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Yielding to high yields? Critiquing food security definitions and policy implications for ethnic minority livelihoods in upland Vietnam

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ABSTRACT

Agricultural intensification is at the core of the current agrarian transition in Southeast Asia. New crop varieties promise higher productive outputs, but depend on significant increases in chemical inputs. In the highlands of northern Vietnam, we find that adopting hybrid maize is inevitably associated with an increasing dependence on cash for direct and indirect inputs and investments. This reliance on the cash economy is a new reality for semi-subsistence ethnic minority Hmong households, and provides evidence of the advancing agrarian transition in Vietnam's remote northern highlands. While livelihood outcomes of hybrid seed adoption include increased maize yields, local farmers highlight numerous drawbacks, including unstable input prices, limited storage periods, pest concerns, and the increased reliance on cash. Strong preferences for the taste of traditional local maize, as well as concerns over regular harvests, lead many households to resist the full adoption of new hybrid varieties and redirect hybrid maize to livestock feed and household alcohol production instead. Thus while state policies extoll the virtues of high-yielding hybrid maize for poverty reduction, we find that food availability is an overemphasized element of household food security and upland agricultural development policies. Food security interventions must move beyond conceptualizing food security as a result of food availability alone, and also incorporate cultural acceptability of food, better understandings of hybrid maize cultivation challenges, and respect the seed diversity on which local livelihoods and food security rely.

1. Introduction

Noteworthy transformations are taking place throughout rural Southeast Asia linked to increasing market integration, the unrelenting commoditization of production, land grabbing, and the closure of land frontiers (Nevins and Peluso, 2008; Borras et al., 2011; Hall et al., 2013). With increasing demand for timber, biofuels, and food products, substantial land conversions are taking place alongside an unprecedented intensification of rural land use. Numerous actors from individual smallholders to large transnational corporations are involved, with these dynamics combining to intensify and deepen the agrarian transition at a scale unprecedented in Southeast Asia. Some individuals and households have benefitted significantly from increased commoditization and global market links, others have engaged only selectively in new market opportunities, while further groups have been disadvantaged by infringements upon indigenous rights, reduced resource access, and intensifying cultural clashes (Moore, 1998; Caouette and Turner, 2009). These sweeping changes are also closely connected to the challenges of food security, biodiversity, environmental degradation, and climate change (Misselhorn et al., 2012).

In the midst of this agrarian transition, Vietnam has been considered a poverty reduction and development success story after reaching lower middle-income country status in 2009. Surpassing a number of poverty-related Millennium Development Goals, the national poverty rate has fallen from 58% in 1993 to less than 3% in 2015 (World Bank, 2009a, 2012, 2015). Moreover, Vietnam now fluctuates between being the world's third or fourth largest rice exporter. While this all sounds extremely positive at the macro level, there are still real and increasing disparities in socio-economic wellbeing and persistent food security challenges (Nguyen Viet Cuong et al., 2015). Notably, ethnic minority households in Vietnam's northern uplands are seldom reaping the rewards of the country's agrarian transition and economic growth. The 2010 Vietnam Household Living Standard Survey (VHLSS) indicated that poverty rates were highest in the Northern Midland and Mountains region (29.4%), with ethnic minority Hmong households among the poorest at 48.7% (GSO, 2010a).[1] While the govern-

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[1] The 2010 poverty line was VND 3.12 million per capita per year (US$162 in 2010). Clearly, poverty rates are an incomplete story, given that many upland ethnic minorities maintain semi-subsistence livelihoods.

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ment has implemented upland poverty reduction and food security policies, little is known about the impacts of these policies on local people's long-held livelihood strategies and approaches to food security.

In its quest to enhance national food security, Vietnam's government is promoting intensified maize cultivation. National maize output rose significantly between 1961 and 2004 (Gerpacio and Pingali, 2007), and this trend continued with 2004 production levels at 3.43 million tonnes (yield: 34, 617 ha) rising to over 5.19 million tonnes (yield: 44,354 ha) in 2013 (FAOSTAT, 2015). This rise has been buoyed by technological innovations such as high-yielding hybrid seeds,[2] strongly endorsed by the government. Production is further encouraged to feed the domestic 'livestock revolution' (Gerpacio and Pingali, 2007; FAOSTAT, 2015). Concurrently, maize remains a staple crop for many upland subsistence producers and, due in part to subsidies and state propaganda,[3] hybrid maize varieties have been widely adopted to replace lower yielding locally-bred or 'traditional' varieties (landraces), including wild, open pollinated varieties (Zeven, 1998; Dang Thanh Ha et al., 2004; Erenstein, 2010; Stromberg et al., 2010). This continuing rise in demand for maize for food and animal feed is expected to result in further crop substitution, commercialization of existing maize-based production systems, and expanded and intensified maize cultivation, particularly in the agriculturally marginalized northern uplands (Gerpacio and Pingali, 2007).

Approximately 6.2 million people in small-farm households in Vietnam's northern region are food insecure or at risk of food insecurity (FAO, 2004). Hmong ethnic minority households in the four most mountainous border provinces (Sơn La, Lai Châu, Hà Giang, and Cao Bằng) are considered among the poorest and most vulnerable to food insecurity (FAO, 2004; Minot et al., 2006). Given the pace of the agrarian transition occurring throughout the region, researchers have suggested that the rapid modernization and commercialization of upland farming in such remote areas is *unlikely* to reduce poverty for many reasons – including inadequate market institutions, insufficient insurance, and weak communal safety nets (Pandey et al., 2006). Through our own fieldwork we have found that Hmong livelihoods in Hà Giang province rely heavily on maize cropping systems. However, limited scholarship is devoted to food security and livelihoods in this province, and to date, none focuses on the challenges and constraints to local Hmong household food security as Vietnam advances its agenda for industrialized agriculture.

This paper investigates how ethnic minority Hmong households in Hà Giang province, northern Vietnam (Fig. 1), are adapting to the introduction of state-supported hybrid maize seeds and the impacts this agricultural intensification program is having on local food security. We have three core objectives. First, to understand the role of state actors in the introduction and adoption of hybrid maize seeds in Hà Giang province. Second, to investigate the successes and challenges for Hmong household livelihoods adopting hybrid maize. Third, to examine the degree of agency Hmong farmers reveal in their negotiations over hybrid maize adoption. But before we address these objectives, why is this not just another paper on the Green Revolution? First, hybrid varieties (see footnote 2) are not the same as the original Green Revolution high yield varieties (HYVs) of wheat and rice. Second, while some upland semi-subsistence farmers in this case study sell hybrid maize for livestock feed or as maize alcohol, rather than consuming it, this market involvement is nowhere near the same degree as farmers typically targeted by Green Revolution technologies (hence a distinction from lowland Vietnam and many other areas of Asia). Third, as Bonnin and Turner (2012) found for hybrid rice in a neighboring upland province, the introduction of hybrid seeds and associated technologies is not presently leading to important social differentiation as occurred earlier in India with HYVs.

To address our objectives, we next propose a conceptual framework that draws on food security, sustainable livelihoods, and agency debates, before introducing the actors at the core of this investigation. We examine how the hybrid maize program has been implemented in these uplands, the official actors involved, and their understandings of the benefits and drawbacks for local communities. We then turn to local farmer interpretations of this intervention, focusing on four causal factors of livelihood vulnerability identified during interviews. We find that farmers are flexing their agency in the face of state agricultural programs, determining the limits of adoption with regards to their astute knowledge of environmental limitations as well as cultural acceptability. Accordingly, we argue that food security interventions must move beyond commonly conceptualizing food security as a result of food availability alone. Consideration must also be paid to the local seed diversity on which livelihoods and food security rely, cultivation challenges, and to more fully recognizing the importance of culturally acceptable food.

This research is based on data gathered during field research in Hà Giang province. During May–July 2013 the first author completed unstructured/conversational interviews with 51 Hmong maize cultivators in six communes (Đồng Văn, Phố Cáo, Phó Bảng, Tả Phìn, Thài Phìn Tủng and Lũng Cú), in Đồng Văn district, Hà Giang, regarding their adoption (or not) of hybrid seeds and associated livelihood dilemmas. Twelve semi-structured interviews were also completed with agricultural extension officers, state officials, and NGO representatives. These data are supplemented by information gathered in 2009 and 2010 by the second author during interviews with over thirty Hmong farmers and marketplace traders in Hà Giang province regarding rural livelihoods.

2. Conceptualizing food security, sustainable livelihoods, and the role of agency

Understanding the core dimensions of food security is critical to examining the impacts of state policies on semi-subsistence agricultural livelihoods in Vietnam's northern uplands. Food security can be considered an ideology, reflecting our normative sensitivities about hunger, inequalities in access to food and the means to produce it, and power differentials in the food system (Maslow, 1954; Maxwell, 1996). Maxwell (1996) has explored the development of post-modern undercurrents in food security debates during the decades following the 1974 World Food Conference when 'food security' was defined as the "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (UN, 1975, 14). Since then, Maxwell (1996) has identified three main transitions: from global and national to household and individual scales; from a 'food first' perspective viewing food as a lower-order human need to a preoccupation with long-term livelihood security (resilience) as a necessary condition

[2] Hybrid seeds are produced from selectively crossing two inbred and genetically different parental (P) lines. Female plants of the first (F1) offspring generation produce hybrid seeds, which are planted. The resulting hybrid plants possess heterosis or 'hybrid vigor', tending to produce higher yields. Yet, the seeds from these hybrid plants are significantly less productive if planted again; therefore farmers must purchase new hybrid seeds yearly (IRRI 2015). By contrast, random open-pollinated varieties (OPVs), and farmer-developed crop varieties (farmer-saved seeds) produce biodiverse landraces adapted to local environments (Zeven 1998; Gerpacio 2001; Vernooy 2003). A central problem of hybrid seeds in the paradigm of sustainable agriculture is the fact that they are essentially a genetic 'dead-end'.

[3] State propaganda to promote hybrid maize seed adoption includes posters extolling the virtues of hybrid maize pasted on the sides of road-side stalls and state buildings throughout the uplands, announcements made over village loudspeaker systems, and calendars distributed to farmers.

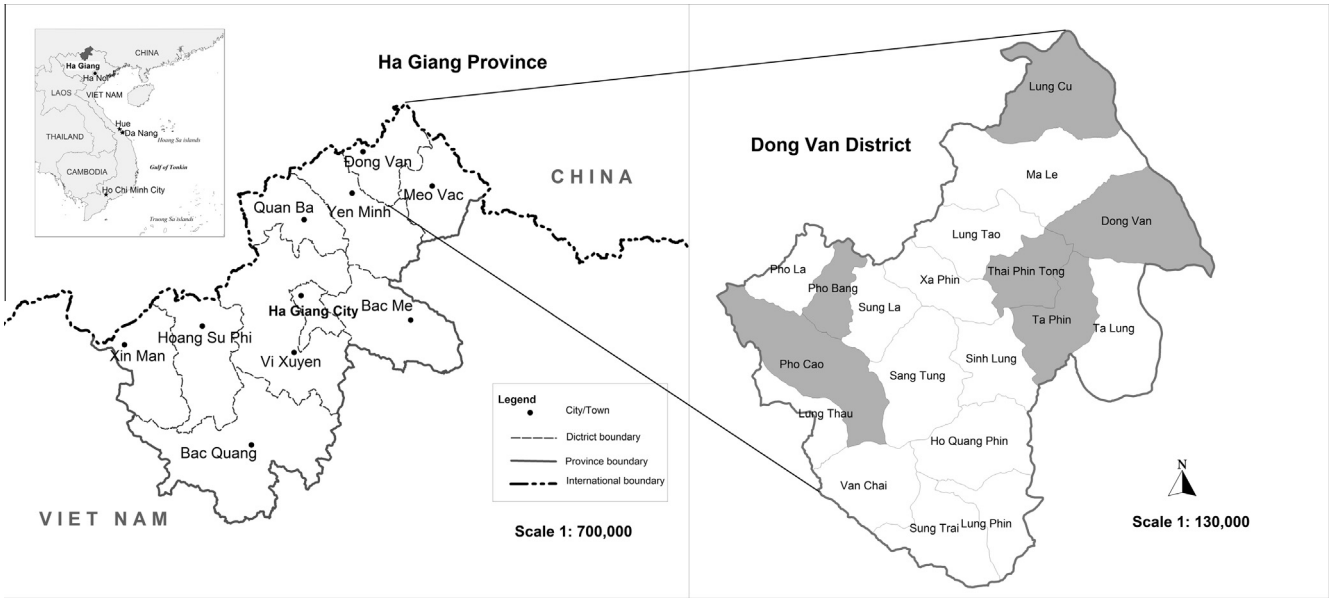

Fig. 1. Hà Giang province situated in northern Vietnam with field site communes shaded (Map credit: Đinh Thị Diệu).

for food security; and from objective indicators to subjective perceptions of causes and situations leading to food insecurity.

Today, numerous definitions of food security revolve around dimensions including *availability*, *acceptability*, *accessibility*, *appropriateness*, and *agency* (Pinstrup-Andersen, 2009; FAO, 2015; WHO, 2015). While many countries and NGOs continue to emphasize *availability* as their key food security focus, debates have arisen over how to create more inclusive, actor-oriented approaches to food security (Jacobson, 2007). It has been argued that defining and analyzing food security at the individual level requires a more subjective approach, while acknowledging that individual food security is still influenced by broader political and socioeconomic contexts (Maxwell, 1996). Indeed, it is only by accentuating the voices and lived experiences of individual actors and their understandings of food security and sustainable livelihoods, that one can truly begin to understand the local, everyday realities of creating and maintaining food secure livelihoods that are culturally acceptable and appropriate (Kontinen, 2004; Long, 2004). In this paper we show that analyses of individual and household food security require greater attention to qualitative measures – such as cultural acceptability of food, perceptions of well-being, and the political processes that influence access to food. This ensures that food security interventions do not follow an oversimplified linear trajectory, as cautioned by Long and Van Der Ploeg (1989).

To investigate the challenges for Hmong farmers adopting hybrid maize, we also draw on the sustainable livelihoods literature. Chambers and Conway (1992, 5) initially defined livelihoods as being comprised of "capabilities, assets (including both material and social resources) and activities required for a means of living". They added that a *sustainable* livelihood can "cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base" (Chambers and Conway, 1992, 5). A sustainable livelihood approach emphasizes that livelihood assets (financial, natural, physical, social, human) are a means to achieving various livelihood outcomes, including improved food security, while noting that livelihood strategies[4] are vulnerable to external transforming structures and processes, and social exclusion. The vulnerability context is especially acute for livelihoods depending on semi-subsistence agriculture. As we explore in our research, government policies towards ethnic minorities in Vietnam's northern uplands aim to transform local agricultural practices, thereby influencing the livelihood vulnerability context of rural households. In this regard, Scoones (2009) has also emphasized the need for more political analysis of livelihood perspectives, particularly relevant for our research with ethnic minorities in socialist Vietnam, where access to arable land and inputs for intensified agriculture (hybrid seeds, chemical fertilizers, and pesticides) is influenced by state policies.

By underplaying less tangible social and political influences in practice, the sustainable livelihoods framework can be constrained by its tendency to focus on aspects of material access and ability (Kanji et al., 2005; Scoones, 2009; Carr, 2013). Yet, ever since Karl Polanyi's seminal works (e.g., Polanyi, 1944), many social anthropologists and human geographers have demanded the recognition of "the cultural, historical, and spatial dynamics of rural livelihoods—in addition to the more obvious economic dynamics" (McSweeney, 2004, 638). These dynamics, embedded in local histories, customs, and systems of regulation, in turn shape economic exchanges and related livelihood decision-making (de Haan and Zoomers, 2003, 2005; Eakin et al., 2006). By considering such micro-scale social relations and their embeddedness, more inclusive and culturally appropriate actor-oriented approaches to livelihoods are possible. Indeed, if we listen to the voices and experiences of individual actors, respect homegrown knowledges of 'development', and analyze the way local actors adapt modern circumstances to their reality, we can shed light on the local everyday practicalities of how people use their agency to make, negotiate, and protect their livings (McGregor, 2009; Turner et al., 2015).

3. Situating people, politics, and agrarian change in upland northern Vietnam

Vietnam is an ethnically diverse society. The state recognizes 54 'nationalities'; the Kinh majority (*Việt*, lowland Vietnamese), and 53 'national minorities' (*các dân tộc thiểu số*). Hmong are the second largest ethnic minority group in the northern uplands, numbering just over 1 million. In Hà Giang province, the most northern province in Vietnam, sharing a border with Yunnan, China, the total population is 724,537, of whom 231,464 are

[4] Scoones (1998, 9) defines three broad clusters of livelihood strategies: agricultural intensification or extensification, livelihood diversification, and migration.

Hmong, the province's largest ethnic group (GSO, 2010b). Here, semi-subsistence Hmong households engage primarily in cultivating staple food crops (maize and rice), various vegetables and fruit in small home gardens, and raising livestock. In the northern district of Đồng Văn, where this study takes place, tough agro-ecological conditions including a steep karst landscape and poor soils, are suited to cultivating upland maize, rather than rice.

Before and after the introduction of *Đổi mới*, the state's economic renovation that began in the mid-1980s, numerous state strategies were designed to "handle highland minorities in the most effective and economic way" to avoid impeding Vietnam's steady 'modernization' (Michaud, 2009, 25). By 1998, the Vietnam government had established 21 different national policies and projects aimed at socioeconomic development, cultural modernization, and poverty reduction among 'backwards' ethnic minorities in upland areas. Such state policies continue to impact the local livelihood and agricultural choices available.

The most important poverty reduction program for residents in what are labeled 'remote and difficult areas' is Program 135 or 'Socio-economic Development for the Communes Facing Greatest Hardships in the Ethnic Minority and Mountainous Areas'. First introduced in 2001 and implemented in three stages to date, Program 135 was designed to "help people in ethnic minority and mountainous areas overcome poverty, narrow the income gap with other communes in other districts and provinces and eliminate risks for social instability" (Ha Viet Quan, 2009, 2; see also Nguyen Viet Cuong et al., 2015). A key component is the provision of agricultural extension and technology, such as access to improved varieties of seed (World Bank, 2009a, 2009b; Bonnin and Turner, 2012). Nevertheless, upland ethnic minorities still frequently encounter government officials lacking reliable information about their livelihoods and cultures, with the state pushing to integrate them into the national agenda of neo-liberal growth (Forsyth and Michaud, 2011). This policy framework has failed to achieve sustained positive outcomes and, based on recent statistics, these policies have fallen short of improving the quality of life for thousands of ethnic minorities in the northern highlands. These outcomes are symptomatic of planned interventions that do not address the agro-ecological and socio-cultural complexities of this region.

Officials at Hà Giang's Department of Agriculture and Rural Development (DARD) noted that hybrid maize seeds were first introduced to the province in 2001. Provincial and district level government officials (and documents) argue that agricultural science and technology, intensive cultivation, and new plant varieties (including hybrid maize) will improve economic development in the province (People's Committee, Hà Giang Province, 2012). However, these seeds are only available through cash transactions from either government distribution centers (via agricultural extension officers) or from suppliers in local marketplaces who have privately imported seeds from China.

Elsewhere in these uplands, local people's resistance[5] and innovative livelihood coping strategies in the face of such agricultural technologies are increasing. Bonnin and Turner (2012) note in their *Geoforum* study of hybrid rice in neighboring Lào Cai province that farmers experiment with different rice seeds to maximize yields and taste. A selective diversification approach is the most popular agricultural livelihood strategy there: local rice varieties are preferred for their taste and are grown for as long as possible, while hybrids are turned to only when necessary for their higher productivity (often due to land constraints). Yet farmers complain that hybrid rice seeds are unreliable in upland agro-ecological conditions, and combined with state management of the hybrid program, farmers must find resourceful ways to compensate for late delivery times, uneven supplies, and poor seed choices (Bonnin and Turner, 2012). Such struggles with hybrid rice in a neighboring province, yet one with a more forgiving topography, lead us to delve further into the hybrid maize program and local peoples' reactions in Hà Giang.

4. Yielding to high yields?

4.1. Livelihood transforming structures: the roles of state actors in the adoption of hybrid seeds

The Vietnamese government has been instrumental in operationalizing the agrarian transition, in turn impacting upland livelihoods through a series of institutions, organizations, policies, and other legislation; namely the 'transforming structures and processes' of the livelihood framework (DfID, 1999). In addition to Program 135, discussed above, which directly impacts ethnic minority communities, hybrid seed management is organized nationally by the Ministry of Agriculture and Rural Development (MARD), which oversees a Crop Department (including a National Center for Plant Variety Testing and Certification), the Plant Protection Department, the Technology Department, and the National Center for Agriculture Extension. Provincial level seed management at the Department of Agriculture and Rural Development (DARD), and District level seed management mirror the national organization in crop, extension, and plant protection offices. Government agricultural officials collaborate with seed companies to undertake research trials assessing seed quality and yields.

To date, hybrid maize seeds are supplied by two main seed companies: Syngenta, a Swiss agrochemical and seed conglomerate; and Charoen Pokphand (CP) seed company, an intermediary supplier based in Thailand (Hà Giang DARD officials, pers. comm.).[6] These seed companies dictate the prices at which the government can purchase hybrid seeds, and in turn the government controls seed prices for farmers. Every district in the province has a seed distribution centre selling seeds. Despite state attempts to regulate prices, officials indicated that prices are higher in rural districts further from the provincial capital city.

Extension service delivery to farmers occurs through commune-level agricultural extension officers (AEOs) and district level agricultural officials. Considering the directional flow of seeds and information from private industry to the provincial and then district levels, extension officers themselves have little influence over which specific seeds are introduced or any effective avenue to communicate cultivation challenges farmers are facing back up the chain of command. Indeed, the prevalence and consistency of cultivation challenges Hmong farmers reported to us concerning hybrid seeds that have been cultivated for a number of years, highlights the lack of effective feedback mechanisms. At the commune level, agricultural extension services supposedly assist local farmers with cultivation concerns regarding hybrid maize seeds. Yet access to technical seed information rests heavily on meetings usually held in the Vietnamese language, not local languages such as Hmong. This limits the knowledge attendees gain, as well as what information can be transferred to family members not attending demonstrations. Extension support also depends on the number of households an AEO serves, and the degree of trust between AEOs and local farmers. Providing extension services to a large number of scattered village populations is challenging, with one AEO inter-

[5] The forms of resistance that we are suggesting here are covert in nature, given the political context in which these farmers live, and majority-minority circumstances (see Turner et al. 2015). Often undetected by officials, these resistance measures parallel those explored by Kerkvliet (2009) as part of his 'everyday politics'.

[6] The seed and agrochemical multinational company Monsanto is not yet associated with hybrid maize seeds in these uplands. This does not preclude its involvement in the future however, given the company has offices in Ho Chi Minh City.

viewed in Phố Cáo commune serving 91 households, a fairly common constituency size (AEO, pers. comm.).

Interviews with extension officers throughout communes in Đồng Văn district revealed that households had variable rates of hybrid maize seed adoption (corroborated by our interviews with farmers themselves). The adoption rate was slow in Phó Bảng commune, as Hmong AEO Mr. Cai[7] explained, with Hmong households continuing to rely on local maize to supply their food and feed needs. Mr. Kau, a junior Hmong agricultural extension officer in Tả Phìn commune, admitted the most challenging aspect of his first six months on the job was trying to convince Hmong farmers of the advantages of new hybrid maize seeds: "Some people believe me, but some say 'you just coming out of school and we have been doing the farming for all our life'". Conversely, Mr. Phuc, a Kinh extension officer, described hybrid maize adoption in Lũng Cú commune as a forced process that took place over a number of years:

> At first they didn't know how to use it exactly, and from 2008 we had to really press the local people to plant it. Right now, they are already used to the hybrid corn and now we don't need to order them to plant hybrids, they actually come to the commune to get it themselves, but before we had to really pressure them to plant.

Understandably, local farmers are apprehensive to change their long-held methods of maize cultivation, and mistrust of extension officers with limited practical farming experience remains high. Moreover, while coercion by agricultural extension officers reflects the state's desire to impose agrarian change onto local households, Hmong farmers' reactions, detailed next, highlight their ability to challenge this imposition, consistent with the overall risk averseness of semi-subsistence farmers (cf. Just and Zilberman, 1983; Besley and Case, 1993; Feder and Umali, 1993).

Interviews with government officials highlighted that the *availability* aspect of conceptualizing food security is often overemphasized in agricultural policies for poverty reduction in these uplands. Unmistakably, those working at the provincial Department of Agriculture and Rural Development equate increasing maize availability via hybrid maize with improving livelihoods. As one official put it, "maize seed is very important – increased quantities of maize helps people have better lives" (Hà Giang DARD Official, pers. comm.). While increasing food supply is undoubtedly a critical aspect of food security, agricultural policies directed solely at increasing production can fail to sufficiently address the socio-cultural implications of high-yielding agricultural interventions.

It is important to note though, that in a one-party socialist political system such as Vietnam's, where local policies cannot contravene national decrees, local commune level officials 'on the ground' do express "rightful criticism" of the implementation process of national and provincial policies they must officially endorse, but have no role in designing (Turner et al., 2016). Also working in Hà Giang province, Turner et al. (2016) found evidence that provincial level decrees and policies generally fail to consider the local context in which officials operate, ignoring factors such as a diverse and difficult topography, poor infrastructure, and limited road access. Indeed, many of the agriculture extension officers (predominantly Hmong) we interviewed voiced critiques of hybrid maize similar to those reported by Hmong farmers including poor taste, insect infestations, and spoilage during post-harvest storage, as discussed next. These repeated concerns suggest that the government is applying lowland surplus-driven agriculture policies, in the form of high-yielding maize seeds, to an upland environment and cultural context most likely unsuitable for intensive agriculture.

Moreover, NGO representatives are concerned about how isolated policy initiatives create an artificial separation between areas of responsibility for different departments, ultimately creating policy or program silos instead of a coordinated policy framework. In Vietnam, such policy failures frequently result in a disconnect between national government departments and their respective programming areas (World Bank, 2009a; Turner et al., 2015). One NGO representative highlighted this clearly in a 2013 interview:

> When I say MARD [Ministry of Agriculture and Rural Development] is responsible for income-generation, and MOLISA [Ministry of Labour, Invalids, and Social Affairs] is responsible for human resource development, you can see the problem of policy because you cannot separate farming from human resources. For example... I say MARD should change the way that it provides more capacity building for human resources, but they say 'no no no, that's not my business, that's MOLISA'... MARD has a very small budget for training, it is very much ad hoc training... and they cannot ask for more budget because MOLISA holds all the budget for human resources...and CEMMA [Committee for Ethnic Minorities and Mountainous Areas] is responsible for culture and customs; you cannot separate customs and culture from agriculture budgets!

All told, while introducing hybrid seeds to the northern uplands is part of a wider national state strategy to modernize and intensify rural agricultural systems, it also appears that the official push for high-yielding maize adoption among Hmong households in Hà Giang province is viewed as a relatively simple agronomy-based solution to food insecurity.

4.2. Farmer perspectives: Hybrid seed adoption and Hmong livelihood vulnerabilities

Dilley and Boudreau (2001) argue that 'vulnerability' within food security debates is often defined in terms of specific *outcomes* such as hunger, food insecurity, or famine. This can mask socio-economic or ecological events or shocks that can lead to such outcomes (but see Sen, 1981 as an exception). By contrast, vulnerability analysis within a livelihoods framework tends to focus on the specific *causal factors* that can have direct impacts on people's livelihood assets and options (DfID, 1999). We focus on four such factors here.

4.2.1. Natural and financial capital demands

A critical delineation has been introduced by the hybrid seed program: only those households with access to relatively flat land can plant hybrids, while local seeds continue to be grown in small pockets of soil on steep karst landscapes (the soil often initially placed there by farmers themselves) (Fig. 2). Provincial agricultural officials and farmers could not provide any insight into why hybrid maize is only viable when cultivated on flat land. Perhaps it is because early hybrid maize research trials were completed in lowland environments in Vietnam or elsewhere, and more recently, in accessible, flat areas of Hà Giang.

Interviewees with access to the required natural capital, namely flat land, noted that seed subsidies are important for obtaining hybrid maize seeds. These subsidies are a key affirmative tool in the state's agricultural policy toolbox. Subsidies are granted based on household income or poverty level following Program 135, and minority farmers pay anywhere from 20% to 100% of the seed price. As Hmong farmer Ms. Hao explained:

> The government supports some households 100%, especially the poor families, while the normal [middle-income] families and

[7] All names are pseudonyms and are first names with an additional gender marker. All quotes are from 2013 fieldwork.

Fig. 2. Flat landscapes where hybrid maize can be grown (left), contrasted with steep kart landscapes where only traditional landraces grow (right).

> the rich families, they have to pay 100%. It also depends on which seed you have; some seed is a little bit more expensive, some is less expensive. CP999 is the cheapest, but a lot of people do not have enough money to pay for this...

Interviewees added that both the prices of seeds and the level of subsidy a household is entitled to, can change from year to year, creating livelihood uncertainties and stress over financial capital needs.

Since hybrid maize cannot be used to propagate new seeds, farmers must bear the expense of buying new seed, subsidized or not, every year (there is generally one maize crop annually in these high-elevation communes). Hmong householders, such as Mr. Yee in Tả Phìn commune and Mr. Nhia in remote Lũng Cú commune, reported frequently selling alcohol distilled from hybrid maize, along with pigs reared on hybrid maize feed to generate this necessary financial capital. Mr. Yee's household plants on average 1 kg of hybrid maize seed annually. Being classified as "normal" (middle income) by local officials, his household does not qualify for seed subsidies and must pay the full seed price. Similarly, Mr. Nhia, having a highly productive farm planting on average 20 kg of hybrid maize seed annually, pays the full price for hybrid maize, and like Mr. Yee, was also selling pigs to generate the required income. A few farmers also gain employment locally or across the border in China as agricultural labourers, or sell homemade textiles in local markets, to access necessary cash. Money is also needed because, despite the agro-ecological conditions making it impossible to grow terraced wet-rice and tough to even grow dry rice, Hmong households overwhelmingly prefer to eat rice as their staple diet food rather than maize, buying rice from local markets where accessible.

When growing traditional maize landraces, local farmers mix organic fertilizer – known locally as 'black fertilizer' – from ash and animal (usually cattle) dung. To grow hybrid maize, farmers are encouraged to use chemical fertilizers (known locally by the fertilizer's color: blue, white, green, red) and apply approximately 70–75 kg per application. Refusing to completely abandon traditional ecological knowledge however, farmers tend to use both: 'black fertilizer' is applied when the seeds are planted, followed by one or two chemical fertilizer applications during the plants' growth cycle. For instance, Mr. Yee, a 29 year old farmer with two children in Tả Phìn introduced above, applied a mixture of natural and chemical fertilizers three times over the maize growing season to improve root development. Similarly, Mr. and Mrs. Sua, both in their early 50s with five school-aged children, cultivated hybrid maize in Phó Bảng by applying the mixture twice seasonally. While hybrid maize seeds are subsidized by the state for some households, chemical fertilizers are not – despite being a co-requisite to hybrid seed cultivation. Moreover, fertilizer prices are high, with farmers in Phó Bảng commune, Đồng Văn district, purchasing fertilizer in Chinese border markets for VND400,000–450,000 (USD$20–22.50) per 50 kg sack. The cumulative cost of multiple fertilizer applications for hybrid maize over the growing season is a significant drawback. As agricultural extension officer, Mr. Phuc, explained: "The hybrid maize produces more maize and of course changes the local people's life and they harvest more. But on the down side, they use a lot of fertilizer, and they can only grow [hybrid seeds] on flat land, not on the hills".

Worrying about having enough cash at the right time to access seed and fertilizer stocks impacts material and psychological well-being, both important when conceptualizing food security. As Hmong farmer Mr. Xa, father of two young boys living in Tả Phìn commune, explained: "We have to worry about selling animals to get money to buy the seed, otherwise if you don't order it, and you don't pay for it [at the necessary time], you won't get anything [seed] to grow". Provincial level agriculture official Mr. Cuong at DARD added, "it is difficult for Hmong to make investments in new seeds – they are expensive and conflict with traditional farming practices".

Farmer interviewees noted that incorporating hybrid maize into their livelihood portfolios as an alternative to lower yielding local maize has generally increased the *quantity* of maize produced (i.e. the *availability* aspect of conceptualizing food security). Hmong farmer Mrs. Lan explained that growing hybrid maize means she and her husband have enough to eat annually, thanks to effective chemical fertilizers and higher harvests. Yet, rather than switching completely to hybrid seeds on their suitable land in Tả Phìn, this small farming household (without children) has been growing hybrid maize for the past five years following a 50:50 hybrid:local proportion due to the cash demands of hybrids, their land suitability, and other concerns discussed next. Indeed, just over half (54%) of the households we interviewed that were growing hybrids have resisted the full adoption of hybrid maize seeds in a selective and partial adoption strategy.

4.2.2. Hybrid variety concerns and pest pressures

Oftentimes, cultivation challenges force households to switch from one hybrid maize variety to another. For instance, Mr. and Mrs. Sua in Phó Bảng commune, introduced above, cultivated hybrid seed variety CP999 for over 15 years, but switched to CP555 due to declining root development. Likewise, farmers Mr. Xee and Mr. Txoo explained that their households switched from growing variety NK4300 because the weather in their commune, Tả Phìn, is "not good for this type of seed". Due to such problems, these households prefer to grow more local than hybrid maize, recognizing that local seeds are more drought resistant.

The susceptibility of hybrid maize to spoilage during storage is also critical to adoption rates. Farmers Mr. and Mrs. Vaa explained that hybrid maize "goes bad [rots] really quickly...so when it's good, it's better than local maize but when it's bad, its much worse than local maize". Householders reported various durations hybrid maize could be stored before spoiling, with these periods always shorter than for local maize. For example, Hmong farmer Mr. Xa, who cultivates CP999 hybrid maize seeds, noted that hybrid maize can be kept for up to one year, while local corn can be stored twice as long. Mr. Tu, a Hmong police officer and farmer in Phố Cáo, praised high-yielding hybrid maize, yet admitted it decays quickly within three months, adding, "many people don't want to grow this corn because it's too difficult to keep". In Tả Phìn, elderly farmer Mr. Xee and a young farmer Mr. Txoo linked their preferences for local maize over hybrid maize to both taste and storage properties, with Mr. Xee explaining: "We like the local corn more, because it tastes better and we can store it longer". For these households, longer storage stability of local maize was attributed to its stronger husk compared to the thinner, weaker husk of hybrid maize. For some, the livelihood vulnerabilities of adopting hybrid seeds are just too great, with the households of Mr. Tho and Mrs. Tsa eventually abandoning hybrid maize cultivation due to its susceptibility to spoilage.

A Kinh agriculture official attributed such storage problems to the so-called 'traditional way' of Hmong farmers and their slowness to adapt: "We teach the local people how to store it but they are still living in a really traditional way...people are used to storing it upstairs in their house, and the smoke coming from downstairs [the kitchen fire] is sometimes not dry enough and that's why it goes bad really quickly". She added that traditional storage practices are not good for hybrid maize, saying "you have to take a lot of time to break it down into small pieces, make it really dry, and put it in a big sack; that's the proper way to store it". While this might be the case, with limited information from agricultural extension officers, farmers need to find their own solutions and maintaining traditional varieties is a rational approach for many.

Adding to storage concerns, post-harvest pest management strategies are critical to maize yields and food security, as middle-aged Hmong farmer Ms. Chi in Phố Cáo commune explained: "A lot of bugs eat the corn because the leaves that grow around the corn cob are not long enough to cover the entire cob...and that's why also when it rains, all the water is coming into the corn, so you really have to harvest it at the right time, in the right season". Likewise, Kinh agriculture extension official Mr. Phuc noted "after harvest it is difficult to store [hybrid maize] because the end [of the husk] is always open a little bit and then is always very easy for the insects to get in it and to eat...". For this specific concern, agricultural extension officers were able to provide little recourse.

4.2.3. Declining intercropping and agrobiodiversity

Mixed cultivation and intercropping are typical features of Hmong food systems that increase the productive output of limited landholdings. Local maize plants are grown further apart than hybrid plants, allowing space for intercropping pumpkin or beans, contributing to greater overall farming output. Moreover, cultivating beans and other legumes in mixed cultivation or crop rotation is widely understood to benefit soil fertility by encouraging the activity of nitrogen-fixing microbes (Cassman et al. 2002, Tilman et al. 2002, Olivares et al. 2013). However, as Hmong farmer Ms. Lang explained: "When we grow hybrid corn we cannot grow beans in between, so we only grow hybrid corn...because the distance is too close, 20 cm is not enough to grow beans". This limited ability to intercrop means households must access, prepare and cultivate more land, or risk reducing total farming output.

Agrobiodiversity maintained by small-scale farmers is a cornerstone of global food security, broadening the varietal database of plants and reducing vulnerability to climate stresses and shocks and pests (Brookfield, 2001; Liang et al., 2001). Such agrobiodiversity is a concern in Hà Giang province, since it is near impossible to control how the genetic components of hybrid plants interact with native species planted in close proximity. As the dominance of local maize genotypes and phenotypes becomes somewhat diluted, it becomes difficult to distinguish between local and hybrid types. Not surprisingly, the mixing of local maize varieties and newer hybrid maize plants is evident when speaking with Hmong householders and maize vendors in marketplaces. One elderly farmer and military veteran in Phó Bảng, Mr. Tee, noted how cross-pollination between hybrid and local maize varieties is contributing to the loss of local varieties:

> Now we have the local maize but when we grow it together [with the hybrid maize] the flowers go through each other so it's all mixed...and the taste is not very good for the hybrid maize. Now it's difficult to find local maize because they are all mixed...because we grow too much hybrid maize, it is already mixed all together.

As Vernooy (2003, 3) has argued, "modern agriculture is like a huge inverted pyramid; it rests on a precariously narrow base". This narrow base is partially comprised of a small number of varieties designed for intensive production. Cross-pollination and mixing of local and hybridized agricultural plants is a naturally occurring phenomenon with implications for seed diversity, and by extension, food security. Cultivating monocultures of food plants, whether through selective breeding (hybrid seeds) or biotechnology, is a controversial strategy in modern agriculture often associated with losses in agrobiodiversity over time, susceptibility to disease, and soil infertility (Altieri and Merrick, 1987; Altieri, 1999; Zhu et al., 2000; UNEP, 2005; Smith et al., 2008). Indeed, Shiva et al. (2002) argue that *rejuvenating* agrobiodiversity is the most sustainable insurance against pest damage. Ultimately, the Hà Giang provincial government's strategy to replace local varieties of maize with high-yielding hybrid maize will have far reaching impacts on the diversity of local upland food systems.

4.2.4. Taste preferences and food acceptability

Talking to farmers it became increasingly clear that conceptualizing vulnerability to food insecurity in terms of outcomes such as extreme hunger was overlooking a crucial conceptual element of food security and livelihood equations in the region, namely *culturally acceptable* food. Taste preferences directly influenced how households decided to use hybrid maize, and in addition to preferring rice to maize, Hmong householders voiced clear taste preferences for their traditional maize over hybrid varieties.[8] Hmong farmer Mrs. Tsa explained, "the taste of [hybrid] maize is not really as good as regular local maize that we have. Hybrid maize is only for feeding pigs, and especially for making alcohol... So we don't eat it

[8] This mirrors recent findings in neighbouring Lào Cai province, where local Hmong households also preferred the taste of traditional Hmong rice varieties over hybrids (Bonnin and Turner 2012).

so much. . .we eat the local maize more". She clarified that her family retains access to local maize as a staple, *despite* its lower yields. Similarly, farmer Mr. Xa noted that his family uses hybrid maize "for livestock and also to eat. . .but we will eat the local maize more than the hybrid corn. . .the local corn tastes much better".

Farmers thus divert the less palatable hybrid maize to livestock feed and alcohol production as a strategy to retain more of the superior tasting local varieties for household consumption. A Hmong woman selling maize kernels at Đồng Văn market, explained that local maize has a softer texture, and therefore "tastes much better" than the tougher hybrid maize. These different properties of traditional versus hybrid maize surfaced again and again during interviews, suggesting a strong association between taste and food acceptability. Indeed, Hmong farmers' comments on taste were unanimous, reflecting a highly embedded cultural response and perhaps even a cultural marker of distinction from lowland populations. Further, farmers frequently spoke positively of those they knew who had enough land to be able to maintain traditional varieties of maize.

5. Discussion: The roles of agency and cultural preferences

Hmong farmers in these uplands are exercising their agency to moderate the impacts of hybrid maize policies on their livelihoods. Mrs. Ze, a successful maize alcohol vendor in Đồng Văn district, highlighted this agency when sharing her perspective on the state seed subsidy strategy: "The government says we are very poor, and they want us to leave the local corn, not to grow the local corn anymore, so that's why they give us the free [hybrid] seed to grow for the land here, but we only grow it for pigs and for alcohol, not to eat". Likewise Hmong farmers retain local maize varieties wherever possible to reduce household vulnerability to yield losses from pests known to attack genetically similar monocultures (Altieri and Merrick, 1987; Altieri, 1999). Such subtle resistance is confronting planned interventions that have been based on an oversimplified linear model of policy, implementation, and positive agrarian outcomes (Long and Van Der Ploeg, 1989). The result is "the reinterpretation or transformation of policy during the implementation process [by Hmong farmers], such that there is in fact no straight line from policy to outcomes" (Long and Van Der Ploeg, 1989, 227). Households organize themselves in different ways in the face of state-planned interventions – at the 'social interface' between structures and actors (Long, 2001) – and when necessary subtly challenge or quietly resist the full adoption of this new agricultural technology.

The experiences of upland Hmong farmers in Đồng Văn are echoed by upland maize farmers in neighboring China, where Li et al. (2012) have highlighted the persistence of landraces planted from farmer-saved seeds on smallholder farms in the karst mountainous region of southwest China (Guangxi, Yunnan, and Guizhou provinces). This trend has occurred despite the rapid expansion of hybrid maize cultivars, new seed regulations (in part to promote hybrid seed adoption), and the establishment of a commercial seed market. Likewise, in Guatemala's western highlands, van Etten et al. (2008) found maize diversity persists (despite the influence of modern varieties) due to local and regional seed exchanges that are a source of crop innovation. Moreover, Negi (1994) found in the mountainous Himalaya region of India that farmers did not adopt wheat high-yielding varieties (HYV) despite marginally higher yields, because corresponding declines in straw yields did not meet their livestock feed needs.

In Vietnam, the World Bank (2009a, 243) states that inappropriate development policies designed by lowland Kinh continue to misinterpret minority livelihoods and cultures, suggesting that minorities are intellectually inferior and must be shown "how to develop". McElwee (2004) adds that ethnic minorities have been quietly resisting poorly planned development policies formulated at the centralized national state level, such as monocropping methods encouraged in highland areas. Further, Turner et al. (2015) provide evidence of a range of ways Hmong farmers indigenize modernity and quietly resist the wholesale acceptance of the state's 'development' approach.

As these cases briefly show, care must be taken in livelihood research not to "assume that people are entirely dedicated to maximizing their income. Rather, we should recognize and seek to understand the richness of potential livelihood goals. . .to understand people's priorities, why they do what they do, and where the major constraints lie" (DfID, 1999). Hence, what do Hmong householder experiences in Hà Giang tell us about people's livelihood priorities and how this agrarian intensification program has impacted food security outcomes?

The benefits of planting hybrid maize, namely higher yields for human food and a feed source to support more livestock (therefore increasing potential wealth accumulation), are tempered in Hà Giang province by a range of challenges and vulnerabilities. These include inconsistent seed subsidies, the yearly cost of buying seeds and fertilizers, the specific type of land required, the inability to intercrop hybrid maize with other food staples, and the susceptibility of hybrid maize to spoilage during post-harvest storage by mold or insect infestations. Hybrid maize adoption is also associated with an unexpected outcome relating to food acceptability, namely hybrid maize's inferior taste. As such, hybrid maize alcohol and livestock reared on hybrid maize-based feed are sold among households or at local marketplaces for cash income, used in turn to purchase hybrid maize seed inputs and rice to eat. This indirect use of hybrid maize to purchase rice was a surprising, yet recurring theme in three-quarters of our household interviews, and further illustrates the significance of food preferences in influencing livelihood strategies and how livelihood assets (especially financial capital) are used.

Some twenty percent of householders interviewed reported having "a better life" with hybrid maize yields, an intangible outcome of well-being, yet an equal proportion of adopters perceived themselves as remaining food insecure, with no increased benefits, and still not having enough food to eat throughout the year. Thus, despite the introduction of hybrid maize, food insecurity persists among some Hmong households in Đồng Văn district. Householders' experiences with new varieties also suggest the possibility that hybrid maize quality and productivity decline over time, causing dependence on a continuous supply of newer 'improved' seeds. An agro-technology adoption treadmill may result, where dependency on new varieties compounds the permanent losses of local indigenous maize agrodiversity – a looming threat to future food security for Hmong farming households.

In ignoring farmer concerns over subsidies, input costs, maize storage, pests, preferred taste, and agrodiversity, the central and provincial Vietnamese governments fail to recognize what Long and Van Der Ploeg (1989, 228) refer to as the fundamental nature of intervention; "an ongoing, socially-constructed and negotiated process, not simply the execution of an already-specified plan of action with expected outcomes". From the perspectives of farmers, there are important limitations to theoretical models of agrarian change that drive policy intervention practices. One such limitation is that intervention "is not a discrete phenomenon in space and time", but rather is linked to the "historical imprint" of past interventions and local context (Long and Van Der Ploeg, 1989, 229–230). With these aspects in mind, revisiting the sustainable livelihoods framework highlights how state-supported hybrid maize seeds are testing the flexibility of upland Hmong livelihoods, and at times increasing their vulnerability. Diagrammatically, this can be seen by superimposing the realities

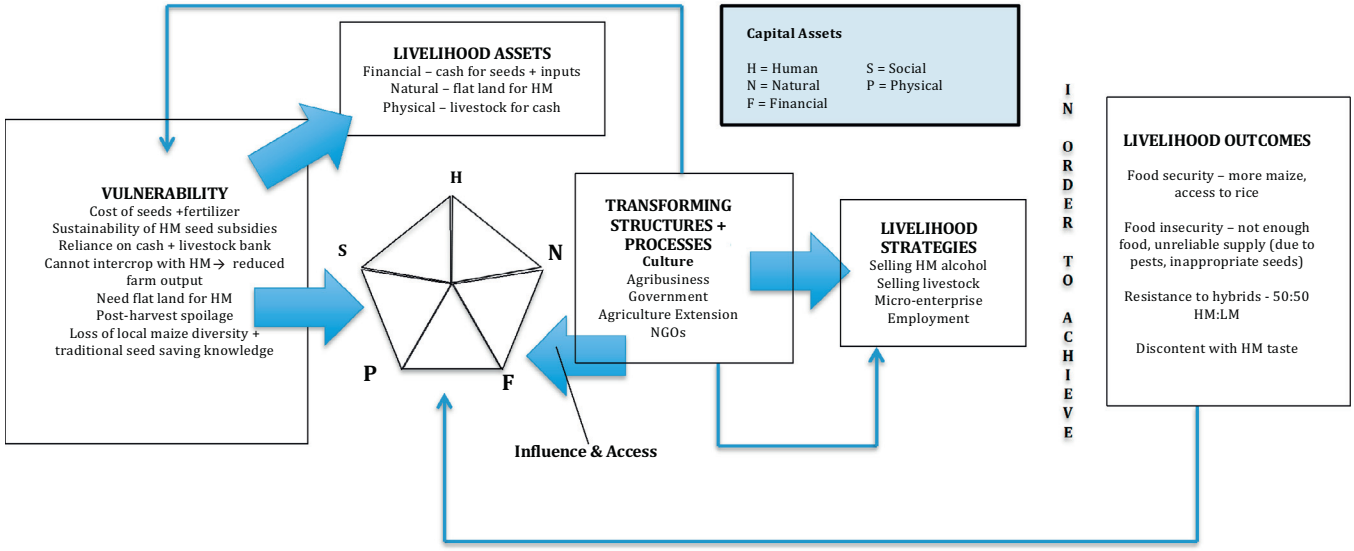

Fig. 3. The Livelihoods Framework for Hmong Households adopting hybrid maize in Đồng Văn District, Hà Giang (adapted from DfID, 1999). HM = hybrid maize, LM = local maize, 50:50 refers to the predominant maize cultivation strategy.

of the hybrid maize experience for Hmong households in Đồng Văn district on the livelihoods framework (Fig. 3).

Hmong households adopting hybrid maize experience a livelihood vulnerability context associated with an increased need for financial capital (reliance on cash to purchase seeds, fertilizers and pesticides), limitations to traditional farming techniques (a decline in intercropping), and the need for flat land (natural capital) to cultivate hybrid maize. Seed affordability and potential losses in local seed diversity as adoption continues, are also important factors. A greater maize supply allows many families to generate income to buy rice – an indirect positive impact on food security. However food insecurity persists for other households as hybrid maize does not ensure enough food for the year. Strategic, cautious resistance to full adoption of hybrid maize, reflected in common 50:50 proportions of local:hybrid cultivation, along with the use of hybrid maize when necessary to generate income to buy rice, strongly suggest the on-going cultural value of and preference for local varieties. In turn, these approaches reflect a reluctance among farmers to fully accept the state's agricultural development policies or full dependency on the market economy – outcomes unanticipated by the state.

We would further argue that, as a conceptual tool, the sustainable livelihoods framework would be enhanced by emphasizing culture as a significant transforming process shaping livelihood decisions (including agronomical decisions) of rural subsistence farmers. Some authors have suggested that 'cultural capital' should be added as an additional asset to the sustainable livelihoods framework (rather than sometimes subsumed under social capital). They draw on the work of Pierre Bourdieu who notes that cultural capital (simply put), relates to the skills, knowledge, education, and possible social advantages a person has that can give them advantages in society (Bourdieu, 1984). Yet, what we are proposing here is slightly different. We are focusing instead on long-term culturally rooted traditions and understandings of agro-ecological norms (such as organic fertilizer) and food preferences (taste), in addition to other regular cultural constructs such as language, social habits, religious practices, morals, and so on. Highlighting these elements is important due to the core role that the cultural appropriateness of specific foods plays in the story of (partial) hybrid adoption.

6. Concluding thoughts: Championing a hybrid intervention

Life in the mountainous regions of northern Vietnam is a delicate negotiation over state ideals of 'market socialism' and 'modernization', state and lowlander prejudices of upland ethnic minorities, and the physical realities of an unforgiving, upland terrain. As the agrarian transition advances in this frontier region, the state appears to be ignoring a number of long-term impacts of intensified modern agriculture on upland livelihoods, local ecosystem health, and the complicated spatial and temporal dimensions of agrodiversity. Yet the question remains: Is yielding to high yields the answer to food insecurity among highland ethnic minorities in northern Vietnam?

The World Bank (2009a, 257) warns that overemphasizing monocropping, high inputs of fertilizer and pesticides, and hybrid seeds will not serve as a sustainable model for agricultural production in "cash-poor areas too remote from markets". The International Assessment of Agricultural Knowledge, Science and Technology for Development (McIntyre et al., 2009) further cautions that scientific achievements in agricultural knowledge systems have unintended consequences that have yet to be sufficiently addressed – namely persistent rural poverty due to asymmetric agricultural development between regions and countries, and unsustainable use of natural resources. Offering an alternative approach to the agrarian transition, Brookfield (2001) replaces Boserup's linear model of intensification with an emphasis on diversified production and livelihood opportunities. Likewise, within their critical appraisal of development challenges facing ethnic minorities in Vietnam, the Ethnic Minority Working Group (2014) acknowledges that many minority livelihoods in the uplands will continue to depend on subsistence agriculture in the near future, therefore recommending that policies recognize and support the small-scale diversified agricultural model these communities have long had in place. As Long and Van Der Ploeg (1989) suggest, planned interventions – in this case, in the form of hybrid seeds, chemical fertilizers, and other associated technologies – are not necessarily a precursor to agrarian transformations, but rather often part of the problem of 'development'.

To improve food security in Vietnam's northern uplands it is necessary to maximize productivity on limited arable land area. Yet, judging from the observed challenges to hybrid maize

adoption, alongside uplanders' intimate knowledge of the sustainability of already fragile upland food systems, state efforts to solely 'maximize productivity' appear to be stalling. Completely replacing local maize varieties with hybrid maize, which provincial authorities aim to do, is likely to make fragile Hmong subsistence food systems more unsustainable in the longer term, adding considerable stress for these farmers. Clearly, this planned intervention for agricultural development and food security does not consider the practical, socio-cultural aspects of Hmong semi-subsistence agriculture. Our findings hence raise important questions about the future long-term impacts and sustainability of hybrid maize in these uplands.

We therefore argue that a *hybrid solution* is necessary – an integrated complementary system of hybrids and landraces supporting both commercial and subsistence needs. As Bellon and Hellin (2011, 1442) note: "The challenge is to develop agricultural modernization pathways that build on the complementary functions of hybrids and landraces to improve farmers' livelihoods, rather than focusing on substituting one by the other". We suggest three core features for this hybrid solution: first, the integration of agricultural research in northern Vietnam that builds on hybrid maize seed adoption experiences in highland environments elsewhere in the rural Global South – experiences that are relevant to semi-subsistence livelihoods. Second, participatory plant breeding (PPB) that engages (instead of marginalizing) local people in finding creative solutions for food insecurity. This approach could maintain, widen, and improve the seed resource database with respect to environmental suitability, taste preferences, and conserving seed agrobiodiversity for food security (Vernooy, 2003; Mba et al., 2012; Winarto, 2011). Indeed, the potential of this approach is already being explored across the border in China, as described by Li et al. (2012) in their conceptual model for participatory hybrid maize breeding procedures. Involving farmers in hybrid development early in the pre-breeding stage broadens the population base of farmer-maintained local landraces, and can support the co-evolution of on-farm genetic resources with hybrid varieties. Finally, food security policies must move beyond conceptualizing food security as a result of food availability alone, and incorporate cultural acceptability to a far greater degree. Understanding upland ethnic minority cultures, dietary preferences, and agricultural systems (including local informal seed-saving systems), is essential to improving agricultural outcomes over the long term. Whether the Vietnamese government can adopt such features will determine if hybrid maize seeds actually lead to real and sustainable improvements in food security for upland ethnic minority households into the future, or whether a rigid, top-down approach that harms local livelihoods will prevail.

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