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# Food Security and Translocal Livelihoods in High Mountains: Evidence From Ladakh, India

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*Reducing food insecurity is crucial to sustainable development in mountain regions. Case studies on complex food systems in these areas facilitate depiction of current trends and challenges and provide detailed information to policymakers. Based on empirical research in Ladakh in the Indian Trans-Himalaya, this study assesses livelihood dynamics in the context of rapid socioeconomic changes and aims to show how diverse spatial and temporal patterns of mobility shape strategies of the mountain population. The results exhibit translocal livelihood diversification as an emerging reality. The consequences are a reduction in land-based food production and an increased reliance on markets and government food subsidies. This shift to a supply-oriented food system implies gender- and intergenerational-biased challenges, such as growing socioeconomic disparities, new dependencies, and an erosion of social institutions in the rural communities. Moving beyond the focus on land-based food production, this article sheds light on the interaction between agriculture, mobility, markets, and supplies, and highlights the need for cross-sectoral policy approaches to meet the challenge of food insecurity in mountains.*

***Keywords:*** *Food security; translocality; livelihood diversification; migration; agrarian change; Himalayas.*

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## Introduction

Food security remains a universal concern with continuing high prevalence of food insecure people and challenges resulting from adverse effects of land use change, climate change, and globalization (eg Misselhorn et al 2012). Following the global food price crises in 2008, the topic regained momentum in the media and policy agendas (FAO 2009; Godfray et al 2010; Ingram 2011). Most commonly defined, "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 1996). Food insecurity not only encompasses a lack of calorie intake resulting in undernutrition, but also micronutrient deficiencies due to little variation in the daily diet (Pinstrup-Andersen 2009). Termed "hidden hunger," deficiencies of vitamins and minerals have severe impacts on general health and wellbeing over the lifecycle (Kennedy et al 2003; Faber et al 2009; Biesalski 2013).

More than a decade after the first report on food (in)security in mountains (Huddleston et al 2003), a recent assessment by the Food and Agriculture Organization (FAO; Romeo et al 2015) depicts a rising number of mountain dwellers in the global South as vulnerable to food insecurity, from 35% in 2000 to 39% in 2012 (ie 329 million people). The share of vulnerable mountain population in Asia living at elevations above 2500 m exceeds 44% (Romeo et al 2015: 38). However, detailed and concise data on nutrition for specific mountain areas, including the Hindu Kush-Karakoram-Himalaya region, are rare (Kreutzmann 2006; Dame and Nüsser 2011; Rasul et al 2018).

The characteristics of mountain regions affect the respective food systems. The main determinants are general remoteness due to topography, political marginalization, market access restrictions, an often limited agrarian resource potential, and reduced income opportunities. Recent studies discuss the adverse effects of climate change on mountain communities (Carey et al 2017; Nüsser and Schmidt 2017), their vulnerability to natural hazards, and the declining agricultural yields and land loss they face due to land conversion (Tiwari and Joshi 2012). At the same time, rapid socioeconomic change influences farming practices as well as dietary patterns (Dame and Nüsser 2011; Tiwari and Joshi 2012; Rasul et al 2018). With such adverse effects, it is critical to reduce malnutrition or hunger to achieve sustainable development in mountain areas and adjacent lowlands. The importance of mountains on a global scale is reflected in international agendas, most recently in the Sustainable Development Goals adopted by the United Nations in



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2015 (Debarbieux and Price 2008; United Nations 2015; Gleeson et al 2016).

Recent research has called for case studies to provide detailed information to policymakers on the complex issue of food security in mountains (Romeo et al 2015). In response, this study assesses the dynamics and challenges of food security in Ladakh, Northern India, from an integrative and multiscale perspective that is vital in understanding complex social–ecological dynamics (Kates et al 2005; Ostrom 2009; Misselhorn et al 2012). Livelihood dynamics in the context of rapid socioeconomic change are analyzed with a particular focus on the role of translocality in shaping everyday strategies of the mountain population. The study addresses the links between food security and migration, which have been underresearched (Crush 2013; Choithani 2017; Crush and Caesar 2017).

## Conceptual and methodological approach

Moving beyond the focus on agricultural production (Ingram 2011), a food system approach builds on social–ecological systems thinking and provides an integrative approach to food security. It has evolved as a core concept and builds on 3 interrelated food system components: availability of, access to, and utilization of food. Agricultural production and crop yields are used to determine food availability along with food distribution and modes of exchange such as barter, trade, or purchase. Access to food comprises affordability in relation to household income, prices, allocation, and sociocultural preferences. Food utilization considers elements like nutritional and social value as well as quality of food. Actors are involved in various food system activities such as production, processing, distribution, and consumption (Ericksen 2008; Ericksen et al 2010; Ingram 2011). Analyses include long-term stability and seasonality. From a policy-oriented perspective, the outcomes should lead to sustainable and resilient food systems to buffer stresses and shocks that could otherwise lead to food insecurity (Misselhorn et al 2012; Dame 2015; Tendall et al 2015).

Livelihood approaches have proven suitable for the analysis of food security. However, more emphasis has been placed on the micro level. Recent academic discourse strongly advocates incorporating multiple scales, a range of governmental and nongovernmental actors (Scoones 2009; de Haan 2012), and translocal practices and relations beyond spatial dualisms of rural versus urban (Brickell and Datta 2011; Zoomers and van Westen 2011; Greiner and Sakdapolrak 2013; Zoomers et al 2016). A translocal perspective allows "to capture complex social–spatial interactions in a holistic, actor-oriented and multi-dimensional understanding" (Greiner and Sakdapolrak 2013: 376). Key to the notion of translocality are interrelations between different localities and actors, which manifest themselves, for example, in spatial mobility, economic relations, social networks, and flows of ideas and knowledge. Translocal networks can be enabling for households and can generate opportunities, but they may also have negative implications and restrict households' agency (Zoomers and van Westen 2011; Etzold 2017). As spatial livelihood diversification has become more relevant in mountain regions (Benz 2016; Gautam and Andersen 2017), a relational and translocal perspective of food security is required.

This study follows a multimethodological approach combining empirical social research, field-based mapping, and Geographic Information System (GIS) analysis. Agricultural land use was mapped in the villages of Hemis Shukpachan and Igoo using orthorectified and pan-sharpened very high-resolution satellite data (Ikonos-2, 11 October 2004, and Quickbird, 27 September 2003) in 2009. A resurvey in Igoo was conducted in 2015. Cropping patterns were estimated based on calculations in GIS. Standardized household interviews and dietary recalls were conducted in both focus villages in 2008 and 2009. During the follow-up visit in 2017, qualitative interviews were used to validate and update trends depicted in the previous phase. Between 2007 and 2010, qualitative interviews with smallholders, as well as with key persons like traditional water managers (*chudpon*), village heads (*goba*), and practitioners of Tibetan medicine (*amchi*), were used along with participatory observation in the villages for in-depth data collection. Local research assistants helped with translations and establishing contact. The interviews were recorded where permission was given, and field notes were taken with all material transcribed for analysis. During all field campaigns between 2007 and 2017, interviews with experts from government agencies, nongovernmental organizations (NGOs), and key informants in Leh were conducted. A market survey, unpublished project reports, government documents, and statistical records were used to supplement this information.

## The high-elevation desert Ladakh

Ladakh is separated from the Indian subcontinent by the Great Himalayan Range and edged by the Karakoram Range to the north (34°09′53N/77°35′08E; Figure 1). Due to its location in the rain shadow of the Himalayas, cold arid conditions with an average annual precipitation of less than 100 mm (recorded for Leh; Schmidt and Nüsser 2017), occasional extreme events (Thayyen et al 2013; Dimri et al 2017), and high seasonal temperature variations characterize the high-elevation desert (Chevuturi et al 2016). Due to climate and topography, settlements are located along tributaries, on alluvial fans, or along the rivers. Irrigated crop cultivation entirely depends on glacio-nival meltwater (Labbal 2000; Dame and Mankelow 2010; Nüsser et al 2012, 2018). Central Ladakh is a single-cropping area, where varieties of barley


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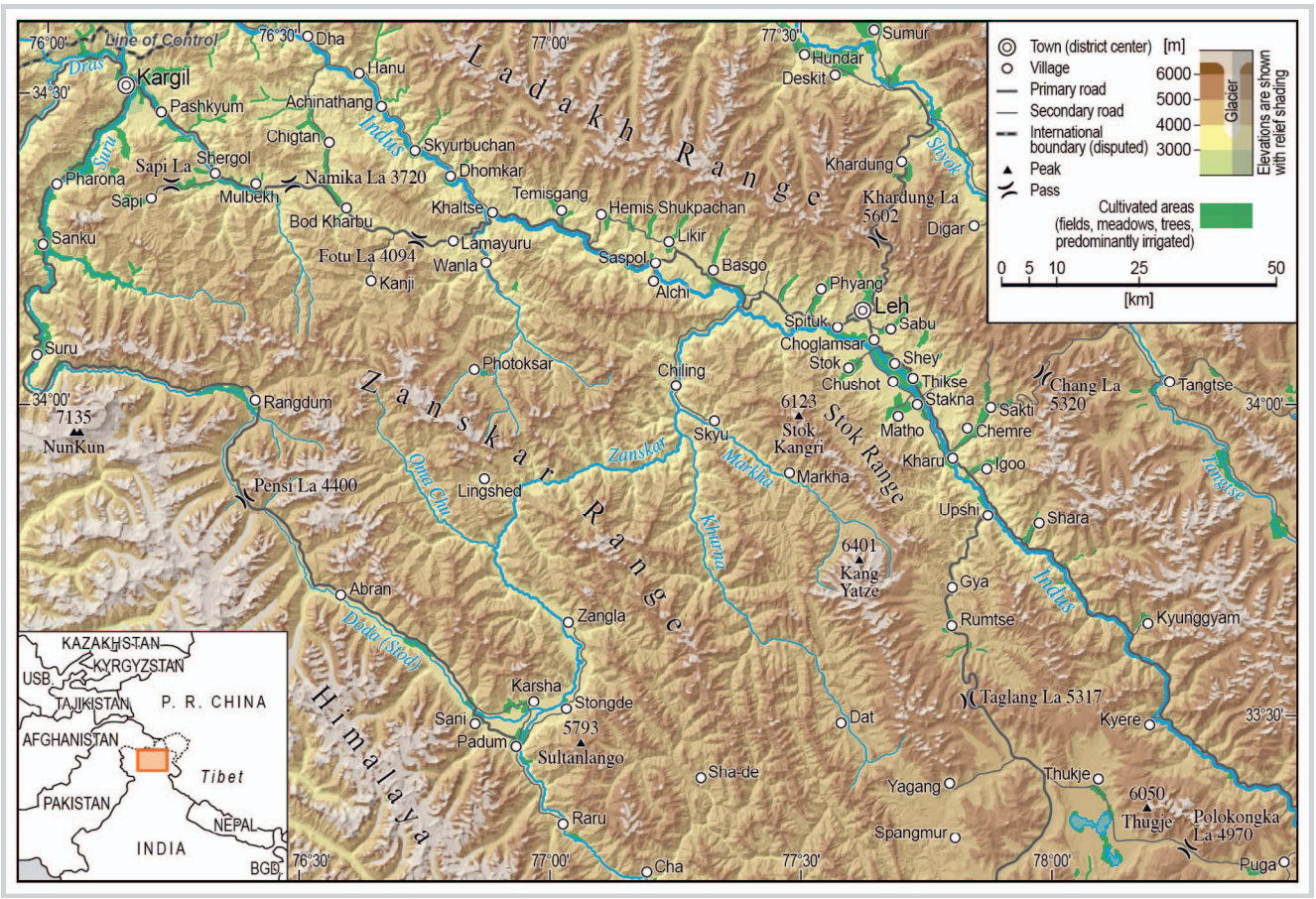
**FIGURE 1** Map of central Ladakh, Indian Trans-Himalaya. (Draft: J. Dame, M. Nüsser. Cartography: N. Harm, J. Dame, S. Schmidt)




and wheat are cultivated on terraced fields in rotation with peas and mustard. Vegetables and potatoes are grown in kitchen gardens and partly sold as cash crops. In a combined mountain agriculture (Ehlers and Kreutzmann 2000), wild vegetables, fruit, and animal products complement food production (Dame 2015).

Since Indian independence in 1947, Ladakh, a former crossroads of long-distance trade (Rizvi 1999), has been part of the state of Jammu and Kashmir. Comprising Leh and Kargil districts, the region is sparsely populated with 133,487 inhabitants living in Leh district (Census of India 2011), excluding the significant but uncertain number of army personnel and seasonal migrants. Regional development has been accompanied by drastic political and socioeconomic changes (Dame and Nüsser 2008; van Beek and Pirie 2008). The sensitive border situation with Pakistan and China led to a considerable stationing of army troops over the past decades and large investments in road infrastructure to improve access from the Indian lowlands. Initially built for military purposes, the Srinagar-Leh highway opened in 1962, and the Manali-Leh highway, constructed in the 1970s (Demenge 2012), opened for civic purposes later. Both roads remain closed for approximately 6 months due to heavy snow cover and during this time, air travel remains the only link to the Indian subcontinent.

Due to the seasonal isolation, food consumption in Ladakh has been primarily based on subsistence-oriented agriculture and local storage facilities. Given the challenges to farming, households rely on a small range of most-eaten foods. Although there has been a general improvement in the nutritional situation over the past decades, micronutrient deficiencies related to a generally low dietary diversity with a strong reliance on grain staples and rice have been reported. Noteworthy, however, is the marked seasonality of dietary patterns (Wiley 2004; Dame 2015).

## Results

### Translocal households: patterns and drivers of spatial and economic diversification

Ladakh has long been characterized as a land-based, subsistence economy. Trade and barter, such as between inhabitants of central Ladakh and nomadic herders of Changthang, sustained food security of the population


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**TABLE 1** Socioeconomic characteristics of surveyed households in Hemis Shukpachan and Igoo. (Source: own survey 2008/2009)

| | Igoo $n = 198$ ($N^{a)} = 223$) | Hemis Shukpachan $n = 103$ ($N^{a)} = 127$) |
|---|---|---|
| **Household characteristics** | | |
| Average household size | 5.2 | 6.1 |
| Households with ≤2 persons (%) | 10.1 | 17.5 |
| **Migrant households** | | |
| Households with members spending >6 months outside (%) | 73.7 | 76.7 |
| Average number of migrants per household | 1.7 | 2.8 |
| Households with ≤2 permanent residents (%) | 30.3 | 39.8 |
| **Household income sources (% households)** | | |
| On-farm income only | 2.0 | 0 |
| Off-farm income only | 48.0 | 82.5 |
| On-farm and off-farm income combined | 43.9 | 8.7 |
| No income | 6.1 | 8.7 |
| **Access to food (% households)** | | |
| Household food production | 98.0 | 96.1 |
| Barter | 17.7 | 46.6 |
| Gifts | 15.7 | 25.3 |
| Ration store (PDS) | 93.9 | 89.3 |
| Shop(s) in village | 90.9 | 84.5 |
| Shop(s) in district capital Leh | 89.9 | 89.3 |
| Other | 3.0 | 2.9 |

[a)] Based on a regional census by TISS (2006).

(Crook and Osmaston 1994). This has changed rapidly, however, with significant implications for mountain livelihoods and regional food security. According to census data for Leh district, only 28% of workers follow agriculture as their primary livelihood (LAHDC 2016: 9). Livelihood diversification and off-farm employment are key drivers for new mobilities. This includes rural-to-urban migration to the district capital Leh (Goodall 2004; Nüsser et al 2015), migration within the region, and migration to the Indian lowlands as well as circular patterns of mobility. The urban population has increased exponentially from 28,639 in 2001 to 45,671 in 2011 (including "census towns"; see Glover 2018) while rural population almost remained stable (Census of India 2011; LAHDC 2016).

The phenomenon of multisited households does not become apparent in these figures. Survey data from both study villages show that families are spread across localities and include those who partake in temporary migration. In 2008–2009, 77% of all surveyed households in Hemis Shukpachan and 74% in Igoo had at least 1 household member spending more than 6 months out of their village of origin which proves that the actual number of continuing residents is significantly lower than what statistics show (Table 1). While no recent detailed numbers are available, qualitative interviews in 2017 confirmed continuing declining trends. Also, interviewees gave medical and administrative consultations, and buying and selling of food and other supplies as reasons for occasional visits to the district capital. Some village dwellers, especially from Igoo owing to physical proximity and better road conditions, visited Leh town on a daily or regular basis for work.

Data show that the most important reason for migration is off-farm employment (Figure 2). With the expansion of the army in Ladakh, a number of income opportunities have arisen in permanent appointments at different levels and lower paid unskilled jobs. The striking


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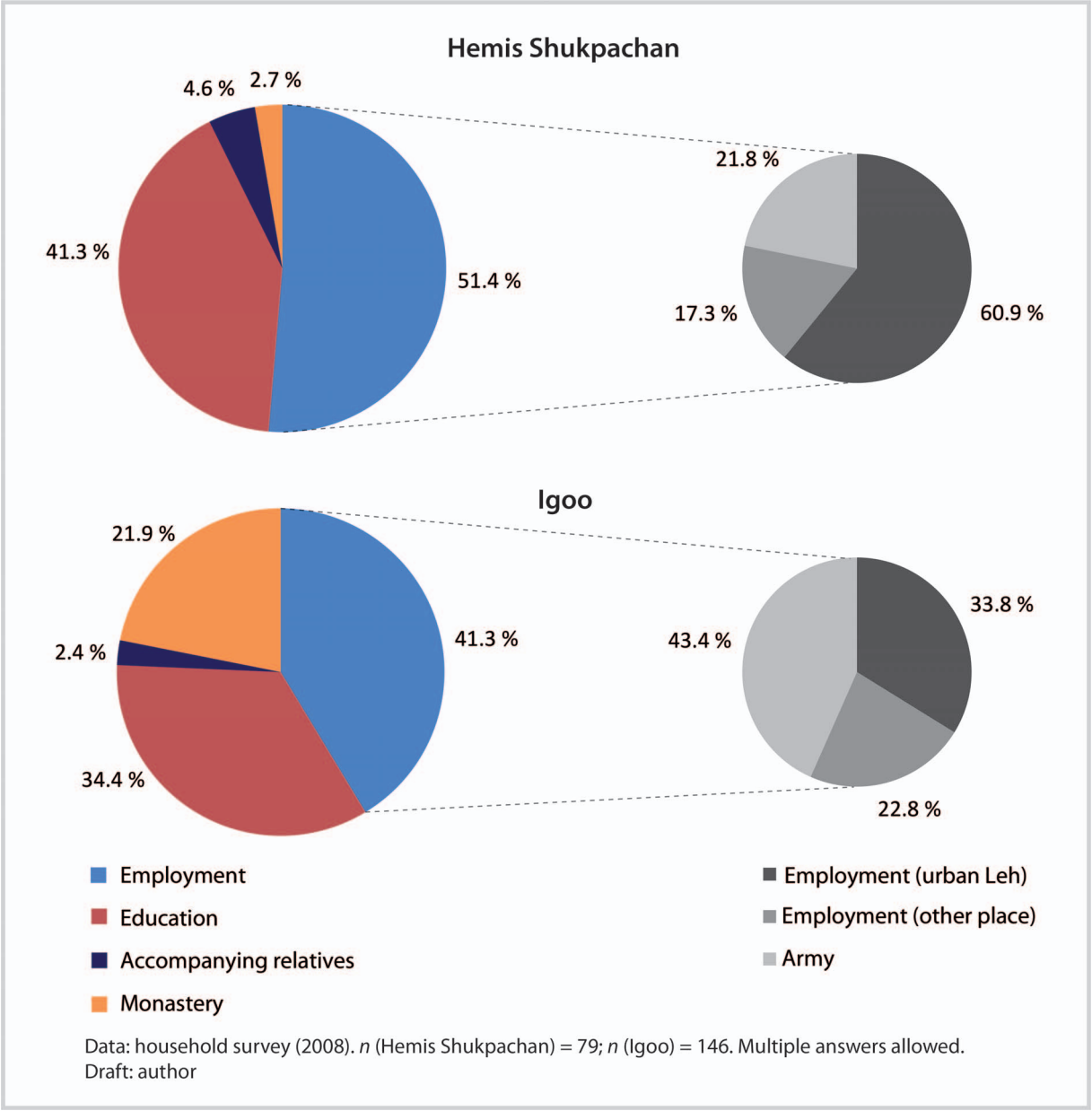
**FIGURE 2** Motivations for migration. (Dame 2015: 257, modified)




boom in tourism, which increased more than 10-fold from 17,707 visitors in 2006 to 235,698 visitors in 2016 (LAHDC 2018: 157), provides a valuable income source for guides, porters, or taxi drivers. Yet these options are generally limited to the peak season between May and September and at the same time overlap with the demands for agricultural labor. Such seasonality also affects wage laborers, craftsmen, or shopkeepers and is thus not fully reflected in the household data. Access to employment options varies. For instance, a homestay program allowed for income from tourism in Hemis Shukpachan, whereas army wage laborers and pensions were important revenue sources in Igoo (Figure 3). Moreover, employment potential with the army and in the tourism sector is generally gender-biased almost exclusively in favor of males. Further, permanent income opportunities for qualified persons arise with the administration, in organizations, or in education. Salaried jobs with the government, NGOs, or private educational institutes are mostly located in the district capital, show less gender bias, and generally lead to a second home in Leh town. Employees at government schools are rotated every 3 years, thus further inducing migration albeit not necessarily to the district capital.


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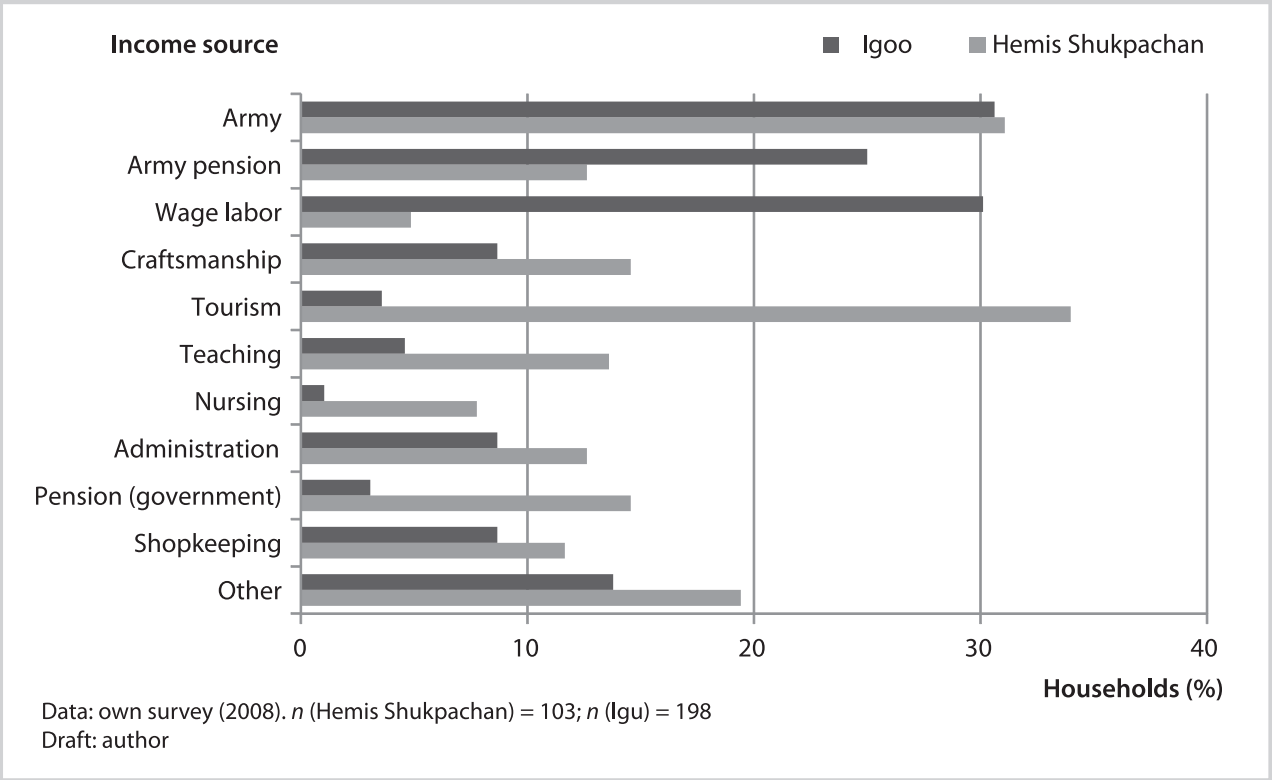
**FIGURE 3** Off-farm income sources of households in Hemis Shukpachan and Igoo. (Dame 2015: 253, modified)




Besides income generation, education was the second important driver for migration (Figure 2). Both focus villages offer schooling up to 10th grade only, forcing students who wish to pursue higher studies to migrate. Yet private schools generally have a better reputation, motivating families to send their children to boarding schools or private schools in larger villages, Leh town, or outside of Ladakh. The share of affected families is reported to be rising, with 57 of 122 in Hemis Shukpachan and 74 of 200 children in Igoo included in the household survey studying outside the village. In many cases, education-driven migration also affected mothers, who accompanied their children. Besides financial assets, social and family networks played a central role in these decisions. To pursue a university degree, students mostly moved to Jammu or Srinagar within the state or Chandigarh or Delhi, where Ladakhi student associations help students acclimatize to the place and bureaucracy (see also Smith and Gergan 2015). Of relevance for Igoo is a comparatively high number of novices. Children have enlisted with the Buddhist monastery community due to the proximity to the culturally relevant Hemis monastery and due to connections with a Buddhist nunnery in Nepal. While such migration decisions have been motivated by economic necessity in the past, households mentioned religious reasons, too, as a driving factor.

### Agrarian change: declining importance of food production

The increasing translocality of rural Ladakhi households has significant effects on agricultural activities. Out-migration leads to shortages in workforce, which results in erosion of community-based institutions for the maintenance of the irrigation network and reciprocal labor arrangements like transporting night soil and stable manure to the fields, ploughing, harvesting, and threshing. Twenty-seven percent of households in Hemis Shukpachan and almost 40% in Igoo reported that only 1 family member is fully engaged in agriculture. Concurrently, a gender gap in the declining agricultural workforce is apparent, as mostly (young) men are migrating (Table 2). Women and elderly then take over increasing workloads. These trends pose risks for households who lack financial assets and a workforce and rely on reciprocal labor. "I receive remittances from my son, but no further help from my neighbors. I have stopped keeping animals since I have been living on my own. For agricultural work, my son sometimes comes to Igoo" (IA35). For those villagers who return to take part in agricultural labor, especially at the time of harvest, their contribution to food production also means fulfilling a social norm. Others fully rely on remittances and food transfers, as described by an elderly woman: "If you get older, it is not possible to go to Leh or to cultivate fields. I get food from my relatives" (H79).


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**TABLE 2** Characteristics of agricultural land use of surveyed households in Hemis Shukpachan and Igoo. (Source: own survey 2008/2009)

| | Igoo | Hemis Shukpachan |
|---|---|---|
| **Crop choices (% households)** | | |
| Barley | 98.0 | 92.2 |
| Peas | 32.8 | 34.0 |
| Mustard | 79.3 | 68.9 |
| Pulses | 2.5 | 33.0 |
| Potatoes | 78.4 | 87.4 |
| Vegetables | 73.2 | 92.2 |
| *Greenhouse* | 17.2 | 20.6 |
| **Agricultural workforce (average)** | | |
| Male, full-time | 0.6 | 0.8 |
| Female, full-time | 1.2 | 1.4 |
| **Employment of laborers (% households)** | 22.2 | 45.5 |
| **Machines (% households)** | 27.3 | 82.5 |
| **Number of livestock (average number of heads per household)** | | |
| Cattle | 3.6 | 3.4 |
| Dzo/yak | 1.0 | 1.8 |
| Goats/sheep | 1.3 | 1.6 |
| Poultry | 0 | 0.1 |
| Horses | 0 | 0.3 |
| Donkeys | 0.8 | 0.6 |
| **Change in livestock reported (% households)** | | |
| Fewer animals than 10 years previously | 44.9 | 76.7 |

Due to the small size of terraced fields, Ladakh generally exhibits a low degree of mechanization limited to few tasks like threshing (Table 2). Consequently, financial remuneration is the only way to address the deficit in workforce, rendering cash income essential for households' food production. Villagers who could afford it employed wage laborers (*kulis*), often migrants from Nepal, Bihar, or Jharkand, for physically demanding tasks such as harvesting or cutting and transporting fodder grass during times of peak labor. One smallholder described the increasing necessity for cash inversion in agriculture: "Now, our children have left the house, so we totally depend on tourism and my income from it. And the children also send money to us. You see, today, we need more money, but now we are fewer people. For the agricultural work, we also employ *kulis*. And we need to use machines, because otherwise we would have to pay for more *kulis*. . . . After our children have left, only we, the parents, stay in the house so the income is less, but the expenses are higher" (H11). For longer-term tasks such as maintaining irrigation or herding of flocks, relatives or villagers with no other income were employed. Households with limited sources of cash, however, have to continue sharing the burden of intensive agricultural work through reciprocal labor agreements.

In some cases, entire households have migrated from the village, but maintain agricultural activities through almost full reliance on wage labor and temporal returns during peak working periods. Besides food production, motivations included the wish to prevent fallow fields (signifying neglect of societal obligations) and the desire to express belonging to the village community. This makes a later return to the village, such as upon retirement, more likely. For the younger generation, a new pattern of behavior can be witnessed, illustrated by a case from Hemis Shukpachan (2017). After the 3 daughters left for university, the elderly parents had to hire wage laborers to keep up food production. They have constructed a new house for the eldest daughter on one of their best fields, in line with the trending decline in multigenerational joint families. However, the house is not used except for occasional visits. Keeping up close social relations between migrated household members—in this case the entire second and third generation—and the village community include the participation in religious and lifecycle ceremonies, or spending the annual vacations from their vocation in the village. Moreover, translocality in their case facilitates the exchange of food and agricultural supplies and monetary remittances for the payment of *kulis*.

The declining importance of farming becomes evident in changing cropping patterns and the increasing extent of fields left fallow, as the case of Igoo exemplifies (Figure 4; Table 3). The abandonment of fields is a striking result of income diversification and a reduced necessity of home-grown food. Low-yielding plots and distant fields are typically given up first. In Igoo, families suffered a lack of workforce and financial means to restore their terraced fields after catastrophic flash floods in 2010.

In the 6 years between 2009 and 2015, the share of barley cultivation in the village dropped from 55.1 to 43.3% of the total agricultural area (Table 3). In Igoo, as in other parts of Ladakh, the number and size of kitchen gardens and greenhouses has increased through efforts of government and NGO programs. Although a smaller share, the area used for horticulture has almost doubled between 2009 and 2015, diversifying local diets with additional vegetables. However, smallholder agriculture with average land holdings of less than 2 ha is not considered economically viable. Cash crops such as potatoes are grown to a limited extent. A negligible number of households dispose of on-farm income exclusively (Table 1). Although land-based income is generally evaluated positively, farmers in the study villages


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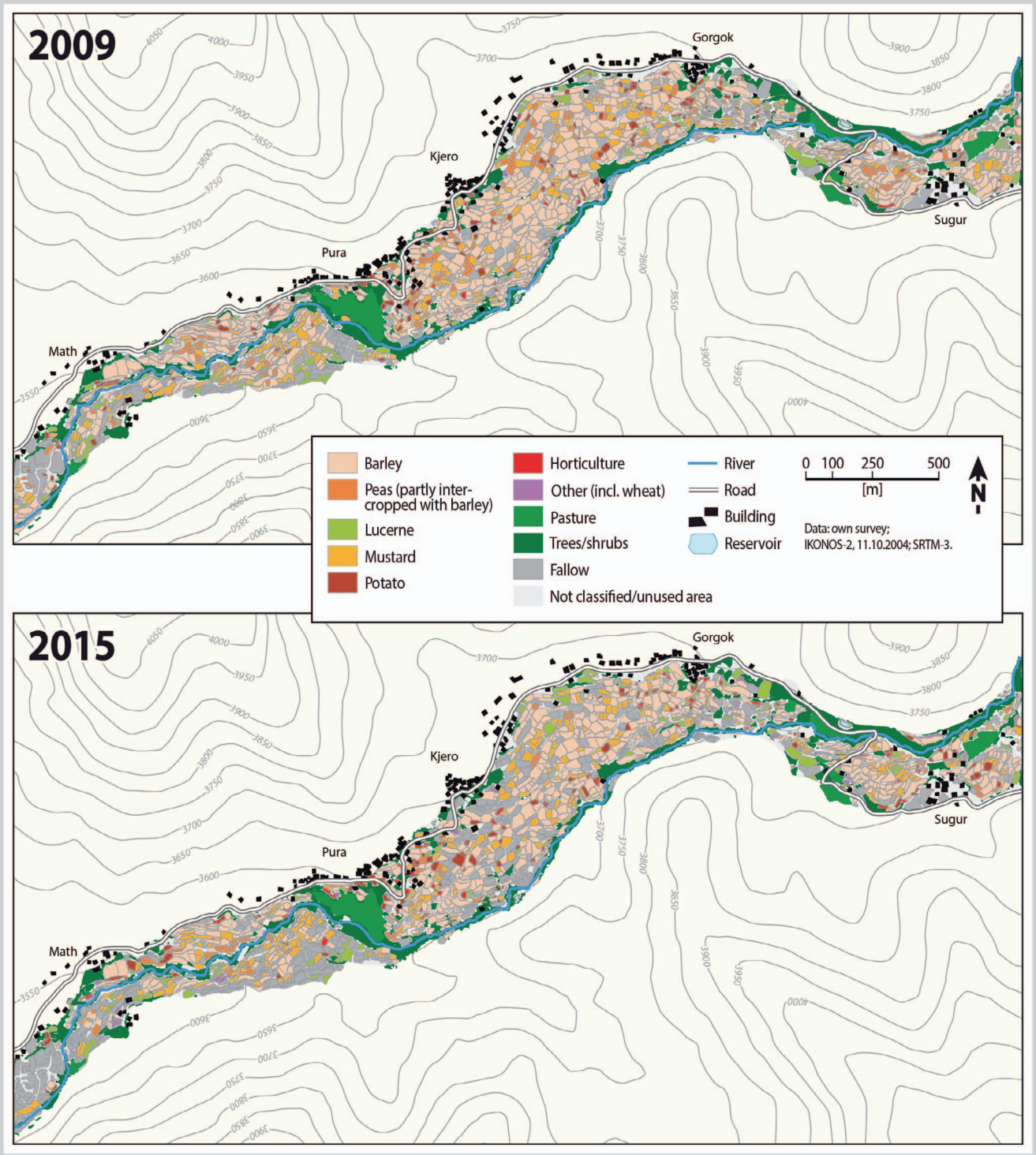
**FIGURE 4** Development of the cultivated area in the central section of Igoo between 2009 and 2015. (Draft: J. Dame. Cartography: J. Dame, J. Anhorn, J. Poerting, B. Kraus, N. Harm)




mentioned access to markets as a major problem. Because of the isolated location of the region, the surplus is sold to the army, tourists, and urban population in Leh. Few families directly sell vegetables in Leh market. Farmers reported benefits from selling surplus peas, potatoes, and other vegetables or fodder grass if the transportation is arranged—be it through the army or through middlemen. This explains the higher share of on-farm earnings in Igoo


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**TABLE 3** Quantitative changes in the cropping pattern of agricultural land in Igoo between 2009 and 2015. (Source: own survey/GIS calculations)

| Crop (share of cultivated area)[a)] | 2009 (%) | 2015 (%) |
|---|---|---|
| Barley | 55.1 | 43.3 |
| Peas (partly intercropped with barley) | 6.1 | 6.0 |
| Lucerne | 8.6 | 8.7 |
| Mustard | 13.0 | 13.1 |
| Potato | 3.9 | 4.1 |
| Horticulture | 1.3 | 2.3 |
| Other (incl. wheat) | 0.2 | 0.9 |
| Fallow | 11.0 | 21.6 |

[a)] Pastures, trees, and unused area have not been included in the GIS calculations.

compared to Hemis Shukpachan, where arranged transportation has only recently become available. Interviewed farmers would welcome a better integration into value chains. Moreover, interviewees stressed that younger generations consider farming less relevant for food security. The lack of land-based income generation is one reason for NGOs and government agencies to support agricultural programs. Experts involved in a program on organic farming stated that young people could return to the villages in future if organic products were marketed within and outside the region to generate local income.

Additionally, gathering of wild plants and numbers of livestock are declining (Table 2) and the use of summer pasture settlements such as in Igoo almost entirely given up. Surveys showed a significant reduction of total livestock (46% in Igoo; 76% in Hemis Shukpachan), mostly due to a lack of workforce. Households keep 1 or 2 lactating cows to meet their own needs, thereby nullifying the impact of the lack of market access to dairy products in the villages.

## Implications for food security

Social change, new mobilities, and modification in agriculture are reflected in the dietary behavior. Despite an increase in greenhouses and kitchen gardens and dietary diversification, households reported that storage options during the winter are limited and thus the concern of seasonality in the diet remains unresolved. Although on the decline, barley remained the main staple crop according to dietary recalls. This choice is influenced by sociocultural preferences. Barley products, such as *tsampa* (roasted barley flour) and *chang* (beer), have high cultural value and cannot be bought in markets. Therefore, family members in urban Leh have to rely on their villages of origin for these products. *Tsampa*, apricots, or vegetables are therefore brought to the city while gas cylinders and other goods are sent to the villages. The exchange of food and commodities thus becomes an important element of reciprocal relations between household members in the rural and urban areas.

Wheat farming has become much more uncommon than barley farming. However, wheat-based meals (eg local noodle dishes and breads) are typical items of the diet. Households can opt against wheat cultivation because the Indian targeted Public Distribution System (PDS) provides fine wheat (*atta*), rice, and sugar at highly subsidized rates to the population (Figure 5). Under the PDS, the state on the one hand assures minimum support prices for crops procured from farmers, mainly in high-yielding regions such as the Punjab. On the other, it guarantees subsidized consumer prices for staples, which are brought across the high mountain passes to Ladakh. Ration-card holders can pursue staples from so-called fair price shops (Landy 2017; Pingali et al 2017). Leh district has an ample coverage of 215 PDS shops (LAHDC 2016) to provide subsidized commodities. Although the PDS is primarily aimed at below-poverty-line recipients, market prices for rice, wheat, and sugar in Leh are even higher than prices for above-poverty-line recipients. Thus, most of the households in Igoo (93.9%) and Hemis Shukpachan (89.3%) benefited from the supplies and the direct availability in the village (Table 1).

Further, the PDS has significantly pushed for the consumption of rice in Ladakh. Dietary recalls have shown that 34% of households prepared rice on an average day. Interviewees give its taste as well as the lesser time necessary for its preparation as reasons for their choice. The preference for rice is also connected to an "Indianization" of diets and its evaluation as "modern," although traditional food items are considered to be healthier by many, especially elder Ladakhis.

The current developments are leading to a deterioration of the local food system and imply a transition towards an increased reliance on the PDS and the market. However, market access is a major concern. During summer months, a variety of fresh vegetables and fruits is available from home gardens and local markets. By the end of winter, when the passes are still closed, even shops in the district capital run out of stock of a range of products, such as eggs, milk, or tea. Few families have members in the army who have access to fresh products and even fewer can afford the high prices for air-transported vegetables.

Overall, a diversified picture of livelihood strategies can be depicted, in which many translocal households benefit, while others become more vulnerable to food insecurity. Increased mobilities generate varied amounts of monetary income and many village households profit from remittances, although often however, only a share of the income is remitted despite close social relations. At the same time, mobilities produce additional costs, such as for a second home, for education, and to sustain the living costs of the household members in urban places. Overall,


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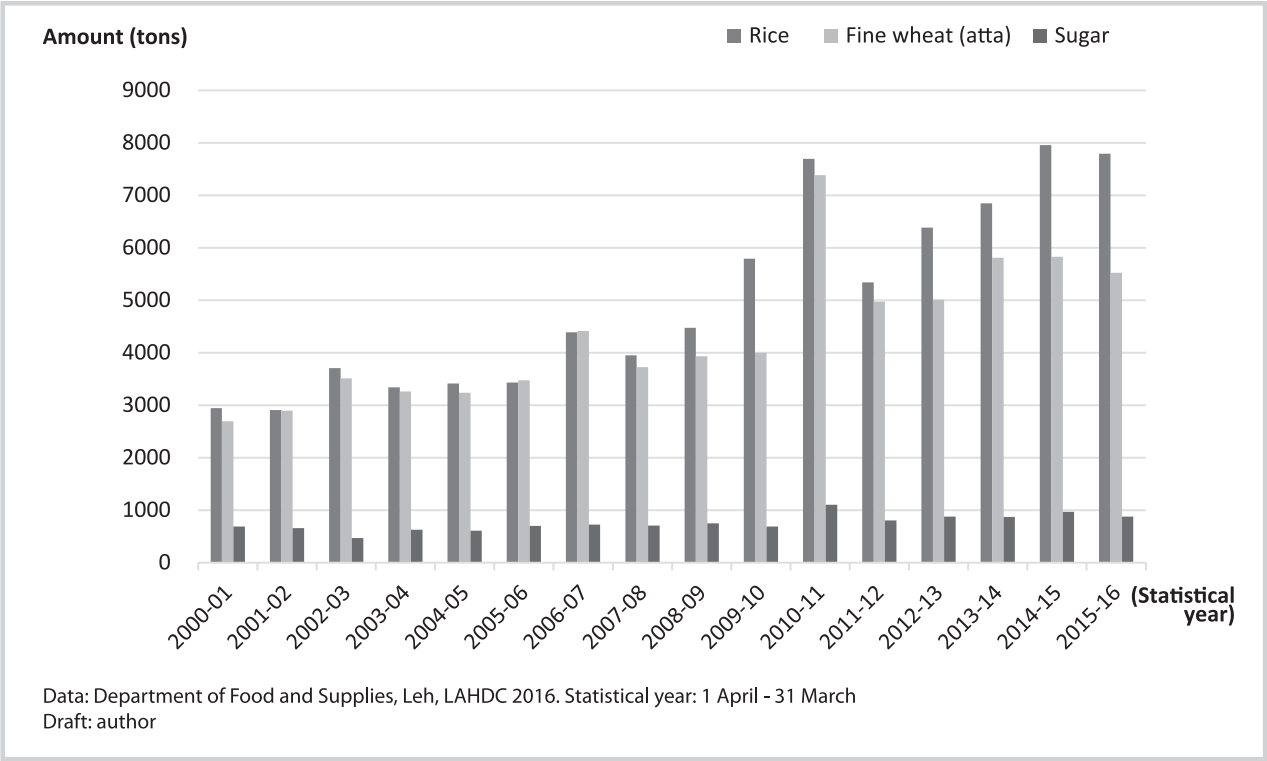
**FIGURE 5** Off-take (the amount that people actually buy from the ration stores) of subsidized rice, fine wheat, and sugar under the Public Distribution System in Leh District. (Source data: Department of Food and Supplies, Leh; LAHDC 2016)




large households with combined on-farm and off-farm income or with many income generators could enhance their food security by diversifying their farming practices and through improved market access.

At the same time, certain rural households are becoming more vulnerable to food insecurity. These households are either fully dependent on remittances from migrating members, unable to afford wage labor and thus reliant on reciprocal labor arrangements in agriculture, or have limited market access for selling and purchasing of food items. These households increasingly depend on their relatives and on food subsidies, as evident from an interviewee's response: "My daughters are working in other households as service personnel. … I face problems during winter, as my husband is not coming to the village and he is the one who usually brings money" (IA87). Elderly, female-headed, and smaller households with little monetary income and lack of agricultural workforce are particularly vulnerable. Their situation becomes especially challenging if additional risk factors like fading health or age restrict their labor potential.

## Discussion

The analysis of food security strategies in Ladakh shows the ongoing shift from a production-oriented to supply-oriented food system in the context of socioeconomic change, as observed in other mountain regions of South Asia (eg Tiwari and Joshi 2012; Rasul et al 2016). The current transitions affect the 3 interrelated food system components: availability, access to, and utilization of food. Changes in agricultural land use lead to a remarkable decline in regional food production. New mobilities induce translocal livelihood strategies and a lack of agrarian workforce in home villages. Instead, *food availability* strongly depends on markets and the PDS. The availability of subsidized staples not only bolsters agrarian change, but also leads to an increased reliance on food imports.

Off-farm income and remittances allow for purchasing food, thereby complementing, and in some cases replacing, agricultural food production. However, as illustrated, *access to food* depends on the overall household income and the amount of remittances. Seasonal employment, gender-biased employment options, and infrastructural limitations in the aftermath of hazards hamper access to food. In Ladakh, the issues of seasonality and limited food diversity during winter months have only partially improved.

At the same time, *food utilization* and dietary transitions relate to changing preferences influenced by a desire for different, urban lifestyles. A "crowding out of traditional micro-nutrient rich food crops" (Pingali et al 2017:77) has been described to explain this phenomenon for many regions of Asia. This change in consumption patterns, with a preference for processed food items and fine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grains, has possible impacts on the nutritional status (Rasul et al 2016; Adhikari et al 2017). Sociocultural preferences, such as the appreciation of barley and changing food choices, further influence the dietary pattern.

Overall, the study stresses the need for a deeper understanding of the role of translocal livelihood diversification for food security. While *translocality* has become an increasingly well-described phenomenon over the past years, it is necessary to acknowledge how it significantly changes rural livelihoods (Zoomers et al 2016) also in mountain regions (Kreutzmann 2012; Benz 2014; Gautam 2017). Findings from Ladakh depict typical processes, which have also been described for other areas within the Hindu Kush, Karakoram, and Himalayan region (Rasul et al 2016).

While some authors (eg Benz 2014, 2016 for the Karakoram, and Choithani 2017 for rural India) have argued that remittances enhance food and livelihood security, this study also depicts its challenges. The impacts of translocality lead to a more diversified picture, rendering some households more vulnerable to food insecurity. As in many rural areas of the global South, new mobilities and off-farm employment lead to "new rurality" and a "feminization of agriculture" (Zimmerer et al 2015: 52). As in neighboring mountain regions, this results in increased workloads for the elderly (eg Gautam 2017; Speck 2017), growing socioeconomic disparities, and an erosion of social institutions in the rural communities.

## Conclusion

Evidence from Ladakh not only underlines the need for holistic research approaches that acknowledge the complexity of food systems, but also confirms the need for food security policies and sustainable mountain development to choose cross-sectoral approaches and consider translocal livelihoods as a reality in mountain societies. This also needs to be considered by policymakers and NGOs who design their interventions based on village census data that is generally blind to the evolving spatial and temporal patterns of translocality. Holistic approaches that consider translocality will make it possible to address the objectives of sustainability, environmental integrity, and intra- as well as intergenerational equity (Wuelser 2014).

Besides programs to support agricultural production, improvements in postharvest processing, storage, durability, and market access would strengthen regional food production and reduce seasonal challenges in food availability. Improved market access and economic opportunities for small-scale farmers would better allow for on-farm income generation. In the context of social change, the most vulnerable households rely entirely on social networks, and supplies should be guaranteed in individual cases. It would be beneficial if economic development focuses on several sectors to secure (qualified) nonfarm-income opportunities for the younger generation. In addition, the provision of nutritional knowledge and a strong public health system can raise individual awareness on the quality of food items in the context of changing nutritional preferences and dietary transitions.

Against the background of advancing societal change and urbanization, future research could explore the effects of physical drivers such as climatic variability, water availability, and extreme events on food security to complete the picture. From a policy-oriented point of view, applied sustainability research on perspectives in agriculture such as organic farming and import dependency, and the question of food sovereignty are desirable.

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