to maintaining a sustainable livelihood, as opposed to solely relying on cash cropping. Cultivating stress-resistant cash crops, keeping a small portion of traditional food crops, engaging in on-farm work within the community, and temporarily and seasonally working off-farm, are livelihood options that can be combined to diversify one's income sources in case of external shocks. Correspondingly, we find that the more remote farmers are located, the more robust their coping and adapting strategies, which can in part be explained (perhaps ironically) by the fact that they are outside the immediate radius of the local government. In the face of extreme weather events, remotely located ethnic minority farmers tend to rely on traditional knowledge and coping strategies rather than the government's relief and aid. Alternatively, Han and Zhuang farmers located closer to the government's offices tend to expect more government help in times of crisis, showing less self-reliance. Nevertheless, on the long-term it is farmers closer to town and government officials who gain easier access to financial capital and technical information regarding new crops.

Within an agrarian transition context, which includes increasing market integration and numerous state development policies, local ethnic minority as well as Han farmers in Honghe prefecture are finding that creating sustainable livelihoods to support food security for their households is a demanding and complex day-to-day task. Local farmers often find their access to livelihood capitals limited by a diverse range of factors, which become even more pronounced in the wake of extreme weather events. Despite government aid and interventions after extreme weather -- interventions that are often too little or too late -- we find that the livelihood vulnerability of farmers in these borderlands has not been reduced by a wholesale switch to cash cropping, nor has their livelihood sustainability increased. In this complex agro-ecological and climatic environment it is those farmers who maintain flexibility via mixed cropping, drawing on a range of informal and formal knowledge and support, who appear to be best adapting to this new agrarian landscape, while meeting their food security needs.

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# 經濟作物與氣候衝擊：中國雲南南部農民的 靈活生計方式與糧食安全

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## 摘要

從歷史上來看，地處中國西南的雲南省，其農民曾一直保持著半自給的生計方式。自20世紀50年代以來，其生計方式經歷了巨大的變遷，先後經歷了集體形式的生計，再又回到半自給生計方式，最近在中國政府的大力鼓勵與財政支持下，又轉移到經濟作物種植熱潮。本文探討了經營經濟作物這一決定對漢族和少數民族農民的生計和糧食安全的影響。本文認為，發生在中越邊界地區的向經濟作物種植的轉型，以及不得不對極端氣候事件的應對與適應，未必能增加生計的可持續性和糧食安全。農民的脆弱性，是由具體的時空變數與社會文化因素交錯在一起造成的，而在政府干預期，這些社會文化因素還沒有被官員所認識。

**關鍵詞：**經濟作物，氣候變化，糧食安全，農民生計，雲南東南部