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Chen, Zhuo

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ROADS, RIDING STABLES, AND HIGHLAND BARLEY

Livelihood diversification as climate change adaptation among Tibetans in Shangri-la, China

Zhuo Chen

Introduction

"No rain still," my Tibetan Papa said, looking up at the sky and clouds. He was feeding the two horses some highland barley dough in the front yard of the house. Water that occasionally dropped from the tap was stored in a rubber tire. "Not enough water to drink, not enough grass to eat. Poor horses," he said again, holding the highland barley dough and looking at the horse eating in his palms. I looked at the clear eyes of the horses and sighed. Shangri-la county had been experiencing extreme drought when I arrived in the spring of 2021. Observing the sky while hoping for rain became a new daily routine for local Tibetan villagers. Almost every morning, I followed my Tibetan grandpa to the village pagoda and observed the villagers' morning rituals there. The pagoda stood near the road, just opposite the riding stable in our village. Many villagers drove a tricycle slowly on the road, followed by two horses. They were leading the horses to the riding stable. Some horses were even led by slowly driven cars. Since I'm not a Tibetan Buddhist, I could not join the villagers. So, I typically stood by the road and shared some words with those who had finished the ritual. They would share information about coming activities I might want to attend—the ceremonial ritual of praying for rain, for example. Trucks and cars occasionally passed by me at normal speed, either toward the Shika Snow Mountain in the north or the central town in the east.

Climate change has adversely affected many places on the planet in myriad ways, and climate adaptation has become an increasingly pressing issue for various societies and communities. Scholars argue that developing adaptation starts with decreasing vulnerability (O'Brien et al., 2004), but it is important to recognize that not all communities are equally vulnerable to harm from exposure to climate change because of different natural, political, and sociocultural contexts (Füssel, 2010). Eriksen et al. (2011) further argue that to develop more sustainable climate adaptation in a particular community, the contexts for vulnerability should be thoroughly recognized, differing values and interests that affect adaptation outcomes should be acknowledged, and local knowledge should be integrated into adaptation responses.

The Indigenous communities who mainly reside in less developed rural areas and primarily depend on nature for their livelihoods have been identified as among the most vulnerable to climate variabilities (Salick & Byg, 2007; Xu et al., 2009; Ghimire et al., 2010; Bardsley & Wiseman, 2012). Scholars have found that livelihood diversity is one of the strategies adopted by

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Indigenous people to decrease vulnerability, thus helping them cope with local climate change impacts (Osbahr et al., 2008; Aryal et al., 2014). However, previous work analyzing the correlation between diversifying livelihoods and decreasing vulnerability has been mostly quantitative. A more in-depth and qualitative investigation of how diversifying livelihoods affects climate adaptation practices and how diversification is formed and sustained in an Indigenous community remains unexplored. Particularly, the ways Indigenous and local knowledge interact with scientific knowledge and other mainstream interests and values in diversifying livelihoods have rarely been discussed.

Interrogating how local knowledge interacts with national policies to form livelihood diversification is crucial for understanding Tibetan communities' adaptation to climate change impacts in Shangri-la county, China. Research has shown that the Tibetan Plateau, at the east edge of where Shangri-la locates, has been identified as one of the most sensitive areas to global climate change (Liu & Chen, 2000; Yan, 2015). The area's temperature rise is approximately three times the average global warming rate (Qiu, 2008) and the snow cover retreats faster in this area than the global average (Yan, 2015). This reality has brought significant impacts on the local livelihoods and forced Tibetan people to take adapting measures (Yin & Zachary, 2018). Local knowledge makes a great contribution to the adaptation of Tibetan livelihoods (Yin & Zachary, 2018), resonating with a surging scholarly discussion on the importance of integrating Indigenous and local knowledge into climate change adaptation (García-del-Amo et al., 2020; Chakauya et al., 2024, Jungsberg and Wendt-Lucas, 2024, However, the Tibetan livelihoods in Shangri-la county have also been dramatically influenced by national policies that encourage the tourism industry and infrastructure development (Yang et al., 2003; Wu et al., 2015). The way traditional Tibetan knowledge interacts with mainstream values in transforming local livelihoods for climate adaptation has yet to be explored. Thus, in this study, I investigated how local knowledge interacts with national policy, roads, and markets to shape diversifying livelihoods among Tibetans in Shangri-la and how such diversified livelihoods help them adapt to climate change impacts.

Tibetans in Shangri-la county and their livelihoods and land-use transition

The Diqing Tibetan Autonomous Prefecture of Yunnan Province, commonly known as the Shangri-la region, is situated in the south of the Qinghai-Tibet Plateau and east of the Himalayas. It is at the junction of the Yunnan, Tibet, and Sichuan Provinces, with a total area of 23,870 square kilometers and a population of about 387,500 (Yunnan Yearbook, 2022). Nearly 90% of the residents are ethnic minorities, defined in China as non-Han population (State Council of People's Republic of China, 2014). Among them, Tibetans account for 36.18%. The prefecture administers three counties—Shangri-la, Deqin, and Weixi. The four villages where I conducted fieldwork are located in Shangri-la county. More than 99% of villagers are Tibetans and share a common belief in Tibetan Buddhism (Figure 20.1).

The Napahai Wetland Reserve is 7 km northwest of the studied villages. The reserve is a provincial natural reserve that was established in 1984 and listed as a Wetland of International Importance by the secretariat of the Ramsar Convention in 2004. Shika Snow Mountain is located 2 km south of Napahai and 10 km east of the villages. According to folklore, the Napahai Wetland and Shika Snow Mountain have played crucial roles in local Tibetan life for centuries.

Four villages located along the large outer ring of the Napahai Wetland were selected for this study. The villages had 31, 59, 56, and 96 households. Roads surrounding the wetland were built in the 2000s, when the reserve became an ecotourism attraction. Each village built a riding stable on the grasslands surrounding Napahai to attract tourists. A tourism bus line called the "Napahai

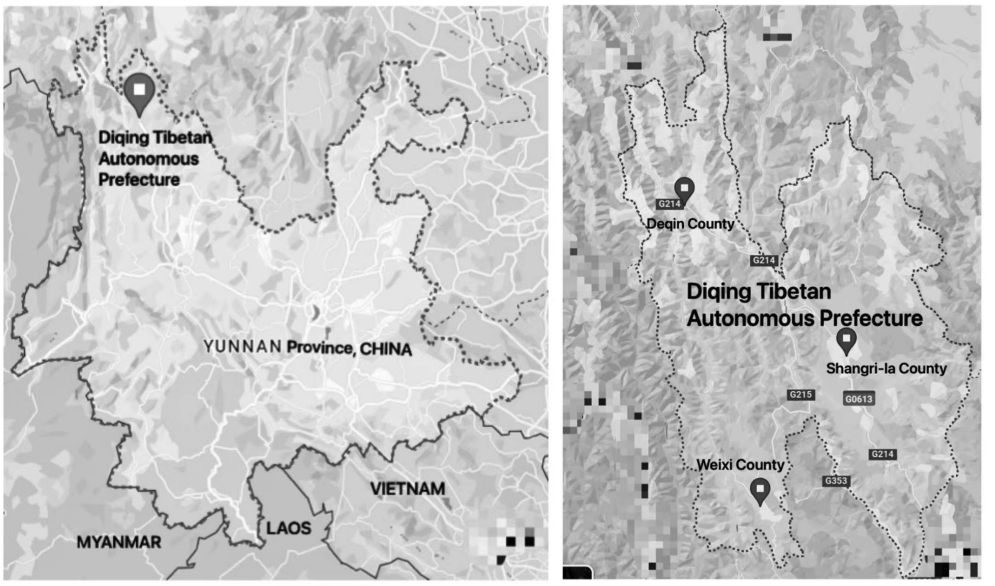

Figure 20.1 Location of Diqing Tibetan Autonomous Prefecture. Reproduced by the author from Google Maps, 2023.

Line" has seven scheduled trips every day from the county center to the wetland. All four villages can be reached by that circuit bus. Most households are located on the outer side of the road surrounding the Napahai Wetland, spreading from right at the edge of the road (Chugu) to farther into the grassland (Yizhai) or up into the mountains (Gedong and Hamugu-Jiaorong). Wooden houses with two or three floors, farmland spots, highland barley shelves, Buddhism pagodas, and riding stables are staggered in between, circling the wetland.

The Tibetans who have lived there for centuries have traditionally relied on agropastoralism and the gathering of non-timber forest products for their livelihood. Yaks and horses are the primary livestock for animal husbandry and grazing, and highland barley is the primary crop for traditional farming. The principal items gathered are various fungi, including matsutake. Local Tibetans have produced rich knowledge of traditional livelihood products. To them, water, highland barley, and yak butter are holy items that have significant material, social-cultural, and spiritual values for local life (Li & Xu, 2007; Li, 2010; Li et al., 2011; Kehoe, 2015; Yang, 2016; Sina, 2019). However, increasingly impacted by national policy on land-use transition, since the 2000s local villagers began to depend more on income from tourism-related businesses.

Chinese national policy started impacting the Shangri-La landscape dramatically in the 1970s. In 1972, the Chinese central government issued a policy encouraging commercial logging to stimulate local economic development. Logging factories spread across the grand Shangri-la region in the following two decades (Yang et al., 2003). As a result, from the 1970s to the 1990s, the forest area decreased by 60%, and the wetland area decreased to only 30% of its original size (Li et al., 2010). After this catastrophic beginning, state and prefecture governments issued a series of policies to restore the ecosystem and landscape in the following decades. In 1998, the Chinese central government implemented the Natural Forest Conservation Program. The program prohibits further logging in the upper and middle reaches of the major Chinese rivers' basin, covering most areas of

the Shangri-La region. A variety of governmental programs followed refocusing natural resource policy from a concentration on fast economic development to ecological restoration (Chan, 2002; Cao et al., 2010; Gutiérrez Rodríguez et al., 2016). In Shangri-la, national, provincial, and prefectural policies and programs were implemented to reduce natural landscape degradation (Li et al., 2010). Napahai was listed as one of the priority wetland ecological restoration projects at both the national and provincial levels, and in 2005 grazing was forbidden in the Napahai area.

Policies on tourism development came hand in hand with landscape conservation policies in the late 1990s. Shangri-la became famous as a land of idyllic beauty, for which national and local tourism policies emphasize its ecological richness as a main tourist attraction. In 2002, cross-provincial policies were issued to support ecotourism development in Shangri-la, and Napahai was listed as one of four pilot spots for ecotourism by the Diqing prefecture government (Wen et al., 2003).

In addition to the lasting landscape restoration and ecotourism development policies, a third national policy contributed to land-use changes in Shangri-la. Since the early 2000s, collective assets and property (including land) rights have gone through shareholding reform in rural China (Chen, 2016). Under the compound influence of these policies, local Tibetans have experienced a significant land-use transition. Common lands in the county, such as wetlands, grasslands, and mountain lands, have been developed into ecotourism sites, while maintaining traditional livelihood functions. Since 2003, nine horse-riding stables have been built on the grassland surrounding the Napahai Reserve, each collectively owned by all the villagers. Similarly, Shika Mountain has been transitioned into Shika Snow Mountain Scenic. Tibetan villagers receive compensation via profit sharing from the companies or rural cooperatives that contracted the land for these ecotourism activities (Ma & Liu, 2020). These changes dramatically stimulated infrastructure development in Shangri-La, including the construction of utilities and roads.

Method

This study used an ethnographic method. Fieldwork was conducted from April to June 2021. Participant observations and semi-structured interviews were used to collect the data following the protocol of Local Indicators of Climate Change Impacts project (Reyes-García et al., 2023). Archival research of national and local policies on land use, economic development, and ecological and environmental protection in Shangri-la was conducted as a supplement to fieldwork.

I collaborated with a local research institute that issued a reference letter for me to the Diqen Prefecture Ethnic and Religious Affairs Committee. I introduced the study and its objectives with this letter and oral presentations to the county officers to obtain their permission to conduct research before entering the field. I only conducted research in villages where I obtained local authorities' consent.

To obtain better observations of local life and to gain cooperation from the Tibetan people, I stayed with a Tibetan family, living in their house, eating meals with them, and following them to the riding stables. Each stable had a resting room where villagers gathered, chatting and playing cards, while waiting for their turns to lead the horses. The resting room became a space for me to develop rapport with the villagers and to begin my observations and interviews. After becoming familiar with them, I also participated in other productive activities. Most participant observations were conducted alongside Tibetans operating within their usual livelihoods, such as in the stable while the informants were cleaning the horses, on the grasslands while they were collecting yak dung, on the farmlands while they were working for the vegetable farms, in the temple while they were chanting and circumambulating, or in the backyard while they were making yak butter or washing highland barley.

Semi-structured interviews were conducted at the same lively sites to explore observed climate changes, drivers of those changes, and relevant adaptation and coping measures. Judgmental sampling was used to select the first five informants, each of whom was knowledgeable about farming, pasturing, and gathering, and had devoted more than 30 years to these activities. Then, snowball sampling was used to identify 20 more informants (Bernard, 2017). The informants comprised 13 men and 12 women, spanning age groups from the 20s to the 60s. Their everyday language is Tibetan. However, as a result of the booming ecotourism industry, most of the younger generations can speak Chinese Mandarin, so the interviews with them were conducted in Mandarin. Interviews with older people who were less fluent in Mandarin were conducted with translation help from younger Tibetans.

Content analysis was used for data analysis. The data were coded and analyzed following a codebook containing themes and subthemes on the topics of interest (Saldaña, 2015; Bernard et al., 2017).

Results

Diversifying livelihoods: roads and local knowledge

According to memories of Tibetan villagers in their 80s, interim grazing used to rotate from the Napahai Wetland in the spring, to Shika Snow Mountain in the summer and back to the villages in the winter. Since pasturing in Napahai was forbidden in the early 2000s, villagers then herded only on the summer and winter grazing lands and became more dependent on the grasslands near the villages, a large portion of which has been transformed into riding stables. The management of each stable was done by a specific villager who signed a contract with the county government (the villager then also became the stable manager). In the studied villages, each household had two horses registered in the stable, and the villagers took turns leading the horses for tourists who wanted to try horseback riding. As they were ecotourism sites while still being used as pastures, the riding stables had many special characteristics. For example, none of the stables had fences or walls, and even the "entrances" near the roads were open because the grassland was still a pasture. Led by the villagers, tourists rode horses on the grasslands near the entrance. Meanwhile, yaks and other horses (not for tourist riding) were grazed on the same grassland, but at a further distance from the entrance. Every morning, the villagers pastured the yaks, cattle, and horses to the grasslands from home and got a queuing number from the manager to lead the horse. Then, animals started to wander on the grassland, and people gathered in the resting room or on the land, chatting, drinking yak-butter tea, or making handmade goods. When their turn to lead was about to come, they would run to the far grasslands to get their horses back and wait together at the entrance for the next wave of tourists, most of whom came by tour buses (though a few came by car). The boundary between traditional pasturing and tourism has been blurred in the grassland/riding stable. The Shika Snow Mountain area—the traditional summer grazing land—has experienced similar transitions. In this case, the villagers receive annual profit-sharing dividends and find labor-wage work cleaning the scenic area. Meanwhile, they can still pasture and collect fungi in other areas of the mountains.

With the transition of the common land to commercial uses, the villagers have made a relatively stable income from the mountain and grasslands as tourist sites. Almost all the villagers mentioned "leading the horse in the stable" and "dividends from the Shika Mountain" as the main sources of their annual household income. A similar transition also occurred with farming lands. Compared to other livelihoods, farming requires more time and brings in a lower income. As a result, local

Tibetan villagers started to rent farming lands to people who came from other places in the Yunnan province to grow vegetables for sale.

Although traditional agropastoral livelihoods have been heavily influenced by the market economy, none of the Tibetan households has abandoned crop farming and pasturing, particularly with highland barley planting and yak grazing. In the villagers' narratives, highland barley was a gift from Tibetan deities, who gave seeds as big as an adult's palm thousands of years ago. According to local narratives, it was the highland barley that made the Tibetan people and the yaks strong and healthy despite living in the harsh environment of the plateau. Thus, highland barley is indispensable to local life, both for humans and animals. The villagers' typical breakfast and afternoon tea is yak-butter tea with fried highland barley flour. Almost every household stores piles of highland barley hay on the attic floor of their house, preparing for herding yaks and horses in the winter. Moreover, highland barley plays a crucial spiritual and cultural role in Tibetan life. Symbolizing pristine grains, highland barley is considered holy. Every morning during my stay in the field, I could see the villagers bring highland barley flour to the pagoda and burn it with clean water and branches of conifers as a religious and cultural ritual to begin their day.

Like highland barley, yak butter is also integral to all aspects of Tibetan life. The villagers drink yak-butter tea and worship with yak-butter lamps every day. They also use yak butter as skin cream when the weather is dry. From their point of view, yak-butter tea symbolizes their Tibetan identity. As one of my interlocutors said, "Drinking yak-butter tea makes us Tibetan." (Anonymous. 2021. Interview with villager by author. April 14th. Resting room of Yizhai Riding stable.) Thus, according to local views, the value of highland barley and yak butter is irreplaceable and supersedes their market value, allowing traditional agriculture and pasturing to survive regardless of the profound influence of the market economy in the area.

Road construction has played a crucial role in Shangri-la county's land-use and livelihood transition. Many older villagers remembered that the first roads from the county center to the mountains were built in the 1970s to transport wood. After logging was forbidden, ecotourism continually attracted government investment in road construction. Many young men in the villages have regular jobs as truckers. They leave home for transportation trips about every two weeks, then stay home to lead the horses at the stable or gather fungi on the mountain while waiting for the next long-distance transportation task. Some also choose to work as part-time drivers for tourists between transportation tasks. Meanwhile, the roads provide the villagers with easier connections to the market at the county center. They used to walk half a day there to sell the dairy products and fungi they collected, but now such trips only take ten minutes by bus.

Although the roads were originally built for tourism and the market economy, they also brought benefits to traditional pasturing. Before there were roads in the area, transporting living materials to the mountain mainly depended on yak carts through trails, which were laborious and time-consuming. But now, as one villager in his sixties said, "My son or my friend could drive all the things up there for me within a half day. It's easy and very quick." (Anonymous. 2021. Interview with villager by author. April 20th. Chugu Riding stable.) Moreover, the villagers previously had to make tradeoffs on summer transhumant timing so they would be able to depart *before* the paths were flooded by the wetland but *after* the grass on the mountain had grown. Now, they worry less about the paths and pasture in the upper areas only when there is enough green for the yaks to eat. Pasturing becomes more flexible in schedule with the roads connecting the villages, the grasslands, and the mountain.

In summary, governmental policy and local knowledge have synergistically contributed to the change in local livelihoods. As a result, market-oriented and traditional livelihoods intertwine with each other in space and time, particularly surrounding the roads, and provide the Tibetan villagers

diversified economic choices with both stability and flexibility. The following sections show how such diversifying livelihoods has become one of their most crucial strategies in the face of local climate variabilities.

Drought, water shortage, and various explanations

Extreme drought, as the one experienced in 2021, and drier spring seasons were the most significant local climate change impacts identified by Tibetan villagers. According to them, it had not snowed or rained even once in the area since the winter of 2020. When I interviewed or chatted with some people in their sixties or older, they often pointed to Snow Mountain and told me that, when they were young, the snow on the top of the mountain would not melt even on summer days. "You can see the whole mountaintop was white, you know," the 65-year-old former village head recounted the scenery of Shika Snow Mountain in his memory when we were chatting on the grassland. He continued with a soft sigh. "Now it's only April, and you can see almost no snow there. It just doesn't snow." (Anonymous. 2021. Interview with villager by author. April 17th. Chugu Village.) Many villagers provided similar narratives and claimed that less rain and snow threatened their accessibility to water. In the four studied villages, all households had tap water, sourced from meltwater from the snow mountains. Almost all villagers I interviewed claimed that they did not have enough tap water to use, either occasionally or often. Anxiety spread across the studied area from this water shortage. "The tap water is cut off more frequently these days. Horses and yaks don't have enough water to drink. And we (people) have to save it all for eating and drinking, with no water left for washing clothes or showering," one young girl complained. (Anonymous. 2021. Interview with villager by author. April 24th. Resting room of Chugu Riding stable.)

Villagers mentioned that the drought brought difficulties for the horses and yaks in finding water to drink. Worse yet, it was also hard for them to find enough grass to eat. As the drought lasted, the grasslands remained yellow, and the grass did not grow. According to the villagers, various plants and fungi in the grassland grew slower than before. Moreover, many villagers claimed that there had been negative changes in highland barley due to less rain and snow in recent years. People described the highland barley seeds as lower in quality and smaller in size, with leaves growing later and an increase in insect pests. "Some black pets fell down on the highland barley from the air, like a pest rain," three of the villagers mentioned the abnormal number of highland barley insect pests two years ago. "We have never seen such things in our lives," they said (Anonymous. 2021. Interview with villager by author. April 18th. Rain praying ritual site).

Facing these negative impacts, local Tibetans provided explanations of the drivers of such changes derived from both scientific and local perspectives. Many informants claimed that extreme drought happened because of touristic exploitation of the land. Some referred to outsiders renting the land and using too many plastic covers to grow vegetables. "Using plastic is not good, not to mention they burn the waste plastic covers," one 31-year-old woman complained when we walked by her rented farmland. "That definitely makes the climate worse. We have fewer sunny days, you see. Always cloudy, but no rain." (Anonymous. 2021. Interview with villager by author. April 18th.) Meanwhile, their beliefs also played an important role in narratives. For example, the villagers mentioned that Tibetan people practiced water burial for hundreds of years. Only since the end of the 20th century have they turned to cremation, following a national policy. However, they still believe that water burial is the only right way. "You should not burn things or bodies during the winter. The deities will get angry and punish you," one 73-year-old woman said (Interview with villager by author. April 18th 2021. Rain praying ritual site.) Like her, many villagers believed that the extreme drought in 2021 and drier springs in recent years were punishments from the Tibetan deities.

Flexibility as response

As mentioned, local Tibetan people have developed diversified livelihoods combining agriculture, pastoralism, gathering, ecotourism, and wage labor in the transportation industry and tourism-related business. Such livelihoods provide the villagers with diversified sources of income, including the relatively stable income from tourism, transportation business, and renting farming land, and the more flexible income from gathering and selling fungi, selling yak butter to tourists, and selling horses and yaks every few years. This differentiated income portfolio helps them adapt to drought and water shortages by allowing them to schedule their work with flexibility.

In the interviews, the villagers named many adaptations to drought by adjusting the timing of activities. For example, for farming, they postponed sowing highland barley seeds to wait for rain and harvested earlier to avoid damage from the abnormal frost; for herding, they transported up to the mountains later—which became possible with the well-connected roads—if it did not rain or snow enough during the winter and spring; for gathering, they postponed collection in the mountains, waiting for fungi to grow bigger. "Even if we go into the mountains now, we could find nothing; no rain, no fungi. But thank God we have this riding stable. At least we can get money from there," one villager said (Anonymous. 2021. Interview with villager by author. April 28th. Resting room of Chugu Riding stable.) Diversifying sources of income prevents local Tibetans from depending solely on one specific livelihood and provides them with a more flexible schedule for arranging productive activities in the face of irregular climate conditions. When climate variabilities impact one or several living resources, they are able to unhurriedly and comprehensively evaluate the influences on each specific livelihood and make a balanced arrangement. As discussed above, local knowledge and road construction synergistically contribute to forming such scheduling flexibility in the timing of livelihood activities.

Reflecting on the sacredness of water, one of the local Tibetans' most crucial ceremony rituals is to pray for rain. Normally, in early spring, women gather at a particular well at the village entrance. They burn wood and add water and highland barley flour into the fire, then sit in a circle and chant. The ceremony lasts an entire day. If it does not rain in the two weeks or so that follows, another ceremony is held. Many Tibetan women claimed that they had held this ritual praying for rain more frequently due to the drought. Believing in its sacredness, the villagers store water, develop ways of recycling the used water, and are very careful about burning things to avoid intensifying the drought. In addition, some villagers mentioned they transport water from somewhere else when the tap water stopped too long. The roads connecting villages and mountains enabled them to transport water by truck from the Snow Mountain far away to the villages and to use the water for both human and livestock, as well as watering the highland barley seedlings. Moreover, there were situations in which some villagers bought bottled water to drink and cook, which was a luxury choice for most residents, yet still affordable in extreme cases. The Tibetan villagers' response to water shortages further demonstrates that the synergy of roads and local knowledge could also provide flexibility in a broader sense, which is reflected in their various coping strategies—from ritual ceremonies to market behaviors—to a particular climate impact.

Discussion and conclusion

In this study, I explored the ways in which governmental land-use policy and local knowledge work together to form diversified livelihoods among Tibetan people in Shangri-la county and how such diversification is relevant to local climate change adaptation. The findings suggest that diversifying livelihoods decreases local villagers' vulnerability to drought and water shortages through

diversifying income, allowing flexibility in scheduling, and enabling complementary and flexible coping strategies.

Some research has revealed that, in nature-dependent societies in developing countries, forms of livelihood diversification are relevant to local communities' vulnerability to climate change impacts. For example, Osbahr et al. (2008) found that in the farming community of Nwadjahane, Mozambique, local people developed a diverse livelihood portfolio of traditional skills in craftwork, herbal medicine, and construction. Such diversification contributed to livelihood resilience and flexibility in response to climate variability. In another case, Aryal et al. (2014) showed that in the Indigenous transhumant community in Himalaya, Nepal, beyond agriculture and livestock income from tourism and tourism-related business contributed to more strategic and diversified livelihoods for local households, thus decreasing their vulnerability to climate change. My study provides one more example to prove the relevance of livelihood diversification to climate change adaptation. Furthermore, through an ethnographic approach, this study provides a more nuanced and thicker analysis of how livelihood diversification works in practice to decrease Tibetan communities' vulnerability to drought and water shortages.

Although Tibetans in Shangri-la county show some similarity in livelihood diversification with Indigenous communities in other areas, their relationship to the new transportation infrastructure is peculiar, as roads have connected all their livelihood spaces, pervaded all aspects of local life, and, to a large extent, driven their livelihood diversification. Li and Hu (2018) studied the Tibetans in another village in the Shangri-la region, Benzilan, and found that roads, as a localized manifestation of national power, stimulated the development of the logging industry and matsutake trade in the 1980s and ecotourism and the transportation industry since the 2000s. The villages I studied experienced almost the same change. Yet, in my case, roads were not merely manifestations of governmental policies or simply stimulated market-oriented livelihoods. Local people also actively used roads to revitalize traditional livelihoods with more flexibility. Roads thus became a key element in their adaptation to drought, both in direct (i.e., enabling flexible transhumant and water transportation) and indirect ways (i.e., through riding stables built surrounding the roads to guarantee tourism). Local knowledge is essential in transforming the roads from a policy expression to a climate change adaptation instrument for local Tibetan people. In his book *Building on Borrowed Time: Rising Seas and Failing Infrastructure in Semarang*, anthropologist Lucas Ley (2021) provides a counterexample showing how infrastructure (the urban sewage system in Semarang) could fail as a "modern" technology to temporarily "fix" the flood problem brought by climate change in Indonesia. On the contrary, in this study, the transportation infrastructure has been integrated into local life in a way that is reconciled with local knowledge. Traditional Tibetan knowledge and governmental policy synergistically repurposed the roads into a sustainable element in local climate change adaptation through villagers' diversifying livelihood practices.

I do not intend to romanticize road construction in remote areas, the negative impact of which has been deliberated on a great deal in both public discourse and academic literature (see Gallice et al., 2019; Pattiselanno & Krockenberger 2021 as the most recent examples). My aim, rather, is to present the complexity of life in communities that have already integrated roads into their livelihoods and the potential of such integration to contribute to local climate change adaptation. In this sense, this study could be a starting point for exploring how roads, or, more broadly speaking, the market economy, could help—rather than impede—local communities in decreasing vulnerability to climate change risks, especially in communities that are under rapid socioeconomic transition and unavoidably affected by the market industry. The Tibetan people's experiences and the essential role of their local knowledge make a valuable case for further exploration.

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