

Agrarian Transitions in Two Agroecosystems of Kayah State, Myanmar

Loikaw Township



Report on the Agrarian System Diagnosis in Kayah State
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Kayah State ASD Report

Cover photos, from top to bottom and left to right: Kayah women cleaning her fields in Daw Lu Shey; tilling and seeding of green gram (mung bean) in Daw Lu Shey; upland rice in Daw Ta Naw © 2013, Aldebert & Meulle

Abstract

Located on Myanmar's eastern border with Thailand, Kayah State has long been isolated because of conflicts between the minority groups there and the Burmese army; as a result, little is known about its agricultural systems. As a preliminary to NGO agricultural development projects, an agrarian diagnosis of two major types of agroecosystems in the state—lowlands alluvial plains and uplands—was conducted. The objective was to identify recent agrarian changes leading to the current presence of different types of farmers in each area and understand their development potential.

Both agroecosystems have followed very different evolutionary trajectories, mainly because of politico-historical factors. In the lowlands, farmers with irrigated plots are administratively obliged to grow irrigated rice, while others who are forced to grow flooded rice but unable to irrigate can diversify into vegetable growing. In the uplands, communications infrastructures allowing access to the market are a source of differentiation between villages. Farmers who have this access are growing cash crops such as maize and pigeon peas, while those who do not have access continue with upland rice-based systems.

The introduction of perennial crops such as rubber, non-perishable food production in the uplands, and horticultural diversification in the lowlands are waiting for future policies at the national level.

Keywords

Myanmar, Kayah State, household agriculture, agrarian diagnosis, agroecosystem, uplands, lowlands, evolutionary trajectories

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Units and Currency Conversion

Myanmar currency: Kyat

September 2013	€uro 1.00	= US\$ 1.30	= Kyat 1,275
Exchange rate used in this report, July 2013	€uro 1.00	= US\$ 1.20	= Kyat 1,300

Conversions from the imperial system to the metric system:

Length	39.4 inches		1.0 meter
Area	2.4 acres		1.0 hectare
Mass	2.2 pounds	1.65 viss	1.0 kilogram
Volume	0.2 gallon		1.0 liter

Acronyms and Abbreviations

ASEAN	Association of Southeast Asian Nations
CP	Charoen Pokphand (a Thai agro-industrial company)
DLS	Daw Lu Shey (lowland non-irrigated village)
DTN	Daw Ta Naw (upland village with access to the market)
DTY	Daw Ta Yoe (upland village isolated until 2012)
HHD	Hsaw Hki Daw (lowland irrigated village)
NGO	Non-Governmental Organization
GP	Gross Product
AI	Agricultural Income
TI	Total Income
GVA	Gross Value Added
NVA	Net Value Added

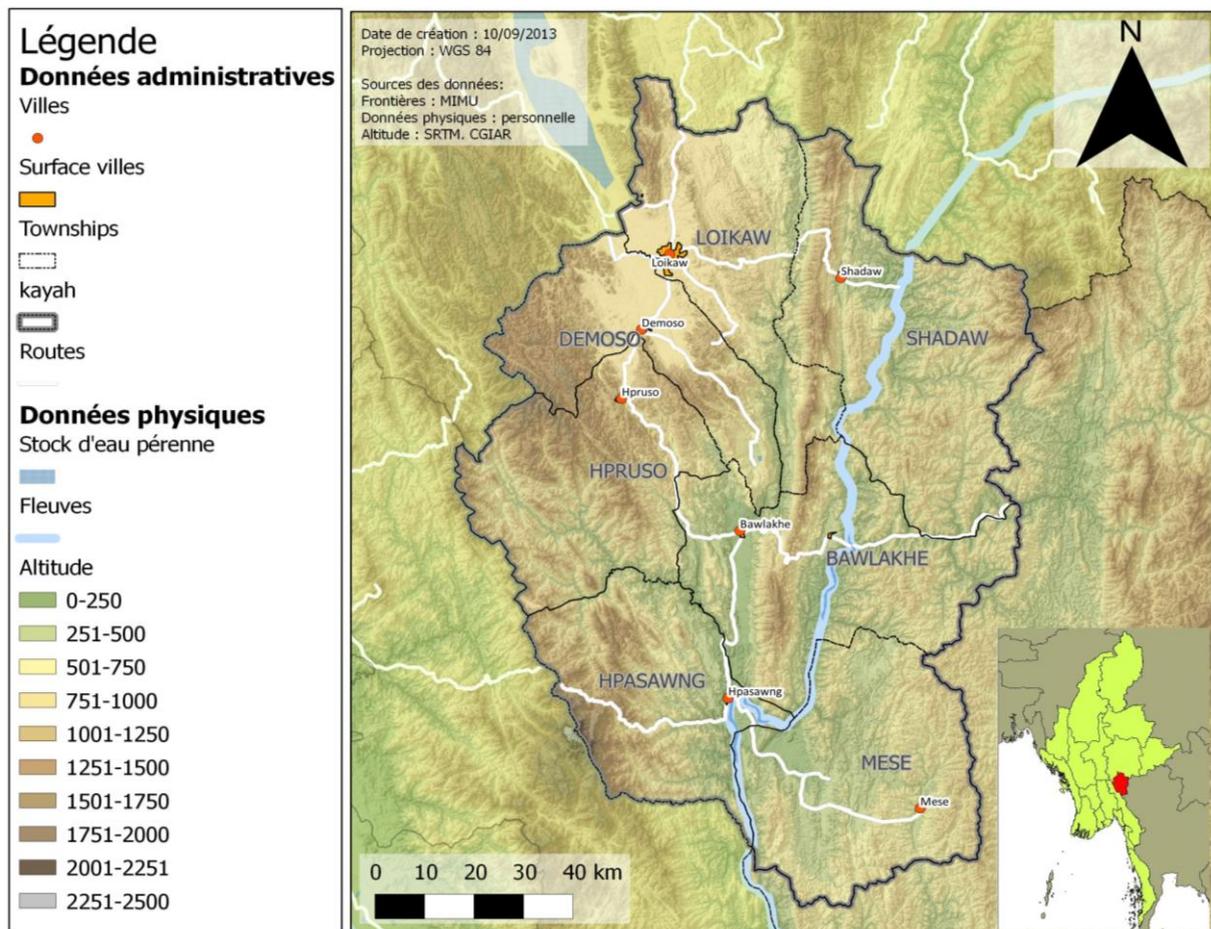
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1. Introduction

Located on Myanmar's eastern border with Thailand, Kayah State has long been isolated because of conflicts between the minority groups there and the Burmese army. Little is known about its agricultural systems. As a preliminary to NGO agricultural development projects, an agrarian diagnosis was conducted in the state. Selecting an area for the fieldwork that covered lowland plains and the surrounding mountain areas allowed for a comparative analysis of two major types of agroecosystems farmed in this state. The aim was to (i) identify the diversity there and the dynamics or transformations underway, (ii) assess economic performances and factors limiting farm development, and (iii) determine needs and define lines of thought for future interventions at different scales (from local to national).

Figure 1: Map of Kayah State and its Townships



2. Methodology

An agrarian system diagnosis is fieldwork that takes in account the society, the environment, agricultural practices, and their interrelations. The important elements of this kind of diagnosis are:

- a regional view of the fieldwork (this scale is useful in explaining agrarian dynamics; it also matches the scale of NGOs' agricultural development projects);

- a focus on the fieldwork and the survey, from the landscape and plot observation to the analysis of the relationship between the biophysical environment and agricultural practices; and
- work on the agronomic and economic performances of the production systems.

One aspect of this type of diagnosis includes a detailed description of farm structure and how farms operate in order to consider hypotheses regarding the prospects for change on farm level taking into account farmers' constraints. It examines agriculture, but does not analyze either its products or the value chains for these products. It can reveal the conditions under which farmers would be able to modify their agricultural practices. This work is based on a systemic approach (multi-scale and multi-perspective analysis) requiring recourse to a wide range of sciences such as agronomics, economics and sociology in order to reveal the complexity of farm operation. The study is founded on the postulate that "farmers have good reason to do what they do" (Jouve, 1992) and it is very important to understand the reasons for some of farmers' actions. They must combine (i) diverse physical factors such as the nature of the soil, rainfall, temperatures, etc., and (ii) exogenous elements such as access to the market or equipment, input prices, policies, etc.

As the authorities limited our movements to Loikaw Township, this agrarian diagnostic was not able to be done for all of Kayah State (as had initially been planned). To be representative of this township, we studied four villages: two villages in the rice plains that, although located in the same agroecosystem, have different dynamics; and two uplands villages, the first of which has introduced market crops, while the second is still predominantly growing food crops.

	Lowlands		Uplands	
Agricultural Conditions	<i>Irrigated</i>	<i>Not Irrigated</i>	<i>With Market Access</i>	<i>Without Market Access</i>
Village Name	Hsaw Hki Daw	Daw Lu Shey	Daw Ta Naw	Daw Ta Yoe
number of households surveyed/total number of households	20 / 80	22 / 70	25 / 75	8 / 10

3. Main Results

The influence of national policy factors on the region has set and differentiated the course of the evolutions undergone by each of the agroecosystems studied.

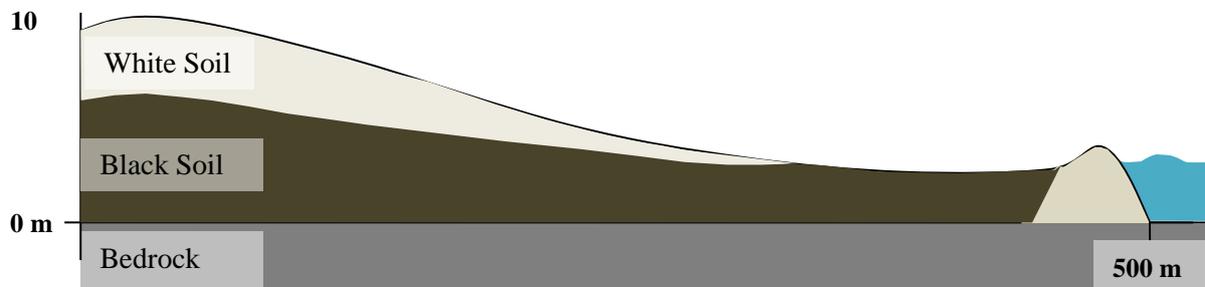
3.1. Lowlands

3.1.1. Landscape

Farmers report that they distinguish between two types of soil, equally distributed throughout the area (Figure 2):

- “White” soil upstream and close to the river; they find it sandy and easy to work with a powertiller, but water management is difficult because the soil retains water very poorly. This type of soil often needs to be weeded twice.
- “Black” soil that they describe as much heavier and stickier than “white” soil. Without water, it is difficult to use the powertiller. Water is much easier to manage on this soil.

Figure 2: Pedologic Transect of Lowland Soils Near Loikaw (Kayah State)



This is an area where, even though the slope is relatively shallow, the small elements in the soil are washed away by heavy monsoon rains. Elements such as clays are carried horizontally and vertically by the water to downstream areas called accumulation zones. This is an indicator of soil acidity. Upstream, soils are mostly composed of large elements such as sand. Soil with low clay content has the characteristic of poor water retention and low cation-exchange capacity. This last property means that the mineral elements (Ca, NH₄⁺, K⁺, PO₄³⁻, etc.) necessary for plant nutrition are quickly washed away because they are not used. However, when white soils are tilled, the white color fades. One hypothesis is that white soil overlays black soil. The depth of the white soil is linked to elevation. These kinds of soils are often encountered in the tropical areas where the wet and rainy seasons are very different.

3.1.2. Timeline

Socioeconomic Changes	1970	Agroecological Transitions
beginning of the economic “4-year plan” creation of the Myanmar Agricultural Development Bank administered prices and market rice production quotas		bubaline disease cattle utilized for field work flooded rice production obligatory

land tenure law	1980	fallows disappear cattle herds dwindle
porcine breed sanitation law open-door policies agricultural construction: irrigation	1990	hog penning introduction of first power tiller and potentially high-yield varieties introduction of mineral fertilizers irrigated rice production introduction of winter crops
introduction of village funds	2000	first thrashing machine
land tenure law	2010	introduction of mung bean before flooded rice

3.1.3. *Typology*

In the lowlands today, farmers who have irrigated plots are still administratively obliged to cultivate dry season irrigated rice and rainy season irrigated rice. On the national scale, the authorities determine which species will be grown, cropping calendars and other modalities such as irrigation management in all irrigation schemes. Farmers whose plots are located outside these schemes are obliged to produce flooded rice in the wet monsoon season, but may also diversify during the winter by growing market garden crops, which are banned within irrigation schemes. Agricultural development projects must take into account the institutional framework.

Within each section of the lowlands, farmers are differentiated by:

- rice-only or diversified cropping systems; and
- equipment levels.

	Rice-Only Systems	Diversified Systems
Irrigated Zone Hsaw Hki Daw Village	Farms with Manual Tools	
	Mechanized Farms (powertiller)	
	Service-Provider Farms (powertiller + thresher or <i>trailawgey</i>)	
Non-Irrigated Zone Daw Lu Shey Village		Farms with Manual Tools
		Mechanized Farms (powertiller)
		Service-Provider Farms (powertiller + thresher or <i>trailawgey</i>)

Service-provider farms have 3 to 5 hectares of land. They generally consist of households from the region that have bought land from small indebted farms to expand. These households optimize their labor as much as possible on their land to limit hiring, necessary on plots of this size. They progressively acquired the means necessary to purchase equipment, and they earn back their investment by renting the equipment out to those who do not have it in order to earn additional income.

Mechanized farms have 1.5 to 3 hectares of land. Formed from previously enlarged farms, they have lost some of their land following a division or health problem. They may also come from

shrinking farms that have managed to develop. These households have plots that are too large and a number of workers that is too small to make due with their own labor alone. They must hire many seasonal laborers for major work. All these households own powertillers.

Farms with manual tools have 0.2 to 1.5 hectares of land. They consist of large native family farms that have shrunk through inheritance or farms obliged to sell land to repay debts. They may also be the farms of migrant households. These households optimize family labor as much as possible and sometimes rely on mutual help. The aim is to do the work rapidly in order to help others and then rent their labor out to other farms. They use their free time during the dry season for seasonal jobs outside the village (logging, road construction).

Service-provider farms are the oldest farms in the zone. Their relative prosperity is based on the blockage or even failure of other types of farms installed more recently. All these farms are interdependent on the scale of the agroecosystem. They trade materials and labor and lend each other money. The small farms find themselves indebted to the larger farms and are sometimes obliged to sell their means of production (livestock, land, etc.).

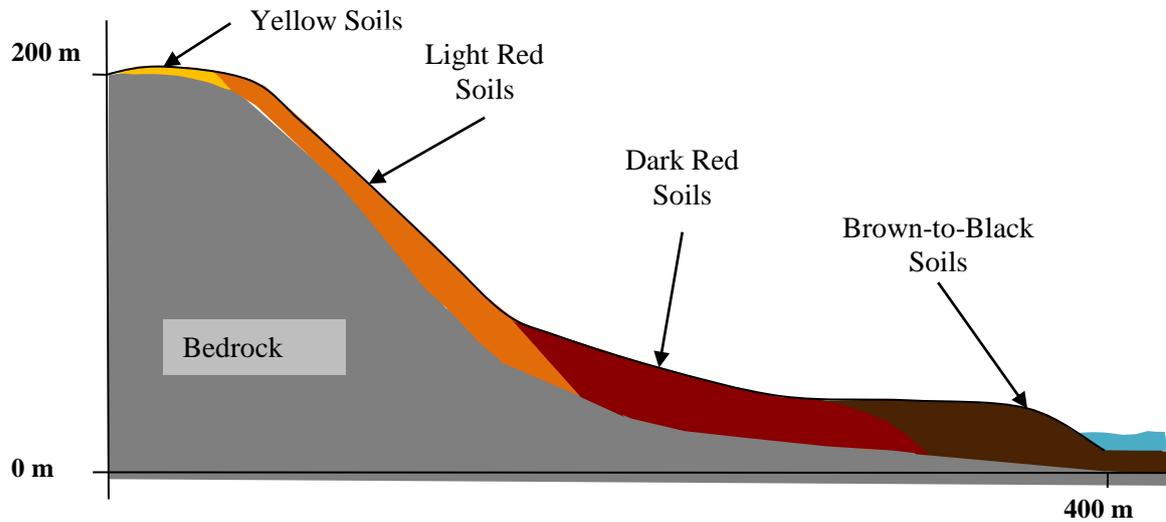
Farm differentiation is more advanced in Hsaw Hki Daw than in Daw Lu Shey. Maximum size per worker and net agricultural income per worker are higher (2 ha and €1,200 per worker compared to 1.7 ha and €600 per worker). In the two villages, farms with manual tools struggle the most, and their incomes do not exceed the survival threshold.¹

¹ The survival threshold corresponds to the incompressible needs of household members that one worker must meet. This threshold was assessed during specific surveys of the poorest households in the zone, and is estimated to be €321 per year.

3.2. Uplands

3.2.1. Landscape

Figure 3: Pedologic Transect of Upland Soils Near Loikaw (Kayah State)



As in the lowlands, there are different amounts of degraded soils along the slope. If the soil is not protected (more than 50% covered), the loss of elements by leaching or runoff can be very rapid, especially calcium. The loss of this element causes a drop in pH, and iron oxides are precipitated and give the red color of some tropical soils. On the slope, we find more or less red soils, which are acidic and mainly contain sand (Ruellan *et al.*, 1993). The transported elements are leached and accumulated in the shallows, which provide richer soils that ensure maize production. Dark black soils are found in the near outskirts of the village where maize is grown. The soil becomes lighter, such as yellow soils, the further one goes from the village.

3.2.2. Timeline

Socioeconomic Changes		Agroecological Transitions
armed conflicts between rebels and the government army	1960	rotational slash-and-burn farming
displacement of people in the village administered prices and market	1970	decrease in fallow years introduction of peanuts
displacement of people in the village enrolment of young people in forced labor (DTN, 1986)	1980	
displacement of people in the village displacement of the village by the "four cuts" "open-door" policies wildlife and forest protection law enrolment of young people in forced labor (DTN, 1994) opening of Indian imports for pigeon peas opening of the Myanmar market for oilseeds	1990	land close to the village requisitioned introduction of hybrid maize introduction of power tillers → sale of herds use of mineral fertilizers introduction of sesame introduction of <i>Guizotia abyssinica</i>

displacement of people in the village	2000	introduction of pigeon pea introduction of pesticides
signature of a cease-fire creation of a village fund	2010	

3.2.3. Typology

In the uplands, communication infrastructures and access to the market are sources of differentiation between villages. Farmers who are located near or on the “road” network are developing commercial crops such as maize and pigeon pea. The others cannot and survive thanks to food crop systems based on rainfed rice.

In villages with communication infrastructures such as Daw Ta Naw village, the following typology was produced:

Multi-activity permanent migrant households: Young couples who arrived in the village after the 2000s. They came from regions where the situation was not yet calm when they arrived in Daw Ta Naw. Their plots are less than one hectare in size. They do not have land recognized as their property. These farms grow rainfed rice or pigeon peas as slash-and-burn single crops on plots very far from the village. These households have two types of resources: agricultural production and outside monetary incomes to purchase foodstuffs. The husband may work outside the farm all year round.

Young couples originally from the village: The heirs born after 1980 of small landowners in the area. They grow crops on plots of less than one hectare. These farmers have kept the same cropping system as their parents, continuing single-cropping of maize or growing maize in combination with pigeon pea. The couple’s tactic is to complete operations rapidly to then be able to offer help and perform paid day labor for secondary and pioneer households in the village. During the winter, the head of the farm goes north to work in opium growing in Shan State where salaries are higher (€3.50 per day compared to €2.00 per day in the village).

Secondary households: These are people who moved in when land was still available in the village—before the arrival of cash crops in 1990. Migrants who arrived after the 2000s were able to become landowners if they came with capital from the sale of their land in their villages of origin. These farms combine two cropping systems. They grow maize as a single crop or in combination with pigeon pea on the plots closest to the village and are planting peanuts and *Guizotia abyssinica* as catch crops or rainfed rice on more distant plots. Large households do not hire workers but rely only on mutual help. In contrast, households that have little child labor² buy day labor from farmers in the previous categories during these periods.

Pioneer households: These households are native to the village or migrants with large plots on the outskirts of the village and flooded rice paddies in the valley bottom. Thanks to the acquisition of valley lowlands converted into rice paddies that make them self-sufficient in rice, they have accumulated capital by selling maize. The cropping systems that these farmers set up rely on flooded rice and maize single-cropping; very few grow pigeon peas in conjunction with maize. They have at least one breeding sow. Despite a large household workforce, they must hire outside labor, one of their main sources of spending. The purchase of a powertiller was made possible by the massive sale

² Weeding is done during school vacations.

of their large livestock (buffaloes and cattle). Renting the tractor to other farmers gives them a return on their investment. They can earn up to €460 for 30 days' rental.

Most farms surveyed in Daw Ta Naw are below the survival threshold. In 2012, agricultural income (and for three-quarters of farms total income) was not enough for these households to meet their needs. With outside income, only six farms attained this threshold, while the others only neared it. None were able to be above the opportunity cost. In other words, workers would earn much more if they left for off-farm work. Today, for a farmer to leave his farm, a job needs to exist and needs to be sure. Currently, Kayah State does not meet these conditions. In addition to this, language is a source of difficulty. Many farm households still speak vernacular languages that prevent them from communicating in the official language. For now, these households have an interest in continuing with their current system because there are no viable alternatives elsewhere. Households with outside income are in the most comfortable situations.

4. Current Dynamics

During the country's socialist-nationalist governance (1972-1988), rice production quotas were established with the aim of providing villages with enough food for their inhabitants. Entire swaths of the country, such as Kayah State where we worked, were forced to produce only rice. The quantities to produce did not take into account real production conditions. Needs were set on the national level and handed down locally. Modified slightly in 2003, this system is still in place today. It has had the effect of blocking all farmer innovation and keeping many farmers in situations of great precariousness.

The relevance of maintaining these quotas today can be questioned. Myanmar has never recovered the level of rice production that had made it the world's largest exporter under the British Empire (1896-1939). Most outlying states have rice deficits. The unanswered question is whether enough has been done in these states to ensure stable, sure rice production or if non-rice diversification opportunities would be more attractive? Past experience has emphasized dysfunctions in several stages of the technical itinerary, notably within the irrigation scheme. Farms' modest technical and economic performances show that the national interest does not match the individual interests of rice farmers in Loikaw plain. In Vietnam at the end of the 1980s, the economic liberalization determined by the government saw rice yields rise suddenly in the Mekong Delta after the removal of quotas (Le Coq *et al.*, 2005). Myanmar could take its inspiration from this experience.

Households with the ability to diversify into market gardening have more value added per hectare than the value added created by rice-only households. But, they are very labor intensive, forcing farmers to limit plot size. The gain from the sale of these crops does not offset the lost income if the plots were irrigated and cultivated with rice. This problem must be resolved by favoring diversification through labor extensive annual crops such as mung bean or soy.

The authorities are focusing their technical teams in the lowlands in order to meet the rice production targets set in national policies. While they are present almost daily in this agroecosystem, their presence is exceptional or nil in the uplands. Even though they provide a link with the Charoen Pokphand company to introduce their hybrid maize variety, they worry little about production. This inaction is explained by the teams' poor means of travel. These villages are located far from their offices. The other point is that these agglomerations were long under the control of rebels and the

teams could not visit them. In all, the development of these mountain villages—and in particular the most isolated among them—is explicitly left to NGOs. There is no project on the national scale aiming to improve the economic and social situation in the uplands.

Myanmar's open door policy in 1988 and its entry into ASEAN in 1995 (drop in customs tariffs) enabled an agricultural revolution based on hybrid maize for animal feed in villages that have access to communication infrastructures such as Daw Ta Naw. Farmers, moving away from a slash-and-burn continuous cropping system, have made extensive changes in agricultural techniques (extension of mineral fertilizer and mechanization) and practices. Farmers in Daw Ta Naw grow only one "CP" brand variety of hybrid maize: "SP 888." It is destined for animal feed. This variety is sold by a Thai agro-industrial company, Charoen Pokphand. This multinational diversified agrifood company controls the entire production chain from the upstream with seed production for livestock feed to the downstream segments with the distribution and sale of their products. The maize of the farmers of the region is sold to one of this company's indoor poultry farms in Loikaw: the outlet is guaranteed. Finally, this agroecosystem is currently being developed by the private sector.

5. Predictable Agrarian System Development Prospects

Kayah State—both its lowlands and uplands—has currently unexploited agricultural development potential.

While the heavy precipitation during the rainy season limits diversification during this period, the lowlands have considerable potential for market garden crops during the cold and/or dry season.

5.1. Lowland Diversification Dependent on Policies

In the Event the Rice Growing Policy Is Maintained

The production systems encountered in Hsaw Hki Daw will not be able to evolve much. The irrigation system, whose current performances are inadequate, could be improved, however. For this, a study should be envisaged to shed light on irrigation system failings and suggest improvements.

That said, it remains that in the medium term the debt situation of rice farms with only manual tools will worsen. Their disappearance is predictable. This will benefit service-provider farms with sufficient capital to buy the land. For their part, mechanized (not service-provider) farms will certainly not manage to accumulate the capital needed to expand. They will only be able to recover. Consequently, in the longer term and because of the division of land between male heirs if they decide to stay on the farm, they will also be in difficulty. The intensity of these difficulties will depend on the speed of land division, which is itself dependent on the non-agricultural job opportunities available to young people in the region.

In Daw Lu Shey, farms will continue on their road to diversification. If debt solutions are not found, the same processes will be seen as in Hsaw Hki Daw. One possible solution would be to introduce high value added market garden crops not suited to mechanization such as chili, cucumber and tomato on farms with manual tools. This possibility can only be envisaged if the consumption basin—the city of Loikaw—can absorb output or if a marketing commodity chain (storage and transportation) is created allowing transit to more distant and larger urban centers. Another possibility is growing flowers for Buddhist ceremonies. Crops such as short cycle (50 days) mung bean (*Vigna radiata*) and longer cycle soy (*Glycines max* (L.) Merr.) could be extended to a larger number

of farmers because they require no inputs and no management during the cycle. They could be grown before flooded rice or after flooded rice with the residual moisture in black soil (white soil reserved for market gardening) (Conway *et al.*, 1980).

Contract Farming Possible if Rice Production Mandates Disappear

In Hsaw Hki Daw, farmers on mechanized and service-provider farms have the capital to introduce commercial crops such as CP hybrid maize, as was the case in the rice plains of Thailand (Ekasingh *et al.*, 2004). This crop is grown after wet season irrigated rice, from January to May. Farmers use the irrigation system to offset the summer water deficit. Farmers in Daw Lu Shey cannot introduce this hybrid maize because, even though they have access to motorized pumps, none of the waterways provides enough water. As was the case in Thailand, Laos, Vietnam and southern China, the Thai agro-industrial company Charoen Pokphand may increase its presence in Kayah State. It is suggesting that the wealthiest farmers (in the service-provider category) set up indoor poultry or pig production. They insist on a contractual relationship with the agrifood company—that is to say that Charoen Pokphand promise to buy the agricultural output once produced at a set price.

Contract farming provides farmers with raw materials and production means such as feed, young livestock, inputs, quality control and advice. The initial outlay by farmers requires the contract to last until the investment has been recovered. The contracts provided by the CP company generally do not last longer than one year, which can cause a net loss to the farmer if the contract is not renewed. Prices, normally guaranteed, can vary during health crises such as avian flu. In this case, simultaneously with the drop in demand, the company allows itself to slow purchases from its farmers, placing the later in a difficult position (Delforge, 2007).

The number of these indoor livestock units is limited by the size of the urban centers in the area. The presence of the Charoen Pokphand company may extend to other orchard and horticultural value chains and create new opportunities for farmers in Loikaw plain.

Prospects for action by NGOs:

- fight against the debt due to credit of farms with manual tools;
- diversify cropping systems by studying their technical feasibility and suitability to current production systems and by offering market studies;
- for farms with manual tools, guide diversification toward crops not suited to mechanization requiring little labor such as mung bean; and
- act on policy level to establish a legal framework allowing for the proper execution of contract farming.

5.2. More Rapid Agricultural Development in the Uplands

Local Processing for Oilseed Crops

While agricultural development seems limited in the lowlands, it may be more rapid in the uplands freed from the rice growing policy. Annual oilseed crops such as peanut, sesame or *Guizotia abyssinica*, already present in upland farmers' crop rotation, may offer them new opportunities to increase their incomes. We know little about the processing and marketing value chain for these crops but we do know that there is no local processing unit present in the production villages. To increase the value added from these crops, low-cost processing units can be built. The cake obtained after oil has been extracted from annual oilseed crops, mixed with maize flour, can be used in the

composition of feed for “CP” livestock rearing. Packaging this feed can offer national and even international outlets.

Prospects for action by NGOs:

- study the feasibility of installing local processing units through a market study taking into account supply and demand;
- set up, via a project, a **cooperative** processing unit and collection organization;
- study the possibility of distributing oilseed cake for animal feed; and
- study the financial gains from this processing for farmers.

Diversification of Village Rubber Tree Farming

In Thailand, following high value added cash crops, farmers have diversified into perennial cash crops. These tree crops can produce perishable and non-perishable goods. The production of perishables such as litchi cannot yet be envisaged in Kayah State because of the lack of communication infrastructures. Non-perishables can, however, be produced. Rubber (*Hevea brasiliensis*) is a crop suited to the acidic soils in the uplands. With an average of 120 tapping days per year as early as the fifth year after planting, rubber offers farmers a regular source of income. It does not compete with other crops for labor because tapping is done at dawn. The raw latex from the tree must be coagulated, squeezed and dried to prevent it from rotting, and then stored to be sold at the right time. Since the highest latitude at which rubber can be grown crosses southern China, China is forced to buy latex from Southeast Asian countries. Outlets are guaranteed for farmers in Kayah State. In the case of village rubber growing, this method of diversification would be profitable for all categories of farms identified in Daw Ta Naw if they have access to credit to plant the trees. Alone, farmers cannot cover the cost of clearing, plant material, fertilizer and inputs. Farmers cannot agree to plant perennial crops unless they are guaranteed land tenure security and as long as the slash-and-burn system continues to be used (for fear of seeing their trees burnt down). But, these same farmers, who have few rights to the land they occupy, can use rubber plantations, the economic lifespan of which is 25 years, to secure their tenure. If these plantations are introduced, the farmers will need to be trained as “planter tappers” to prevent the hiring of outside labor. Rubber growing is not always found in village agricultural systems. Private companies set up plantations on large tracts of land, managed like companies with employees. This type of rubber plantation is found in Kayin State, located south of Kayah State. It is risky for the authorities of Kayah State to accept this type of rubber plantation in the Karenni territory. Local farmers are often thrown off the land they use, grabbed by these private companies. Renewed rebellions would then be feared in a still fragile state.

Other Perennial Crops as a Path to Diversification

If all the conditions cited above (access to credit, land tenure, etc.) are met, farmers may chose other perennial crops to diversify. If they have the necessary capital, they may combine all these crops.

Tea (*Camellia sinensis*) is already widespread in the uplands of Shan State to the north of Kayah State. Farmers report that it is also found in the township of Mese in southern Kayah State. This plant is suited to the ecologic conditions in the uplands of Daw Ta Naw. This crop requires considerable labor (500 to 700 days of work per hectare), notably during pruning and harvest, limiting the size of household plantations to 0.2 to 0.5 hectares (CIRAD, 2009). Green tea is widely drunk in Myanmar and requires drying that could be done by farmers.

Arabica coffee (*Coffea arabica*) can enable the diversification of cropping systems whose weather requirements force them to be located at altitudes of more than 1,000 meters. The maximum surface area cultivated in village plantations is 0.5 ha/worker (*ibid.*), limited by considerable labor needs. Coffee is not very popular in Myanmar and outlets in the country are small. Thailand, whose urban population is growing and Westernizing, represents a potential market focused on quality. Drying the coffee berries harvested allows farmers to store them for sale at the right time.

Longan (*Dimocarpus longan* Lour) is a tree crop similar to litchi. Its fruit, covered in a thin brown peel, are round and consist of a white flesh and hard, round seed. This tree, already present in the agroforestry gardens of farms in Kayah State, is perfectly suited to the weather conditions there. Its fruit are very popular in China where it is very commonly eaten, notably for its medicinal properties. It is a potential market for farmers in Kayah State. The fruit can be eaten fresh locally or dried for export. Like the two previous perennial cash crops, it requires labor during the year (pruning), notably during the harvest in July.

The labor needs for rubber and the three crops discussed above show which would be the most advantageous for farmers in the uplands of Kayah State. Rubber requires 120 to 180 days of work after entering production in the fifth year. Tea, coffee and longan require twice the labor, which limits the cultivable surface area on smallholder farms (*ibid.*).

Prospects for action by NGOs:

- study the feasibility of introducing perennial species in village agriculture systems;
 - technical issues (create a training school for planters);
 - farmers' crop rotations;
- study marketing value chains for the products and by-products from these perennial crops;
- allow the introduction of crops by facilitating farmers' access to credit and solidifying their land tenure rights; and
- establish a dialogue with the authorities to limit as much as possible the introduction of agro-industrial plantations and the grabbing of farmers' lands.

On an entirely different scale, a large amount of land in Kayah State has been set aside as protected areas or forest areas following the passage of the law on the wildlife protection and the conservation of natural areas in 1994. The authorities excluded village communities from the management of these areas. Much of the Kayah uplands contain a wealth of tree species with high commercial value. One of these, teak (*Tectona grandis*), is the subject of restrictions on its use. Only the state has the right to grow, work and sell this species. Yet, this forest resource could enable a non-negligible financial income for households in the uplands. It would be interesting to reconsider management of this resource on a smaller scale. In Laos, family farms exploit teak on small plots, allowing them to access tenure security and supplementary incomes (Newby *et al.*, 2012).

6. Conclusion

This study should not be used as a representative study covering all of Kayah State; it is representative of only Loikaw Township. Other production systems are present in the state. In Mese Township, in southern Kayah State, farmers have begun growing green tea. The presence of mines in Hpasaung Township offers farmers the possibility of being multi-active. East of the Salween, deep valleys surrounded by steep mountains have led farmers to develop rice terraces. The valleys along the border with Thailand undoubtedly present different economic and demographic situations with informal flows of goods and people. The biophysical diversity in the state that we saw in Loikaw Township may not cover all of Kayah State.

Studies continuing the work already begun in this state can be conducted in the future to know the other production systems present in Kayah State. For this, the authorities must grant greater liberty of movement to research teams or assign these studies to local teams.

If national rice production targets are maintained, the performance and quality of the irrigation system must be assessed to increase potential. The canal is not concrete, which leads to much water loss and regular repairs. The management mode, currently government-run, could be discussed with the various stakeholders.

The probable emergence in Kayah State of contract farming must happen along with the creation of a legal framework protecting farmers, their investments and their livelihoods.

The diversification of the uplands into perennial cash crops must be done progressively so that farmers do not find themselves on a single cash crop. If problems were to arise with production or sale, the consequences for farms would be horrible because they would no longer have what it takes to meet their needs.

Farmers agree to change their agricultural practices if, while contributing to the general interest, doing so is in their own interests.

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