The Evolution of Farming Systems and Diet in Hakha Township, Chin State, Myanmar

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October 2017 to February 2018

Funded by:

Livelihoods and Food Security Trust Fund

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Table of acronyms and abbreviations

CARD	Chin Association for Rural Development
CCERR	Chin Committee for Emergency Response and Rehabilitation
CHRO	Chin Human Rights Organization
CORAD	Choklei Organization for Rural and Agricultural Development
DHS	Demographic and Health Survey
FSA	Farming Systems Analysis
GAV	Gross Added Value
GP	Gross Product
IC	Intermediary Cost
LEARN	Leveraging Essential Nutrition Actions to Reduce Malnutrition
LIFT	Livelihoods and Food Security Trust Fund
MFI	Microfinance Institution
MIID	Myanmar Institute for Integrated Development
MIMU	Myanmar Information Management Unit
NAV	Net Added Value
NLUP	National Land Use Policy
NOAC	Securing Positive Nutritional Outcomes through Agricultural Extension, Nutrition Education and Institution Building in Rural Chin State
PFLNA	Post-Disaster Floods and Landslides Needs Assessment
VTA	Village Track Administrator

Abstract

Farming systems of rural households in Hakha, Chin State have undergone an evolution due to social, political, and economic drivers that have occurred since pre-colonization. The following study analyzes the evolution of the farming systems through a historical lens, and the potential impacts on the diversity of products grown and consumed in the agro-ecological landscape. Since Chin State has the highest rate of stunting of all states and regions of Myanmar, ranked the poorest, and almost 80% of the population depends on agriculture for their livelihood; it is important to understand the farming systems that exist in the region. The study employs a mixed-methods ethnographic approach exploring agricultural practices and diets that includes historical interviews, economic qualitative and quantitative interviews, and agro-ecological zoning with local farmers. The study identifies a trend in the reduction and simplification of shifting cultivation systems as a response to a reduction in the labour force, dietary preference for rice, and the stigmatization of this original local farming system. Also, cash crop production has increased and less labour intensive forms of farming such as fruit orchards and elephant foot yam cultivation are becoming increasingly popular.

Key words: Northern Chin State, Hakha township, small-scale farming systems, agrarian system, economic analysis of farming systems, agrarian history, shifting cultivation, subsistence agriculture, cash crops, out-migration, land tenure, biodiversity, diet diversity

Acknowledgements

"It was the house of a farmer,
but in fact of hospitality,
It was worth that of a king"
- Jules Verne, Journey to the Centre of the Earth, 1864 -

First and foremost, this study would not have been possible without the support of the 60+ farmers who answered our endless questions over the eight weeks we completed fieldwork in Hakha. Translators Julia and Victor made it possible to ask those questions, and patiently worked with us to make sure everyone understood each other.

We are also immensely grateful for the support from both the local teams of the Myanmar Institute for Integrated Development (MIID) and Gret who supported logistics of the study and offered advice and data from related project activities and studies.

Murielle Morrison, Lai Uk Nawl , and Steven Van Bik were invaluable for their knowledge of the area, the cultural context, and connections to the community.

We would also like to acknowledge other organizations in Hakha such as the Chin Human Rights Organization, The Hakha Post, Chinland Post, and the Chin Association for Rural Development (CARD)MF that allowed us to interview them for this report.

Furthermore, we would like to thank Celine Allaverdian for her mentorship, and MIID and Gret offices for overseeing the study.

This study would not have been possible without the financial support of the Livelihoods and Food Security Trust Fund (LIFT) who funded the study.

I. Background of the Farming System Analysis Study

1. Presenting the development actors of the area involved in this study

The Farming System Analysis (FSA) was completed by Gret and the Myanmar Institute for Integrated Development (MIID). The study was funded by the Livelihoods and Food Security Trust Fund (LIFT).

LIFT's overall objective is to contribute resources to a livelihoods and food security program to sustainably increase food security and incomes and strengthen resilience to shocks and setbacks. Therefore, it is now funding a number of projects that provide agricultural extension service, promote agricultural technologies, and support agricultural value chains.

LIFT recognizes the importance of having sufficient understanding of the local contexts of the farming systems in the intervention target areas to be used as evidence to encourage greater public and private funding for rural development projects that are context-specific. In line with this approach, LIFT launched a service procurement process and selected Gret as a service provider in order to provide technical support to implementing partners to conduct farming system analysis. This ensures an appropriate level of quality of research product in regards to coherence, data quality and synthesis of findings.

Active since 1995 in Chin State, Gret has supported agricultural and economic development by developing local organizations that aim to a) improve access to investment capital (Chin Microfinance Institution (MFI) and b) promote the diversification & intensification of agriculture as well as the economic integration of farmers in the markets (Choklei Organization for Rural and Agricultural Development (CORAD)). Gret project is supporting the institutional and technical reinforcement of these two organizations and facilitating a platform for development organizations that aims to: promote the implementation of studies on the livelihood issues in Northern Chin State, the publication of evidence-based documentation by local actors, and the organization of sharing & learning events among local stakeholders.

In 2014, MIID published a 5-year comprehensive "Local Social Development Plan for Chin State". LIFT-funded project operations commenced in Hakha, Chin State in June 2016. The LIFT-funded project, *Securing Positive Nutritional Outcomes through Agricultural Extension, Nutrition Education and Institution Building in Rural Chin State* (NOAC), works in collaboration with Cornell University, Yezin Agricultural University, and the State Agricultural Institute in Falam to improve nutrition via education, through strengthening nutrition-sensitive agricultural extension services. MIID works with 24 villages in Hakha Township.

MIID and Gret agreed to collaborate toward the common aim that the FSA would be conducted in northern Chin State in order to:

- Better capture the current situation of the different farming systems and livelihoods in different zones, their recent evolutions and their interactions with other livelihood activities (animal husbandries, off-farm, etc)

- Provide more in-depth knowledge of the technical and economic characteristics of farming systems as well as on the categorization of households as per their, farming systems, and economic performance.

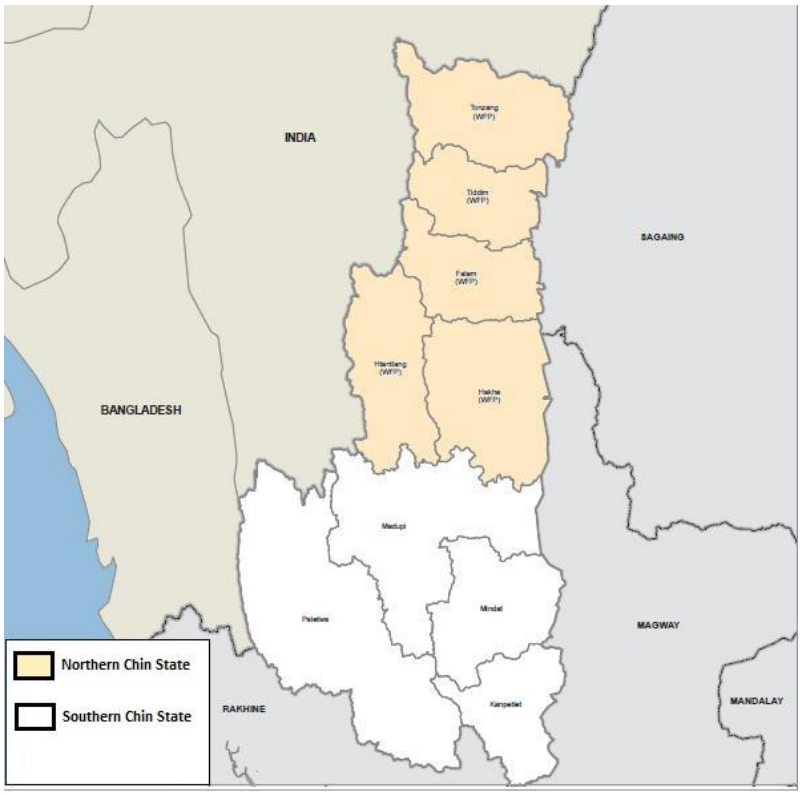
- Look into the conditions of access to land and all other resources that affect production and income (access to equipment, labor, credit, access to inputs or markets etc.) and into all forms of contributions (crop, livestock, fishing, off-farm)

- Identify challenges & opportunities of the different systems

- Identify how different farming systems and land use change influence diets of rural families.

The FSA collaboration consisted of one month of planning, two months of data collection in Hakha, Chin State, and one month of data analysis and report writing.

2. Situating the study area: Hakha Township, Chin State

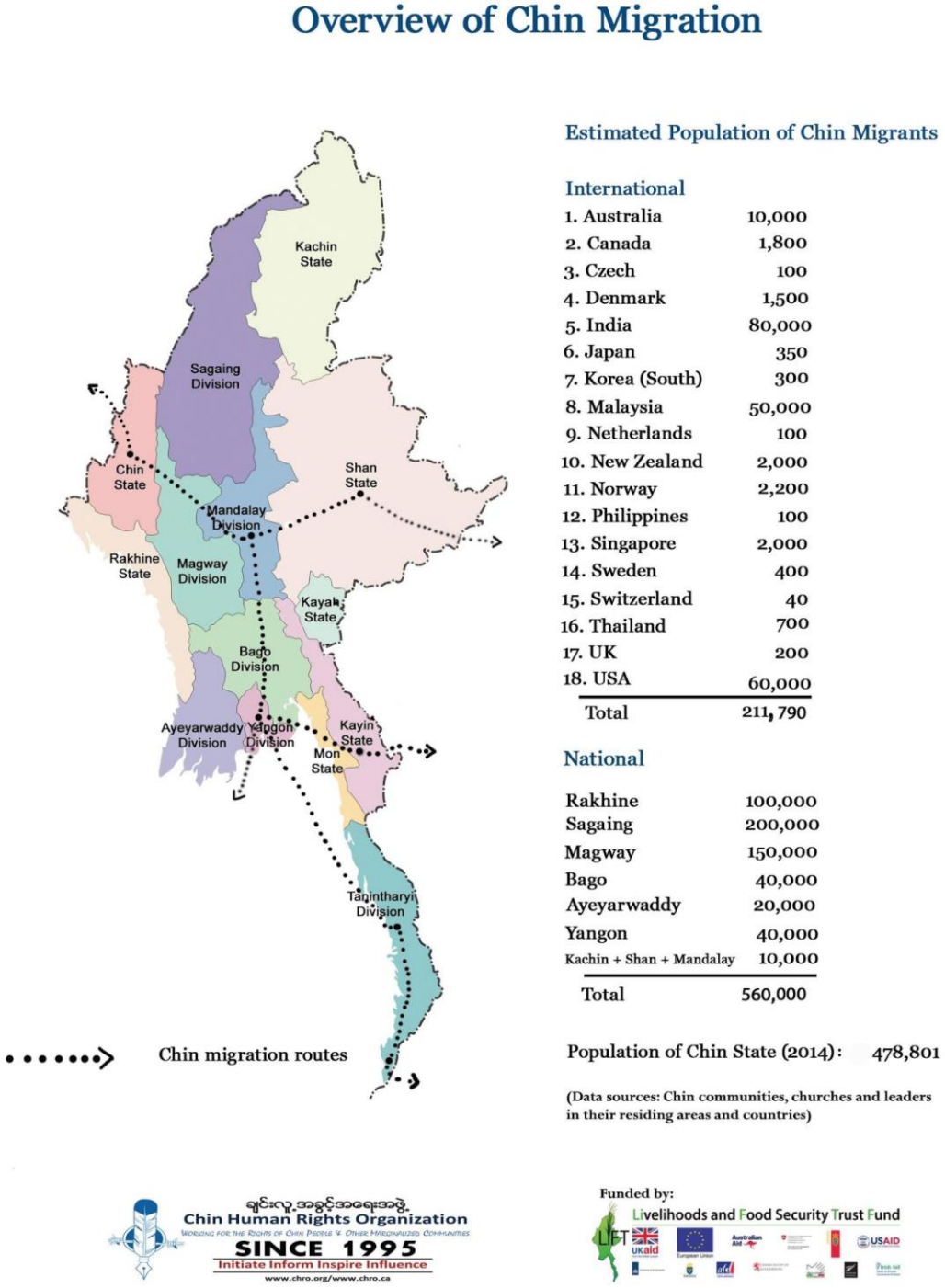


Map 1 - Administrative map of Chin State - MIMU

Chin State is an upland region of Myanmar located in the northwest, that shares western borders with India and Bangladesh. Chin State is comprised of a series of hills known as the "Chin Hills". The rugged terrain coupled with poor road infrastructure designates Chin State as the most remote state or region in Myanmar by country standards. The total population is 478,801 people with a population density of 13.3 people per square kilometer (Chin State Census, 2014). Seventy-nine percent of the population resides in rural areas and depends on agriculture for their daily subsistence.

The Chin Hills are home to the Chin people, who sub-divide into six linguistically and culturally diverse subgroups (Asho, Cho, Khumi, Laimi, Mizo and Zomi). The Chin people speak over 40 different dialects of Chin language. Subgroups share certain commonalities, such as patrilineal inheritance systems, religion, and structure of the social organization. Eighty-five percent of the population of Chin State is Christian (UNFPA- Religion, 2016). The majority of Chin people converted from Animism to Christianity in the last century after the arrival of missionaries in 1889. Only six percent of the population practices Christianity in greater Myanmar (UNFPA- Religion, 2016).

Local livelihoods are primarily based on small-scale farming, supplemented with animal husbandry, wage labor (in the timber and road construction industries), and cash crop production. Historically, Chin people depended on shifting cultivation; however, in some areas of the state, these complex systems are being replaced by a variety of permanent agricultural land uses. Demographic trends are one driver of these transitions, as the labor force has declined due to out-migration. The history of religious persecution and political tensions in the 1990s coupled with the collapse of the economy under the military dictatorship caused many Chin people to flee, migrating abroad mainly to India, Malaysia, the United States.



Map 2 - Overview of Chin Migration - Chin Human Rights Organization

Since the 1990s, Chin people have fled the state as refugees and then received reunification visas for family members to join them abroad. Younger Chin people (mostly men) migrate seasonally to India to work; especially those who live along the border (interview 2017, Van Biak Thang, CHRO). Today, there is an increased interest in temporary but long-term migration (up to 6 months) to China, Singapore, Japan, and South Korea (interview, 2017, Van Biak Thang, CHRO). However, reliable statistics on this type of migration are absent. Out-migration has left Chin State with a high population of children under the age of 15, as observed in the population pyramid in table (1). The wide base of the population pyramid illustrates the high fertility rate found in the region; 4.6 children per woman (the highest fertility rate in Myanmar), compared to 1.8 children per women in Yangon

region (DHS Myanmar). High fertility rates coupled with out-migration of economically productive aged persons result in labor shortages and a high dependency ratio of 81.0, compared to 49.0 in the Union as a whole (Chin State Census).

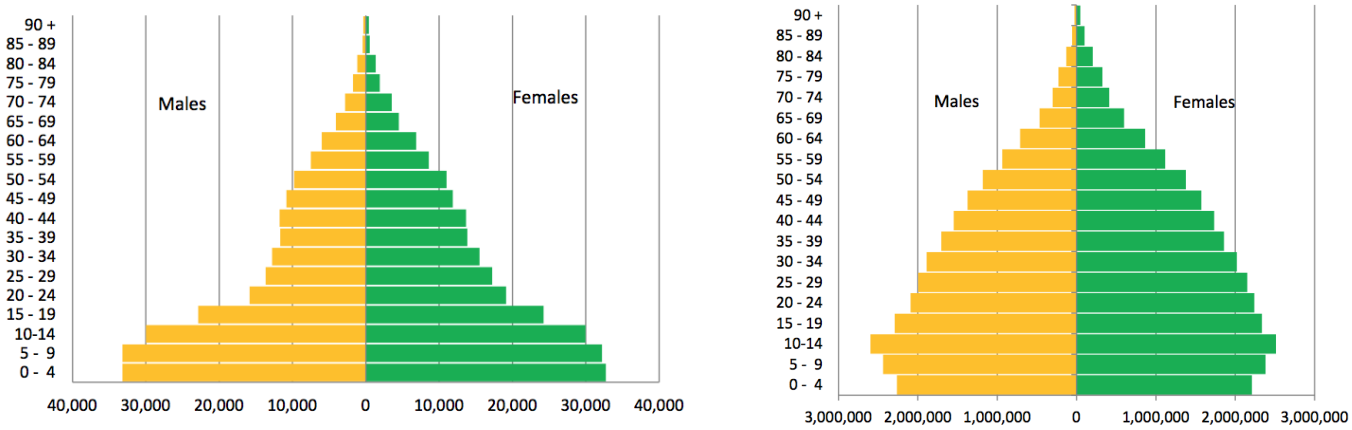


Figure 1. From left to right: Population Pyramid Chin State and Population Pyramid Republic of Union of Myanmar, 2014- Chin State Census 2014

	MIID Baseline 2017	Chin State Census 2014	Myanmar (World Bank, 2017)
Percentage of Population by age group			
Children (0-14)	**40%**	**40%**	**27.6%**
Economically Productive (15-64)	**55%**	**55.2%**	**67%**
Elderly Population (65+)	**5%**	**4.8%**	**5.4%**
Dependency Ratios			
Total Dependency Ratio	**82.0**	**81.0**	**49.0**
Child Dependency Ratio	**73.9**	**72.3**	**42.0**
Old Dependency Ratio	**8.1**	**8.7**	**8.0**
Percentage of female headed households	**11%**	**22.9%**	**27%**
Mean Household Size	**5.4**	**5.1**	**4.2**

Table 1 - Percentage of Population by age group and Dependency ratios - MIID Baseline Survey Report (2017)

Chin State is ranked low in indicators regarding health and nutrition. Stunting[1] among children is highest in Chin State, at 41%, with 13% severely stunted. As stunting is caused by inadequate

[1] According to the World Health Organization, stunting is the impaired growth and development (short height-for-age) that children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation. Consequences of stunting include poor cognition and educational performance, low adult wages, lost productivity, and a risk of nutrition-related chronic diseases later in life.
http://www.who.int/nutrition/healthygrowthproj_stunted_videos/en/

nutrition, and the majority of food consumed by rural households is from subsistence agriculture, this study aims to explore relationships between the evolutions in diet and food security and the evolutions of the agrarian system.

This study is especially important given the poor nutrition indicators among children in the state. According to a 2016 secondary analysis of the LIFT Household Survey by Leveraging Essential Nutrition Actions to Reduce Malnutrition (LEARN), a child aged 6 to 23 months in Chin State is five times less likely to meet the threshold for minimum dietary diversity[2] than children in Shan or Kachin States (Zaw Win & Cashin, 2016). However, as noted in an anthropological study of the region in 2013, generalizations cannot be made between different areas of the state. "As already noted by Lehman half a century ago (1963), the Southern Chin diet […] is quite undiversified (compared to the North) […] While Northern Chin adopted since a long time the use of cooking oil and curries inspired by an Indian basis, in the South oil is absent for the daily meal […] Even eggs are rare in the Khumi diet, generally reserved for ritual exchanges." (Boutry, 2013).

Given the diversity of Chin society, this study focused on studying the evolutions in agrarian systems and dietary behavior in a single township in northern Chin State, Hakha Township. Hakha Township is inhabited mostly by the Laimi ethnic group, and at least 9 dialects of Chin language are spoken in this Township. Hakha, the Union level state capital, is located in the Township. The population of Hakha Township is 48,000 people (Chin State Census, 2014).

Demographic trends in Hakha township such as out-migration and high dependency ratios are similar to those described for the state as a whole. Rural populations in Hakha township are also migrating from rural areas to the capital of Hakha, seeking better employment and educational opportunities. Some families move to the city at the request of family members living abroad to ease communication (Interview, Van Biak Thang, CHRO, 2017). The population of Hakha city was 20,000 in 2009 and then increased to 25,000 by 2014, a 25% growth in 5 years (Chin MFI and Chin State Census data, 2014). As previously noted, out-migration from rural villages causes labor shortages that have direct implications on the agrarian system in the region, as people switch to less labor-intensive modes of farming.

Local diets in Hakha Township are based mainly on boiled rice, and to a lesser extent maize, accompanied by a soup made from cabbage, mustard, or roselle leaves. *Seasonal* fruits and vegetables are also consumed by some households, as well as wild and domestic meat and fish. Most household's rice sufficiency depends on purchased rice from Kalay during at least 4 months of the year. According to a baseline study conducted by MIID of 24 villages in Hakha township, 71% of surveyed households reported that there were times in the past year when they did not have enough food to meet their household needs. They reported coping with this challenge by taking out loans to buy rice and eating less preferred food such as maize and millet (Pistor, 2017; MIID Baseline, 2017). The months of June- October had the highest reported instances of food insecurity.

Powell et al. explains that dietary behavior is linked to the social, cultural, and agrarian context, beyond the control of individuals. Effective nutrition education programs are therefore dependent on understanding these contexts. As a culture, local knowledge, and agrarian practices are not fixed, but fluid, it is necessary to understand how knowledge systems and practices evolve over time and the drivers that mediate change (Powell, et al., 2017).

[2] Dietary Diversity is defined as "the number of unique foods consumed by household members over a given period, has been validated to be a useful approach for measuring household food access" https://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score

Through an analysis of the evolution of farming systems and the interrelations of social, political, economic, and demographic drivers of change, this study offers important insights to predict levers of agricultural and dietary change.

II. Agrarian Diagnosis: Aims, concepts, and methodology

Concepts and methods used for this agrarian diagnosis were developed at the "Agricultural Development – Comparative agriculture" at AgroParisTech. This specific approach interests LIFT for its systemic approach, integrating economic, sociological and agronomic elements and techniques to understand the area studied. This approach was complemented by a research protocol developed by Bronwen Powell, and bi-monthly collection of Household Diet Diversity Scores and assessments by MIID field staff. We will present the aims, concepts, and methodology used for the agrarian diagnosis done in Hakha township, Northern Chin State in the Republic of Myanmar.

1. Diagnostic analysis: a methodology to characterize an agrarian system

The aim of a diagnostic analysis is to "study the agricultural situation of an area and its transformations, in order to identify the ecological, economic and social implications of the evolutions in the process […]. It consists of identifying and prioritizing the various kinds of elements that condition the function and evolution of farms in the area. These explanatory elements are to be investigated not only at the farm level and its functioning, but also at the ecological, economic and social levels in which they are situated." (H. Cochet et al, 2007).

a/ Key Concepts

An agrarian system is a concept used to describe an agricultural situation in an area. It encompasses the utilization and regenerative methods of an environment, (ecosystems) and the corresponding technical package(s), a fixed number of farming systems, with differentiation paths and mechanisms), a set of social relations of production (defining modalities of access to resources and the conditions of the agricultural wealth sharing) as well as the modalities of both division of labor and market integration. (H. Cochet et al, 2007).

Concept	Agrarian system		
	Farming system activity system		
	Cropping systems / Animals husbandries		
Object/analysis scale	Crops/Livestock	Farm	Village / Region / Nation
Type of analyse	Agro-ecological (bio-technical)	Agro-socio-economic	Agro-geographic and socio-economic

Table 2 - The concept of the agrarian system and its interlocking scales - H. Cochet (2005)

The analysis is done at various scales:

- The *agrarian system* consists of farming systems that are themselves comprised of cropping and animal husbandry systems.

- A *farming system* is defined by structural aspects (combination of production factors: land tenure, work, and assets) and by functional aspects (articulation between the cropping systems, animal husbandry systems and post-harvest processing systems when they exist).

- A *cropping system* refers to the ways a set of plots are being utilized. It is characterized by crops, crop rotations and management techniques applied to each crop.

Note: *Permanent crops* refer to cropping systems characterized by a permanent division within the holding between arable land and grassland, clearly demarcated fields, and a predominance of annual and biennial crops. (L.O. Fresco and E. Westphal, 1988)

Although paddy terraces match this definition, they will be considered separately in this report. **Therefore, *permanent crops* will hereafter refer to areas of land cultivated every year, out of the shifting cultivation cropping system, grasslands, forests and paddy terraces. They will include orchards, open field vegetables (as opposed to home-garden vegetables) and grains.**

An *animal husbandry system* refers to all that is done to value a herd of domesticated animals in order to get one or various products.

This agrarian diagnosis chose the village as a scale of the study, where various agro-ecological areas that are utilized differently exist, as well as relationships between landscape units. The villages selected fall in a gradient from north to south, with varying distances to the city of Hakha.

b/ Steps to do an agrarian diagnosis (farming system analysis)

(1) Agro-Ecological Zoning

The first step consists of analyzing the landscape and creating an agro-ecological zoning map with farmers. The purpose is to understand the different ways farmers utilize this landscape: Identifying a set of homogeneous landscapes that correspond to a utilization, and the links between the different sets of landscapes. This is done through landscape observation and socio-economic interviews with farmers.

(2) Identifying Farming System Evolutions

The second step consists of understanding the main evolutions the agrarian system has undergone since the late 1800s. The aim is to identify the main evolutions that took place and follow the differentiation paths of the farming systems. The analysis takes into account pedoclimatic, economic, demographic and political changes.

These changes are explained at the level of family farms, the larger area studied (Hakha Township), and then put into perspective in a National context. In order to do so, interviews are conducted with elder farmers who have grown up and practiced farming in the area. History has had direct consequences on the current agrarian system. Therefore, viewing agrarian change through a historical lens is pivotal to understanding the current agrarian system in Hakha Township. By understanding the evolutions of the agrarian system, a pre-typology of current farming systems was established.

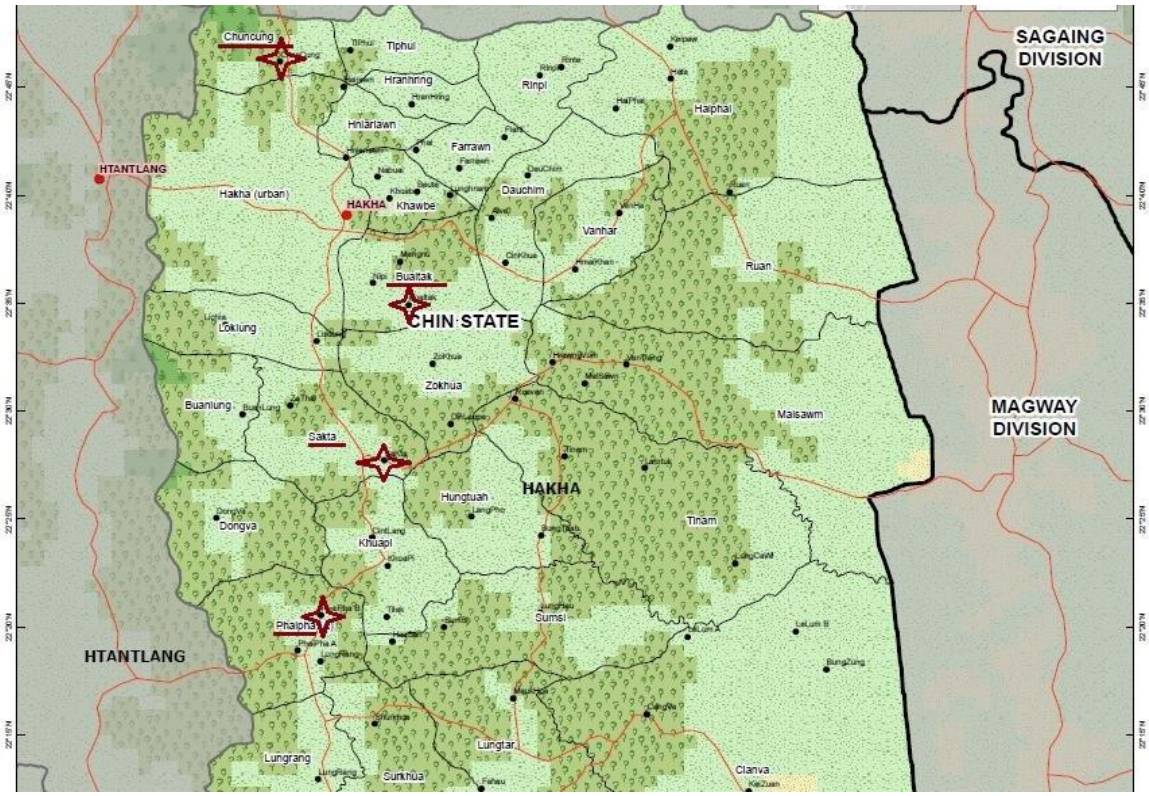
(3) Typifying Current Farming Systems

The third step of an agrarian diagnosis consists of defining the current farming systems (typology of farming systems) by explaining the way they function. A farming system refers to a set of farms that have access to comparable resources (land tenure, assets, labor force) and follow the same management logic (interactions between the different cropping systems and animal husbandry systems). Defining farming systems is done based on data collected through in-depth interviews with farmers.

(4) Economic Analysis

Finally, an economic analysis of these farming systems is completed. Based on data also collected through these in-depth interviews, it is possible to build archetypes for each farming system. Based on these models we will calculate the wealth (added value) created by each archetype and explain the allocation of this wealth (bringing us to the agricultural household income). The economic results obtained for each type will then be compared (refer to Chapter VI.).

2. Data collection in Hakha Township, Northern Chin State



Map 3 - Location of studied villages in Hakha township - MIMU, 2009

In addition to bibliographical research, the agrarian diagnosis is mainly based on fieldwork: observations and interviews with farmers in the area.

Two months of fieldwork were completed in Hakha specifically working on this agrarian diagnosis, sleeping in the different villages studied: **Chuncung, Bualtak, Sakta and Phaipha-B**. This allowed us to be closer to their reality and grasp how a village and a household is organized as well as how work is organized inside a household.

We conducted over 60 interviews with farmers from the 4 selected villages. The farmers that were interviewed were purposefully selected to target specific ages of farmers that were agriculturally active during specific periods of time. After completing interviews with farmers from different backgrounds, we developed an idea of specific archetypes of farmers. An archetype represents a group of households that participate in a specific combination of agricultural land uses (paddy terrace cultivation, shifting cultivation, permanent farming, animal husbandries).

To develop these archetypes, landscape observation was crucial to identify the different types of land that exists and how different areas and types of land is used. Landscape analysis provided the research team with a rough idea of the cropping and animal husbandry systems that exist in the landscape. To understand how these land uses combine to create archetypes, the landscape analysis was coupled with historical and current-day economic interviews.

The historical interviews and landscape observation conditioned the farming systems targeted for economic interviews. Certain types of farmers were purposefully selected to get more in-depth data about their system. The research team did not fix archetypes until over 50 interviews (both historical and current day) had been completed.

However, what is important to note is that because the team followed the steps of first observing and then going through historical interviews with different elders with different backgrounds, the research team did not arbitrarily choose who to interview for current day interviews. The information provided by the people interviewed and landscape observations by the research team guided the typology process.

Based on these semi-unstructured in-depth interviews, we were able to trace the evolution of the agrarian system since the 1900s and characterize the current farming systems. Through these interviews, we also collected data that allowed us to conduct an economic analysis of the farming systems identified.

On average, an interview lasted 3 hours and was completed with two local research assistants who acted as translators. Interviews were not conducted based on a questionnaire. Closed questions limit depth of analysis and a comprehensive understanding of the situations encountered. Open interviews, allow us to follow the natural flow of conversation to create a more relaxing environment. Open interviews also invite exploration of tangents to collect the most comprehensive data. The data collected is primary data, meaning it is lived and observed by the farmers. Based on individual situations we built our reasoning on the identification of types of farming systems. Farmers interviewed were selected through a reasoned selection in order to best reflect reality. We tried to have the widest range as possible of socio-economic situations and historical backgrounds.

3. Limits of the study

a/ Time

Ideally, this methodology is intended to be conducted over a seven- month period, with six months of field work and one month of data analysis and writing. Seven months is especially important when translation time doubles the duration of an interview. The current methodology was conducted in three months, with two months of fieldwork, and one month of data analysis and writing. With limited time, the research team was unable to critically situate the village level data on a global scale. It is important to note that one researcher had been working on the NOAC project completing a baseline study for 14 months prior to the FSA, and the research assistants are from and grew up in Hakha. Therefore, had previous knowledge of the context, primary data, and interactions with farmers in three of the four studied villages.

Due to lack of time, this research has mainly focused on the agricultural activity of the households. If agriculture is the main source of livelihood for households in the area, most households also rely on other income generation activities and on remittances for their livelihood. It was not possible for the research team to assess the importance of these other sources of income for each type of farming system identified. It was not possible either to analyze the different areas of expenditure. So presented in this study is only a “first to second level” of differentiation based on the household agricultural production.

b/ Language

Interviews were conducted in English and translated to local languages by two local research assistants. The research team acknowledges that real-time translations risk miscommunications. The researchers confirmed the collected data back to interviewees when possible.

c/ Bias

Both qualitative and quantitative data were directly collected from the farmers, minimizing the different levels of data sourcing and bias.

It is important to note that there are many NGOs operating in Hakha Township. Villagers have certain perceptions about NGOs and projects that could influence the answers that they report.

Similarly, as outsiders, the research team could hold certain bias that could influence the interpretation of the data. Bias was minimized through the anthropological approach to the study, the assistance from two local research assistants, and asking local people for advice, interpretations, and feedback. The ethnographic approach allows for the exploration and analysis of unexpected factors.

d/ Infrastructure

The research team faced difficulties traveling to villages. Landslides are very common and most roads are not paved. It was necessary to travel on foot to some villages. Foot-travel up and down steep mountain slopes was also required to observe and interview farmers completing different types of agricultural activities. This increase in travel time put more time pressure on the research. The research team mitigated this challenge by spending multiple nights in the same village rather than traveling back and forth every day.

e/ Diversity of the area studied

Data were collected in four villages. Due to the diversity that exists within Hakha Township, it is not possible to generalize the factors that drove the changes in farming systems from post-colonial period to today for the whole Township. However, actual trends such as outmigration, individualization of land and acute monetization of crops, will have similar effects on the current farming systems.

III. Defining "*family farms*" in the study region, a necessary prerequisite to the agrarian system

In order to understand and interpret the evolution of farming systems, their functioning today as well as their economic results (refer to Chapter VI.), it is necessary to define and conceptualise *family farm* in Hakha township. It is also necessary to define *familial active members* among which *agricultural active members.*

These definitions are articulated around "three fundamental economic principles: **production**, **consumption** and **accumulation**" inspired by Gastellu's work in 1979. As such, the *production community*, the *consumption community*, and the *accumulation community* will be defined within the Northern Chin society of Hakha township.

1. The residence community

In order to deal with the three economic units mentioned here above, it is necessary to first define the *residence community*. "A *residence community* is perceived as a group of persons sharing the same dwelling place, separated from others by a clear barrier" (JM Gastellu, 1979).

Delimited compounds in Bualtak village - Photograph by Clarisse Frissard

In Hakha township, we considered the *residence community* to be the group of persons living in the same **compound.** Villages are divided into multiple compounds, each of them delimited by clear barriers (bamboo, wire fences…). A compound includes the house, in which members of the same *residence community* sleep and eat, and the home garden delimited from neighbors' by clear fences (also having a protective role against livestock). Houses are usually located along the road and home gardens behind (lower on along the slope). In this report, the *residence community* will be referred to as the **household**.

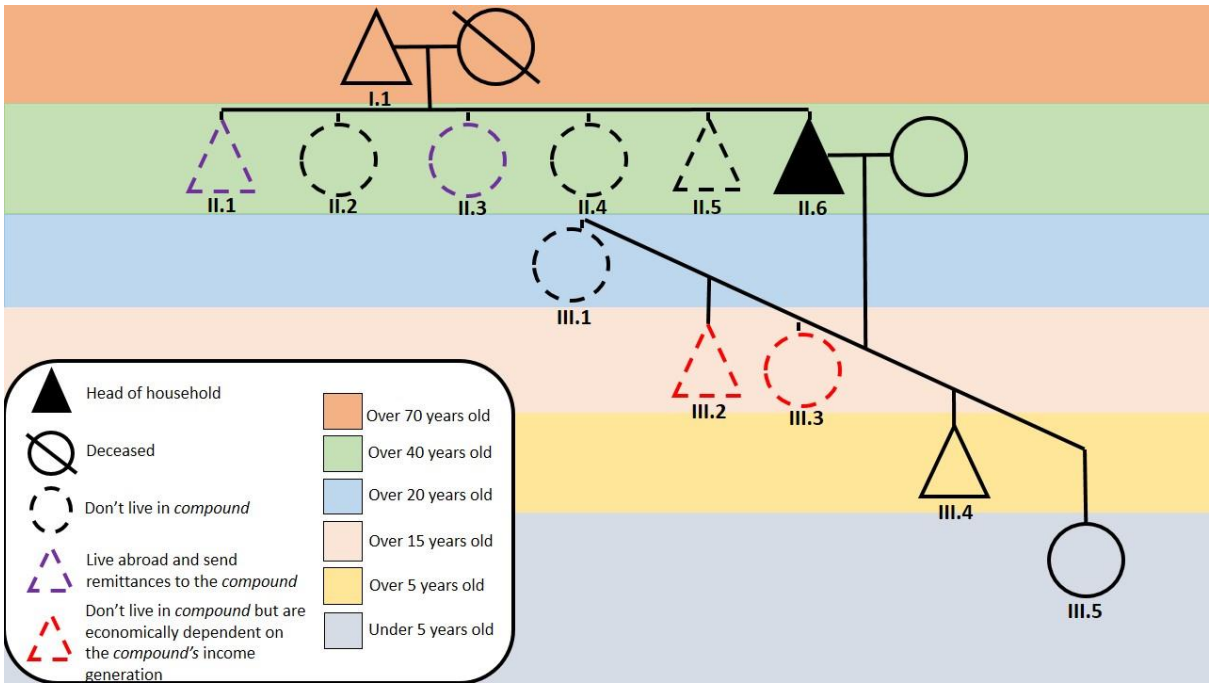


Figure 2 - Archetype of a residence community

Note: Although there are similarities regarding customary law according to the ethnic groups there are also specificities that have to be acknowledged. In this report, customary law thus refers to the area studied within Northern Chin State.

The different ethnic groups studied in Northern Chin State are patrilineal[3] and patrilocal[4]. In the household, there are multiple generations of members belonging to the same lineage.

(1) I.1 used to be the former head of the household. All his children left the household, except the youngest man, according to the customary law and inheritance. All married daughters (II.2 & II.3 & II.4) have left their father's compound to become part of their husband's *community of residence.* The eldest son (II.1) is usually the first male descendant to get married and start his own household elsewhere.
(2) II.1 & II.3 have both moved abroad. Both send **remittances** back to their relatives in Chin State. However, if II.1 sends remittances to his father's compound, II.3 will send the remittances to her husband's relatives in Chin State.
(3) II.5 is the **head of the household.** He is the main decision-maker of the *residence community.*
(4) Children (III.2 & III.3) attending boarding school (usually middle school and high school) are not considered as part of the *residence community.*
(5) On the other hand, members under 15 years old are considered as full-time members of the *residence community.*

2. *The production community*

A *production community* is "perceived as the group of persons that contribute to the creation and supplying of a product" (JM Gastellu, 1979) without any salary. Members contributing to the agricultural production of the compound are identified as follows:
Agriculturally active members include all members of the household over 15 years old.
Agriculturally active members do not include members of the household over seventy years old.
Members under 15 years old are not considered **agriculturally active members**. We will see this was not always the case in the past, as they were in charge of the cattle.
In the historical overview we will see that through the years, work has been organized according to gender and age. Specific tasks were done either by men or women; children or adults.

3. *The consumption community*

A *kitchen* is "perceived as the group of persons consuming together a set of products coming from the same place" (JM Gastellu, 1979). A compound has one *kitchen.* Subsistence crops are stored in a room underneath the house or in a bedroom. They are placed in a wooden box (rice), or big baskets (millet, corn…). Or, they can be hung to dry in a room.

[3] Patrilineal: Relating to or based on relationship to the father or descent through the male line. (Oxford's dictionary)
[4] Patrilocal: Relating to a pattern of marriage in which the couple settles in the husband's home or community (Oxford dictionary)

Wooden box and big baskets used for storage - Photograph taken by Clarisse Frissard

Household members under 15 years old (III.4 & III.5) are part of the *consumption community*. Although they do not contribute to the creation of a product, they contribute to its depletion along with the rest of the permanent household members.

Children (III.2 & III.3) attending boarding school (usually middle school and high school) are not counted as active members since they do not live in the compound. However, they still depend economically on their father's compound (tuitions, roof, and food) and will have an economic consequence on its economy.

4. *The accumulation community*

Finally, 'family farms' are defined as farming systems and are replicated over time through the accumulation community. The *accumulation community,* or, "A set of persons putting in common what's left after consumption" (JM Gastellu, 1979) contributes to the sustainability and reproduction of the farming system through the accumulation of cash, goods, etc. In this study, the *accumulation community* contains the *residence community* as well as some members not belonging to the same *residence community* through the customary inheritance system.

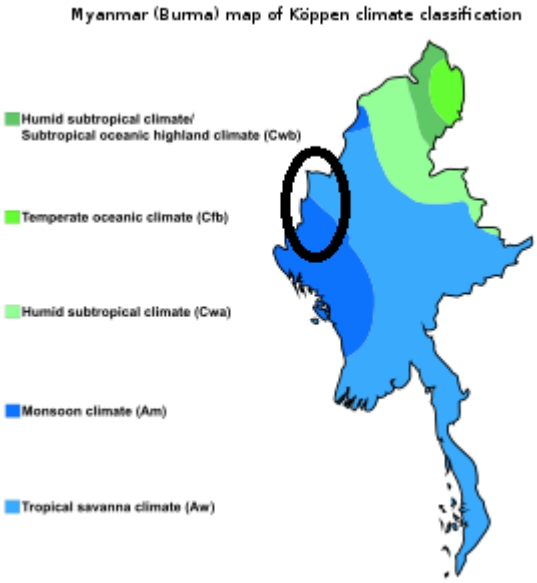
The villagers in the study area were animists and polygamists. In pre-Christianization times the perpetuation of the system was ensured by a set of ceremonies and rituals. The most famous one being the *chicken kill* ceremony[5].

[5] *Chicken kill* ceremony: ceremony done after wedding in order to legitimate the future children.

IV. Agro-ecological Zoning

1. Climate

According to the Koppen climate classifications, Chin State contains both Monsoon climate (*Am*) and Tropical Savanna climate (*Aw*).



Map 4 - Köppen climate classification - Enhanced, modified and vectorized by Ali Zifan

"Type A climates (the warmest) are differentiated on the basis of the seasonality of precipitation: *Af* (no dry season), *Am* (short dry season) and *Aw* (winter dry season)" (A. John Arnfield, 2018).

Am: precipitation in the driest month is less than 60 mm but equal to or greater than 100 – (r/25)[6]
Aw: precipitation in the driest month is less than 60 mm and less than 100 – (r/25).

[6] In this formula, r = average annual precipitation total in millimeters.

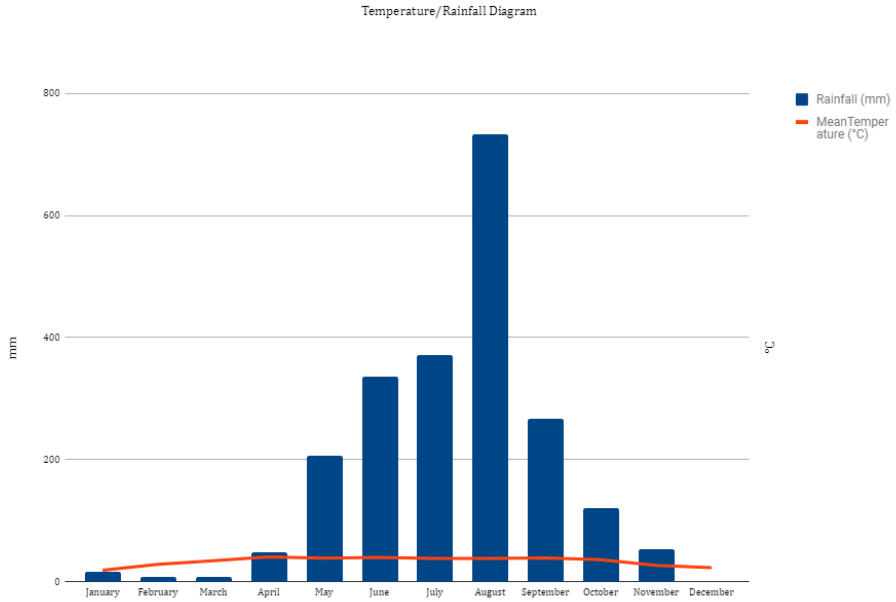


Figure 3- Rainfall and Temperature Diagram of Hakha Township - Data collected from the meteorology department in Hakha (average of 2015, 2016 and 2017)

According to the data collected with the meteorology department in Hakha, the average annual precipitation of Hakha Township is 2,619 mm. The rainfall and temperature diagram here above represents precipitation and temperature averages for the past years as collected by the meteorology department in Hakha. It clearly identifies December as the lowest rainfall month with an average of 0 mm precipitation, defining Hakha township as an *Aw* Tropical Savanna climate.

Köppen's classification does not consider the uniqueness of highland climate regions with elevations above 1,500 meters. In terms of precipitation, the Köppen's classification is accurate for the area. However, the elevation gives Hakha township a lower average temperature than areas below 1,500 meters. The average annual temperature is 17°C with an average of 9.4°C during the coolest month (January) and an average of 20.3°C during the warmest month (April). Until April, Hakha only receives an average of 2.21% of the average annual precipitation total, the temperature chart remains above the rainfall chart. Therefore, a clearly defined dry season exists.

Farmers in the area specify three seasons:

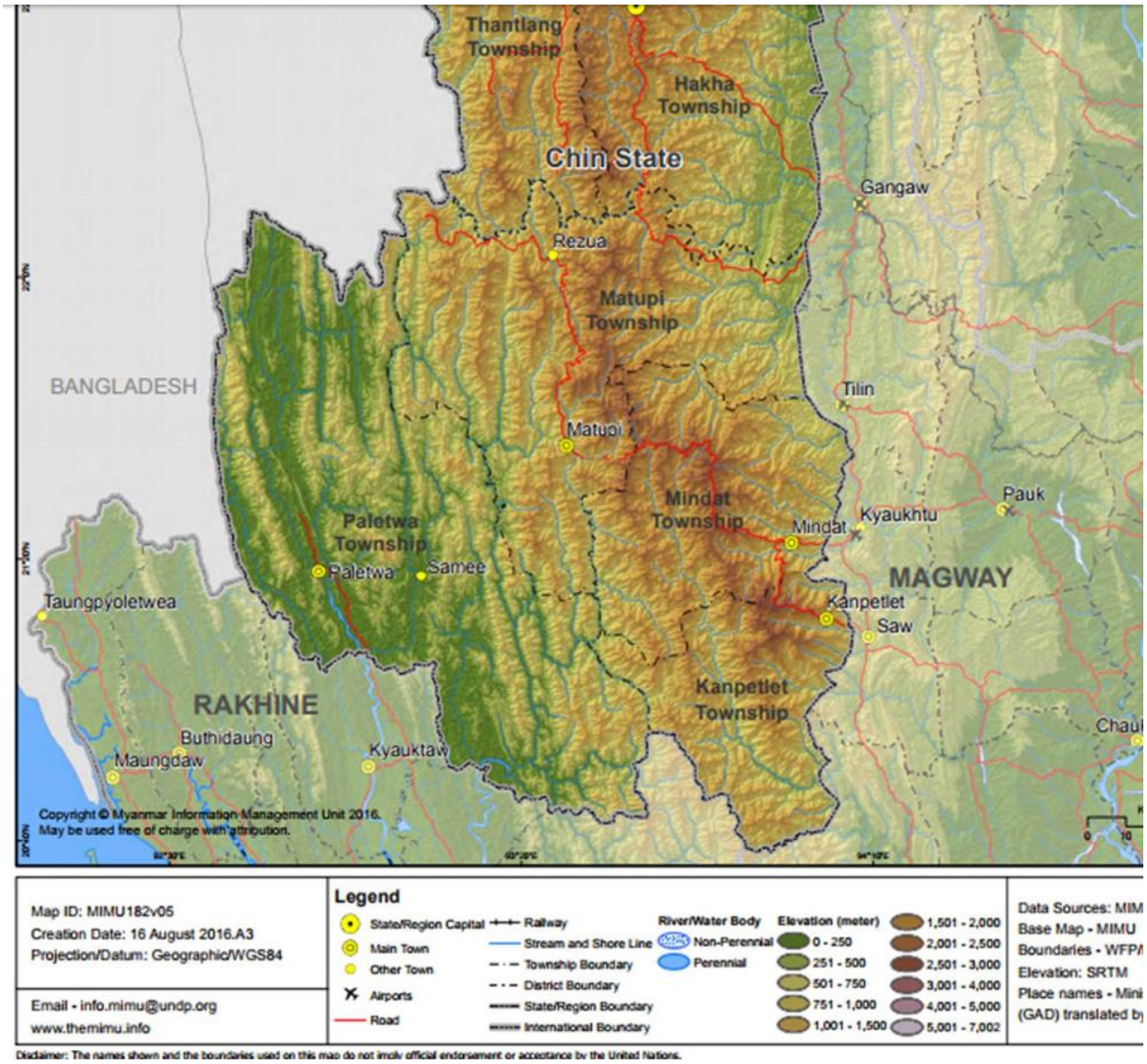
(1) The rainy season occurs from mid-May to mid-October with 94% of the average annual precipitation concentrated in these 6 months. This season coincides with the vegetative cycle of crops sowed by farmers in shifting cultivation plots and paddy terraces.

(2) Winter season occurs between mid-October and mid-February. Winter season marks the beginning of the dry season as well as the coldest season of the year. It coincides with the majority of the harvests of annual crops.

(3) Summer season occurs from mid-February to mid-May. Although December has an average of 0 mm precipitation, the streams still benefit from the sufficient rainfalls of the previous months (November included). The rainfalls of March are not high enough to be utilized by cropping systems. As March is in the midst of the dry season with rising temperatures, streams have dried up or have had too low of a water level to be used for irrigation.

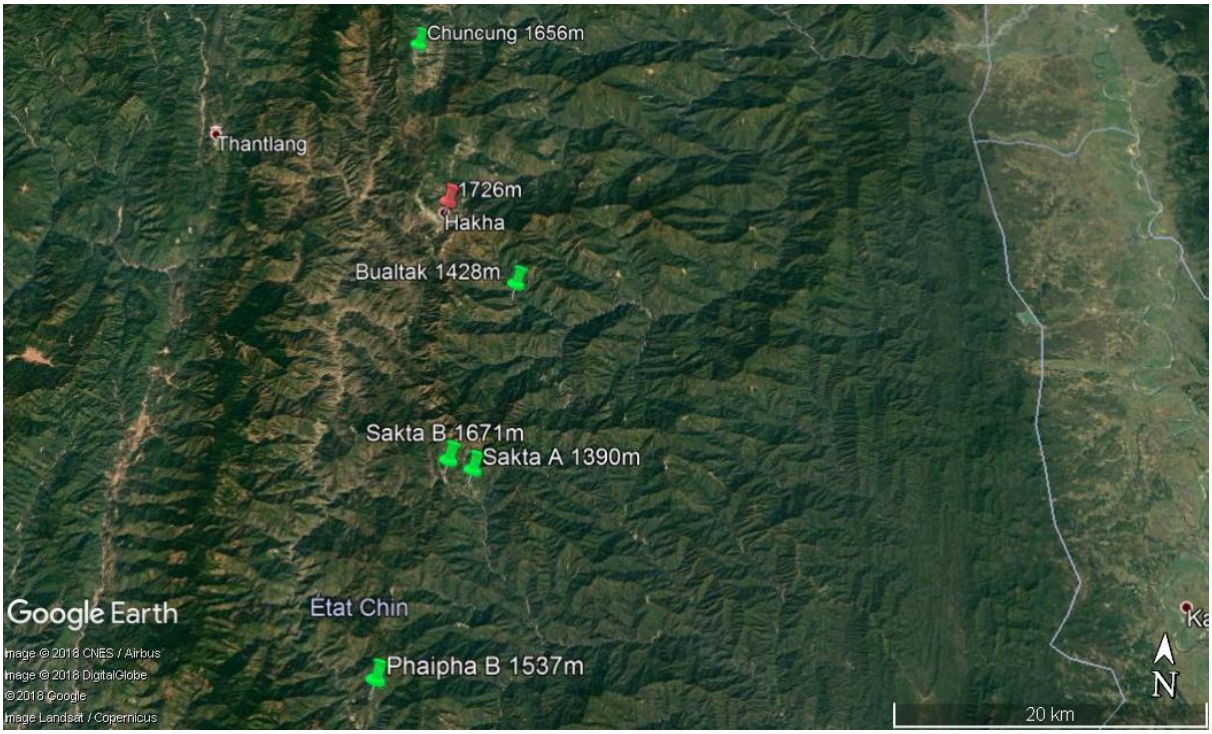
Therefore, for farmers in the area, March is considered the driest month of the year with forage availability at its lowest peak.

2. Topography



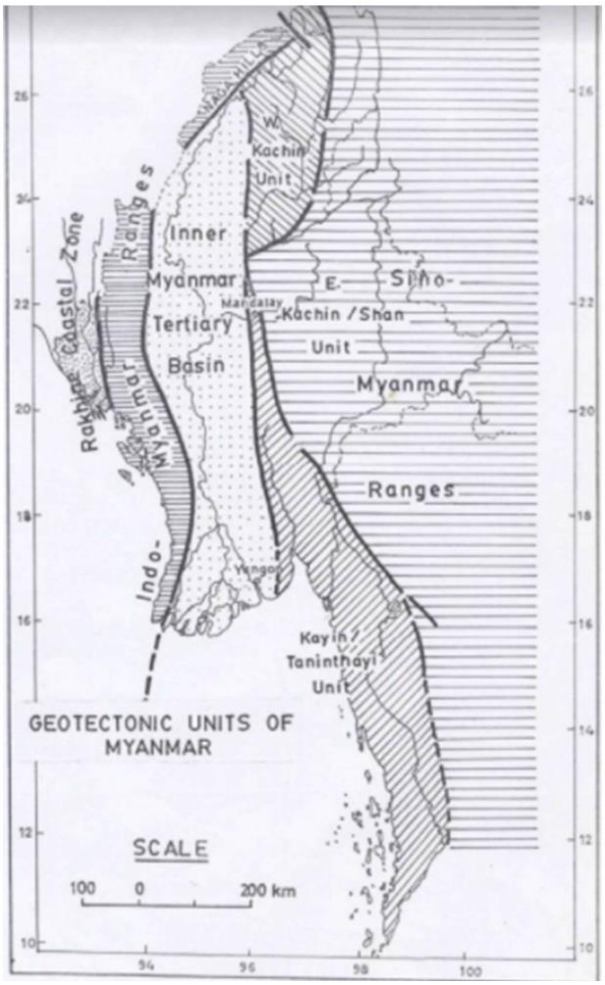
Map 5 - Topography and Hydrography map of Chin state - MIMU

Chin State is part of the Indo-Myanmar Ranges, branching southwards from the eastern Himalaya, with peaks and valleys running from North to South. In Hakha township, elevation can reach over 2,000 meters. This highland landscape conditions the cropping systems of the area. Farmers must take into account the elevation (and coldness) as well as the steepness of the slopes. A network of rivers and small streams cut the region into valleys. They connect either to the Chindwin river or directly into the Bengali gulf. Surface water plays an important role during the dry season for specific cropping systems such as paddy terraces but also orchards with young trees and other permanent crops (mainly annual).



Map 6 - Topography and localization of the villages studied - 2018 CNES Airbus, 2018 DigitalGlobe, 2018 Google Image Landsat / Copernicus

3. Geology and soils

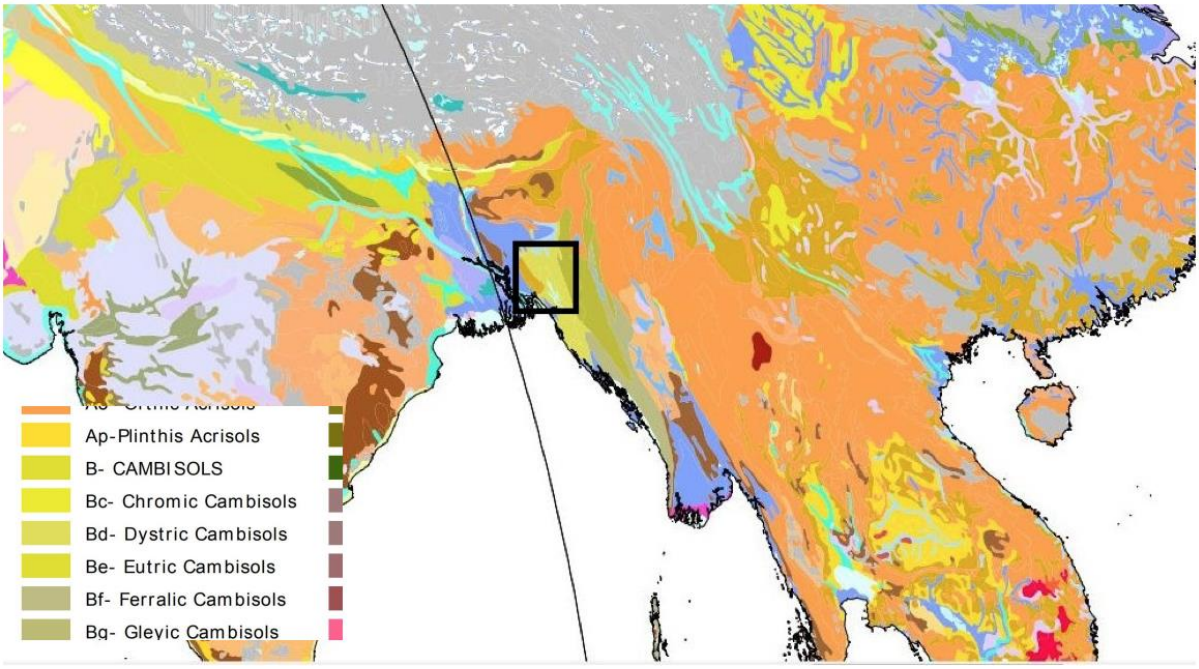


Map 7 - Major geo-tectonic units of Myanmar - Dr. Ir Subagyo Pramumijoyo. et al. (2010)

Hakha is located in "The Arakan – Chin metallogenic province[7]". It is formed of early Tertiary flysch-like sediments with allicochthons of Cretaceous and Triassic rocks. (Dr. Ir Subagyo Pramumijoyo. Et al., 2010).)

[7] Metallogenic province: geographic area characterized by a particular assemblage of mineral deposits, or by a distinctive style of mineralization- Encyclopaedia Britannica

Flysch soil in Sakta village - Photograph by Clarisse Frissard



Map 8 - Extract of FAO's soil map - FAO

According to the FAO's classification, Chin soils belong to the Cambisols[8] group. "Cambisols in the humid tropics occur predominantly at medium altitudes in hilly and mountainous regions. […] By and large, Cambisols make good agricultural land and are intensively used. […] Dystric Cambisols, though less fertile, are used for (mixed) arable farming and as grazing and forest land. Cambisols on steep slopes are best kept under forests; this is particularly true for Cambisols in highlands" (ISRIC: International Soil Reference and Information Centre). This description made by the ISRIC coincides with the use that was made of the land by farmers in the Chin Hills before any political intervention: Shifting cultivation systems with long fallow periods allowing forest regrowth, sacred forests, and pasture land (as described in Chapter V.1).
During our interviews, farmers roughly identified two "types of farming soil". Mainly, "sandier soil" which is found closer to the bottom of the valley, streams, and rivers; and "clayey soil" going up the slope.

[8] Cambisol: one of the 30 soil groups in the classification system of the FAO » - Encyclopaedia Britannica

4. Farmers' own, common, classification of their land

Farmers identify two distinct types of farming land: warm land (*Lai Lo*) and cold land (*Zo Lo*).

- Depending on the sun exposure

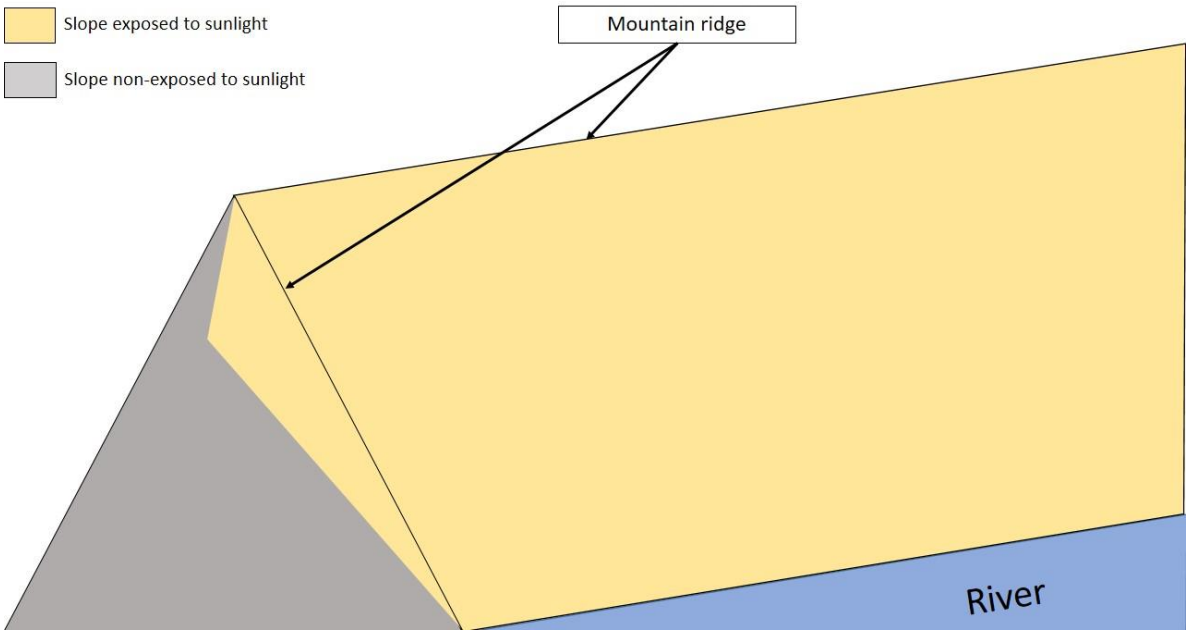


Figure 4 - Lighting of slope according to sunlight exposure

- Depending on elevation

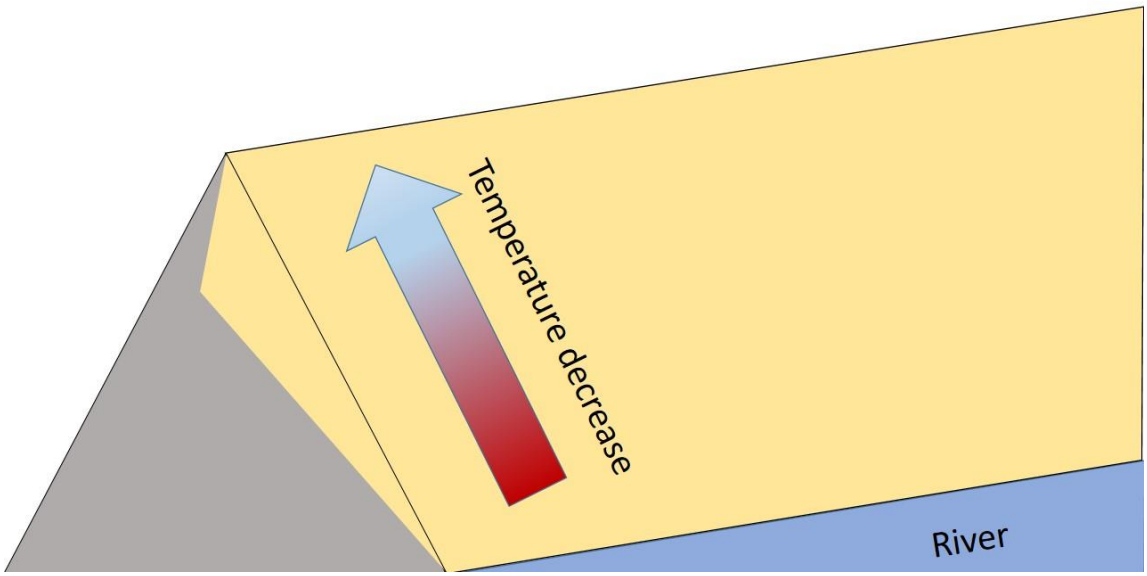


Figure 5 - Soil temperature according to elevation along the slope

- ❖ Depending on soil

Clay soils keep more heat (higher thermal inertia) than sandy soils.

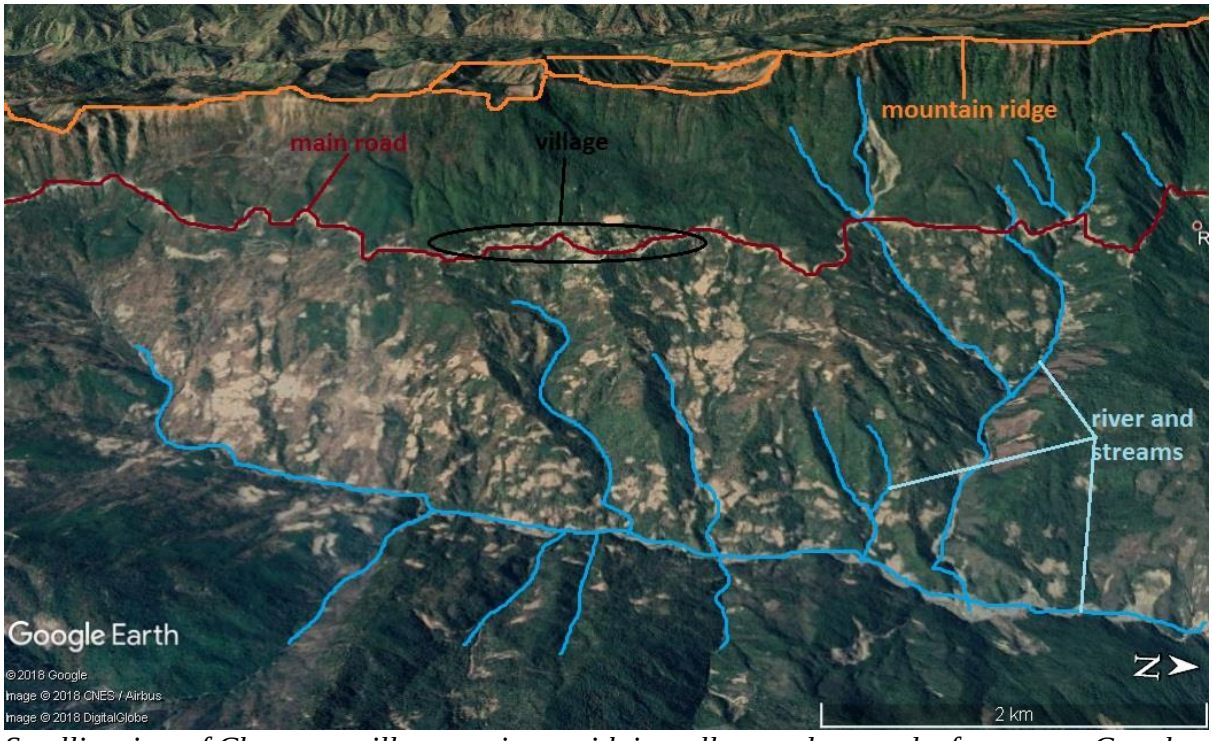
These types of land have specific cropping compositions and calendars due to their unique characteristics.

5. Spatial organization of a village and its surroundings

a/ Villages

Villages are usually situated close to a road for a better access to markets. In the past, the agrarian system was exclusively based on shifting cultivation. Villages would physically move to follow the different *lopils* that were opened for cultivation. New villages could be created by a few households that had enough labor force to clear a "new" *lopil*[9] from a neighboring village. These households were considered the founders and thus have a higher rank in the new village.

After British colonization, the administration defined the borders of each village, recognizing a certain territory belonging to each. From then on, villages stayed in the same place, and the population grew within these fixed boundaries. Usually, the old part of the village and the extension of the village are recognizable by their names: "A" referring to the old part and "B" to the new part. These village "extensions" situate the new village area close to the road.



Satellite view of Chuncung village territory with its valleys and network of streams - Google Earth, 2018

[9] new *lopil* opened on forests land that had never been used for shifting cultivation before.

Chuncung village - Photograph by Clarisse Frissard

b/ Rivers and Streams

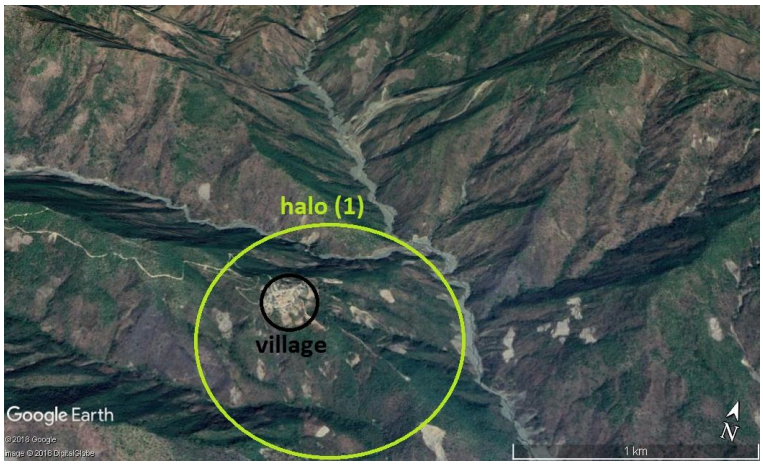
Rivers and streams are used by villagers as a source of irrigation, drinking water, and food. Rivers and streams are pivotal for protein provision in rural household diets when used for fishing. Historically the people surveyed report eating fish at least once a week. Today, rivers are also used for irrigation of paddy terraces at land preparation time, and on young perennial crops (orchards, plantations…) that need regular water provision throughout the year. Annual crops, on the other hand, have a vegetative cycle during the rainy season.

The presence of home gardens inside villages is conditional to the presence of a water source close enough to irrigate the crops in winter and summer season. Today, almost every rural household in Hakha Township has a home garden because water infrastructure is present.

Stream and river in the Phaipha-B territory - Photograph by Clarisse Frissard

c/ Halo 1: Permanent orchards and paddy terraces

The first halo is closest in proximity to the community's place of residence. Here, permanent plots and paddy are established. Crops cultivated in this halo are usually cash crops. Since cash crops often require picking almost every day, the close proximity allows for shorter transportation times and better market access. Furthermore, since livestock are usually kept far from the village, the first halo offers these crops a increased protection from livestock that could damage the high-value crops.



Satellite view of the first halo of crops surrounding Bualtak village - Google Earth

First halo of crops surrounding Chuncung village: Paddy terraces and permanent fields - Photograph by Clarisse Frissard

d/ Paddy Terraces: Halo 1

Paddy Terraces are also located in the 1st halo of crops around the village. They are located alongside rivers and streams because of their need for irrigation. Usually, one set of paddy terraces includes terraces of multiple households. Gravity irrigation is done by diverting water from the river with pipes (plastic or bamboo) or earthen channels. The water is brought to the top of the terraces and then flows down. Debris in the streams is minimal since terraces are flooded at the end of the summer (see Figure 6). When the water supply is not enough for all households at the same time, priority is given to the first settlers that arranged the irrigation system.

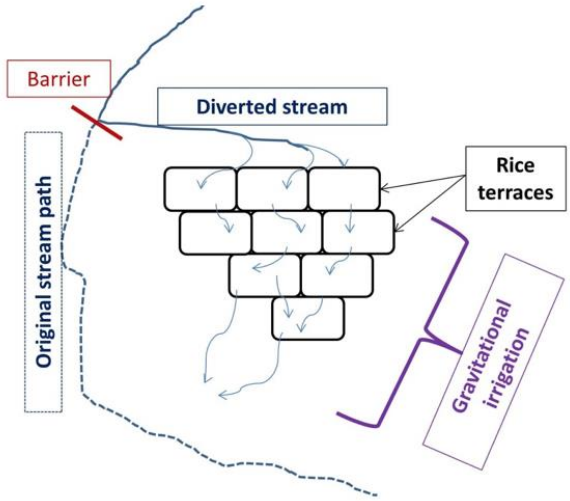


Figure 6 - Irrigation system of a set of paddy terraces

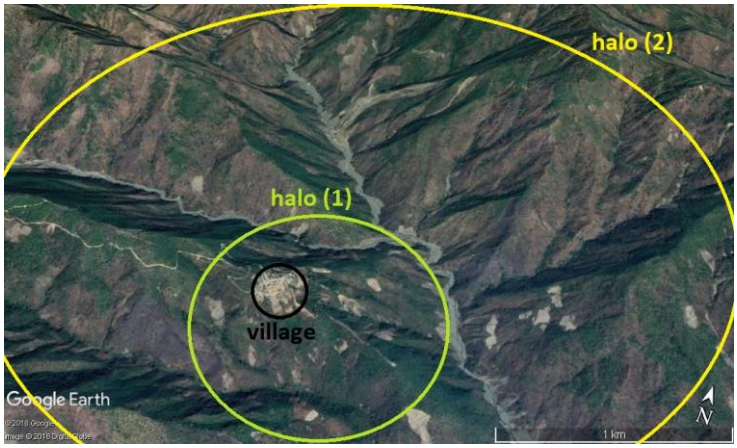
A water pipe used to bring water from the stream to a set of paddy terraces in Chuncung territory - Photograph taken by Clarisse Frissard

Set of paddy terraces in Phaipha B - Photograph by Clarisse Frissard

e/ Shifting Cultivation *Lopils*: Halo 2

A *lopil* refers to a big area of land that is opened for shifting cultivation. Each *lopil* includes a set of plots grown by each household in the village that practices shifting cultivation. Size of the plot depends on the number of household members. Today, farmers usually change *lopils* every year.

The location of the *lopil* is decided at the village level by the village administrator and the village committee, in agreement with the shifting cultivation producers. *Lopils* are then left fallow for a period of 6 to over 20 years (depending on the village) before they are grown again. Forest is left to regrow on fallowed areas.



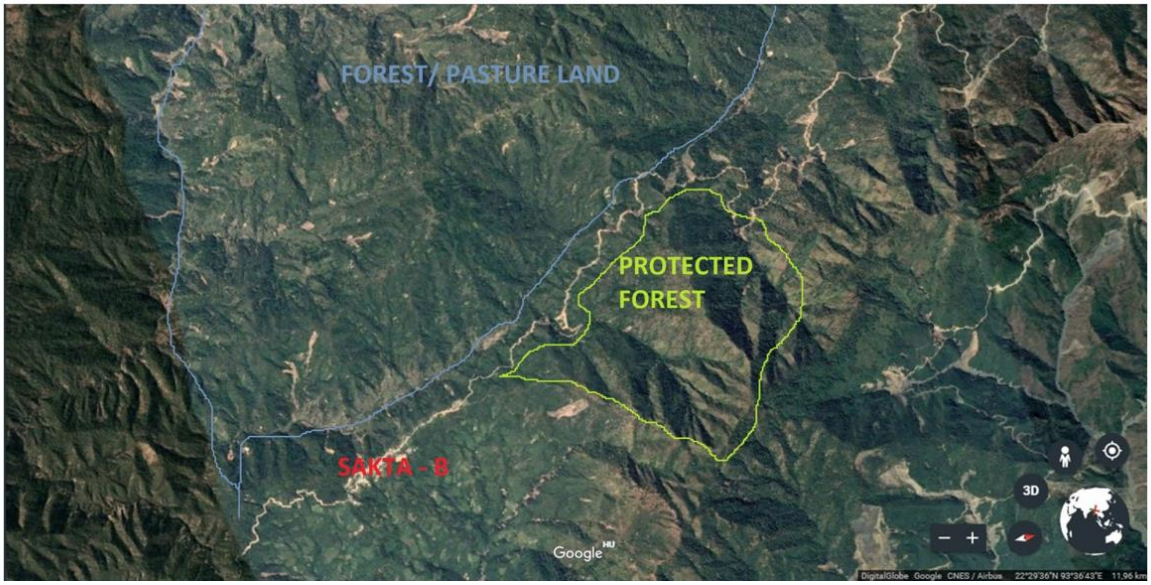
Satellite view of the second halo of crops surrounding Bualtak village - Google Earth

Lopil located in the 2nd halo of crops in Chuncung village - Photograph by Clarisse Frissard

Forefront: halo (1) paddy terraces and permanent fields, background: halo (2) shifting cultivation lopils - Photograph taken by Clarisse Frissard

f/ Protected and/or Sacred forests

Protected and sacred forests are not part of the shifting cultivation cycle. They are always left as forests, either to protect a water resource or because the forest is in close proximity to the village, and burning the forest would endanger the village. Forests are used to hunt and to collect vegetation to sell or eat. They also act as a forage reserve for cattle during the dry season. Today, forests are also used to grow cash crops such as elephant foot yam.



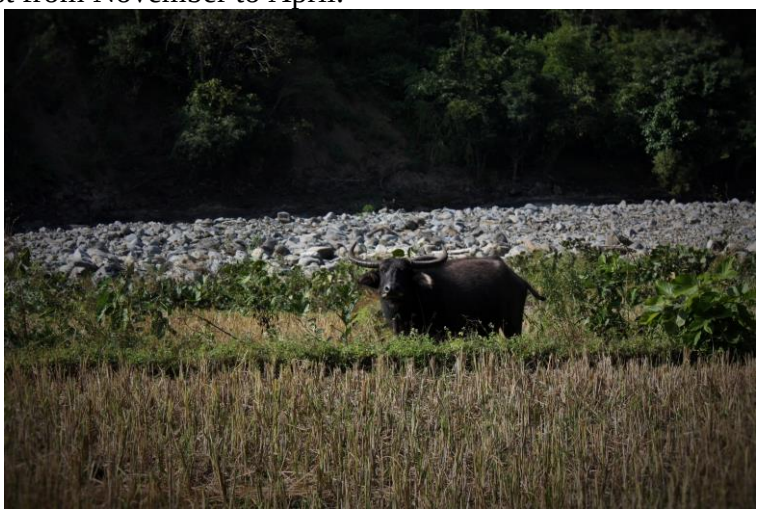
Satellite view of the protected forest and pasture land in Sakta territory - Google Earth

Elephant foot yam - Photograph by Clarisse Frissard

Pasture land in a forested area - Photograph taken by Clarisse Frissard

g/ Pasture Land

Pasture land is a specific area where large livestock (buffaloes, cows, mythons, horses) are left to graze from May to November. They are usually areas of forests kept away from the permanent fields. In the past, large livestock spent the daytime in the forest and were brought back to the village at night (refer to Chapter V.). Today, it is not possible to bring large livestock back to the village because of the risk of crop destruction in permanent plots. Cattle are left in the pasture land from May to November (increasing the risk of casualties due to wolves) and then moved to the paddy terraces after harvest from November to April.



Cattle grazing on paddy terraces in the Phaipha-B territory - Photograph taken by Clarisse Frissard

V. Historical Evolutions of Farming Systems

1. Pre- Colonial Hakha Society (Before 1885)

a/ Structure of pre-colonial Hakha Society

In this period, the agrarian system of Hakha was intrinsically linked to the social organization of the pre-British society[10]. Hakha Chin society is a patrilocal, patrilineal clan-based society that was majority animist (the children integrate the father's clan through a *chicken kill*[11] ceremony).

The society was organized into noble clans, middle clans, lower clans & slaves:

The village chief was part of the *bawi* or noble clan and was believed to have a spiritual connection to the land that granted him the power to define and allocate areas of land cultivated (*lopils*). According to customary law, an area of land belonged to the household that had first cleared it (cut and burned the trees, weeded and prepared the land to cultivate). Wealth, in the form of land claims within *lopils*- was highly concentrated in the hands of the *bawi*, or noble clans, since the *bawi* had enough force (with slaves) to clear big areas of land.

Although middle clan members still worked on the land of the *bawi*, they could claim land in *lopils* by offering the *bawi* a mython in return for land tenure security. When the village would return to that particular *lopil*, the household (or household of the eldest son) would have the first choice to cultivate that specific area of land. By customary law, this specific area of land was considered "bought" from the *bawi,* allowing the purchaser not to contribute to the *bawi's* livelihood anymore. Men from middle clans could also hope to acquire land by marrying a woman from a noble clan. By marrying, she would integrate her husband's clan but while he was alive, her father could choose to donate her an area of land that she could bring to her husband's household. This area of land would then be considered the husband's household property.

Lower Clan members were the last to be allocated plots within *lopils*. The size and the plot location was given depending on the number of household members and the food needs of the *bawi*. Lower clans would not necessarily be given the same plot within *lopils* when the village returned to a specific *lopil*. Lower clans gave a portion of harvested crops to the *bawi* in rent since the *bawi* were the landowners.

Slaves had no claims to land, nor rights to any harvested crops. They worked the land of the *baw*i and gave the harvested crops to the family. The research team was told of three types of slaves. The first type of slaves were indentured servants who were formerly members of lower clans. They worked in the home of the noble family in return for livestock and food. Secondly, Chin people captured slaves during battles, as they often raided villages in the plains or went to war with other Chin ethnic groups. Finally, members of higher clans also purchased slaves, however, the research team was unable to find information about where these slaves were purchased from.

[10] A comprehensive analysis of the social organization of Northern and Southern Chin is presented in anthropologist F.K Lehman's book published in 1963: *The structure of Chin Society*. This analysis was built upon specifically for Hakha township in the Land Tenure report published by Gret in 2017.

[11] *Chicken kill* ceremony: ceremony done after wedding in order to legitimate the future children.

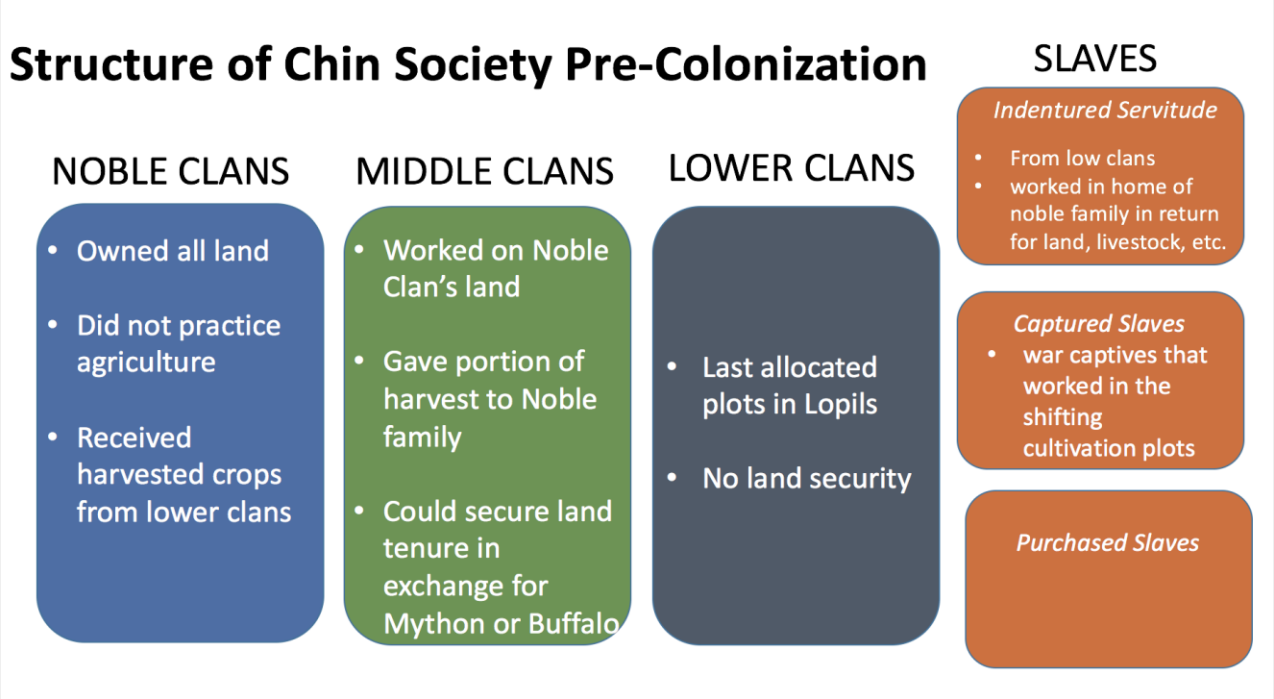


Figure 7 - Structure of Hakha society in pre-colonial times

In this time, the *community of production* and *community of consumption* referred to different individuals, depending on the clan. The group of persons that contributed to the creation and supply of the products was not necessarily the group of persons consuming together the said product. Since noble clans had the status of landowners, they did not practice agriculture: they did not have a production community and their consumption community depended on other production communities to supply their products. A noble household comprised of about six members would have around five acres of land cultivated by their slaves. Noble clans served a protective role for the village in times of hardship. Middle clans and lower clans worked the additional land of the *bawi* (around one to two acres per household) and gave a portion of their harvested crops to the *bawi* in return for the land and protection.

Cost of a bride was high (multiple animals sacrificed and offered to the bride's relatives, as well as copper pots etc.). Therefore, polygamy was mainly practiced by higher class clan members. In these cases, inheritance (as described in Chapter III.4) would only concern the children of only one wife: the *Nu Tak*[12], legitimated by a *chicken kill* ceremony. The research team documented the following inheritance rules:

(1) The eldest son receives the land and the cattle at his father's death. He is thought to be the first one to get married and build his own house to start his own household.
(2) The youngest son receives the whole compound at his father's death. He is thought to be the last to marry and usually stays with his wife within his father's compound to care for his parents.
(3) Other children (daughters and middle sons) are not in a position to claim anything once their father is dead unless he has willed something to them prior to his death.

Children from other wives *(Nu Chun*[13]), could only receive land, cattle, or objects from their father through donations while he was still alive.

[12] *Nu Tak:* "principle wife". Wedding cost most expensive so in case of polygamy, usually the last bride. Preferably from a higher clan if husband can afford the cost.
[13] *Nu Chun:* "side wives". Wedding cost is lower: usually only 1 cattle given to the bride's family.

Nu Tak fee If groom couldn't pay all of this in a year. Negotiations could be made with the grandfather of the bride to be able to pay every year until the debt was settled

(1) To father of the bride

1 cattle (mython, buffalo, cow or pig depending on wealth) to the father of the bride. Through this donation, the bride integrates her husband's clan and household.

(2) To brother of the bride
1 cattle (mython, buffalo, cow or pig depending on wealth) (+horse if husband really wealthy).
Silver coins from India, bells, copper pots, horn

(3) To the aunt (from the father's side) of the bride
1 cattle (mython, buffalo, cow or pig depending on wealth) (+horse if husband really wealthy).
Copper pots
Presents given 4 times: when she enters the compound, when she stands in front of the house, when she enters the house, when she sits on the mat

(4) To the mother of the bride
1 cattle (mython, buffalo, cow or pig depending on wealth) (+horse if husband really wealthy).
Copper pots

(5) To the grandfather (from the father's side) of the bride
1 cattle (mython, buffalo, cow or pig depending on wealth) (+horse if husband really wealthy).
Copper pots

Traditional bells used in animist ceremonies - Photograph by Clarisse Frissard

b/ Pre- Colonization Farming Archetypes

1. Noble Clans (*Bawi)* - Landowners. Held highest status in villages, owned all land and did not participate in agricultural labor. This farming system relies on the *slaves* for labor force and on other farming systems to supply them with the rest of food needed for their *community of consumption*.

2. *Middle Clans*- Worked on the land of the *bawi* but had some access to land tenure.

3. *Lower Clans*- Worked on the land of *bawi* and kept some harvest for home consumption.

4. *Slaves*- Laborers for *Bawi*

c/ The shifting cultivation system of Hakha in the pre-colonial period

As described in Chapter IV.4, the land was divided into two types, cold land (*zo lo*) and warm land (*lai lo*). Cropping systems at the time were exclusively shifting cultivation systems. Areas around villages consisted of either permanent forests (usually above the village, or in some cases surrounding the village to be used as a firebreak) or rotational land involved in the shifting cultivation cycle. The spatial organization was communal, all households practicing shifting cultivation grew their plots in the same *lopil* the same year. Forests wouldn't be exploited by any household apart to collect vegetation for consumption, or to hunt.

A *lopil* would be cleared from November to January, and then burned in March. Sowing would begin in April. Farmers stayed in a *lopil* for one to three years depending on village customary land tenure. As a general trend, the warm land was cultivated for three years, and cold land for one year. After this time, the land would be left fallow for vegetation to regrow and soil to regenerate naturally. Fallow periods were reported to be over twenty-seven years in some villages. When managed within customary systems with long fallows, this agricultural practice does not cause significant deforestation as the forest simply moves and the soil is given time to replenish fertility. Along with the high diversity of crops that were grown in association in the same area, it was also a way to control pests and diseases.

Fallowed lopil where the forest is growing back - Photograph by Clarisse Frissard

The table (3) explains the agricultural calendar of the shifting cultivation system, after which major steps would be described. Through in-depth interviews and bibliographical research, the research team presumes that over the years, the calendar and techniques used to grow shifting cultivation plots had not changed. As it will be described later on, these systems were simplified over the years in terms of diversity of crops grown and the geographic location of *lopils*. However, the techniques used to grow each crop remain the same. Therefore, the description given below will also apply to the shifting cultivation systems over the years. It is important to note that this table is incomplete: (a) *Cang Pang* and *Mumg* are no longer cultivated, therefore sowing times were not known.

Month	Agricultural Activity	Labour Organization
November	**Each plot within *lopil* was cleared**: small trees are cut, big trees are pruned, tall grass is cut	**Each household in charge of clearing the plot they would cultivate** (men of the household) **& slaves**
March	***Lopils* were burned.** Bigger branches form natural barriers that will be used to maintain the ash	**1-2 men from each household** (excluding noble households) **and slaves** would burn *lopil* as a village
April	**Sowing** of Millet, Corn, Pumpkin, Cucumber, Pigeon Pea, various beans and peas (sulfur bean, pigeon pea, long bean), banana plants near termite mounds **Weeding & pushing debris/ash** against the natural barriers	**1 person** in the front **broadcasting the Millet** followed by the **working group sowing the rest**, **weeding and pushing the debris/ash**
May	**Sowing** Cowpea, Taro	**Working groups**
June	**Sowing** Sweet Potato, Soybean	**Working groups**
July	**Harvesting** Cucumber	**Working groups**
August	**Harvesting** Millet and Pumpkin	**Working groups**
September	End of September- **Harvesting Corn**	**Working groups**
October	Continued **Harvest of Corn**	**Working groups**
November	**Harvesting** Long Bean, Soybean, Taro, Tree Tomato	**Working groups**
December	**Harvesting** Sweet Potato	**Working groups**

January	**Harvesting** Cowpea	**Working groups**

Table 3 - Agricultural calendar of a shifting cultivation system in pre-colonial times

Shifting cultivation systems relied on **communal spatial organization** but also on **communal work organization**.

(1)Clearing step

Only the (1) **clearing step** of the seasonal calendar was organized at the household level where the men of the household were responsible to clear the plot their household would cultivate on. Nothing was reported to be collected from the sacred forests. Cooking and timber wood were taken from the plots that were cleared before cultivation.
Tools used: Axe and *Nam Tong* (long knife).

Nam Tong - Photograph by Clarisse Frissard

(2) Burning step

The (2) **burning step** was organized communally at the village level. The men from cultivating households, together with slaves, combined to burn the *lopil*. They controlled the propagation of the fire and to organize "*Tlang Ram Riah"*[14]. According to historical interviews, if 60 households worked on a 70-acre *lopil*, one week was needed to prepare the firebreaks around the *lopil*: on the sides and on the top. To make the fire breaks, tall grasses and small trees were cut with the *Nam Tong* and branches of bigger trees were pruned. Then, small fires were started and stopped (fire was beaten with sticks) all around the *lopil*. During this step, 2-3 men were responsible to feed the others with hunted meat or fish since the entire group would remain in the *lopil* until the end of the burning process.

[14] *Tlang Ram Riah:* refers to a hunt organized communally.

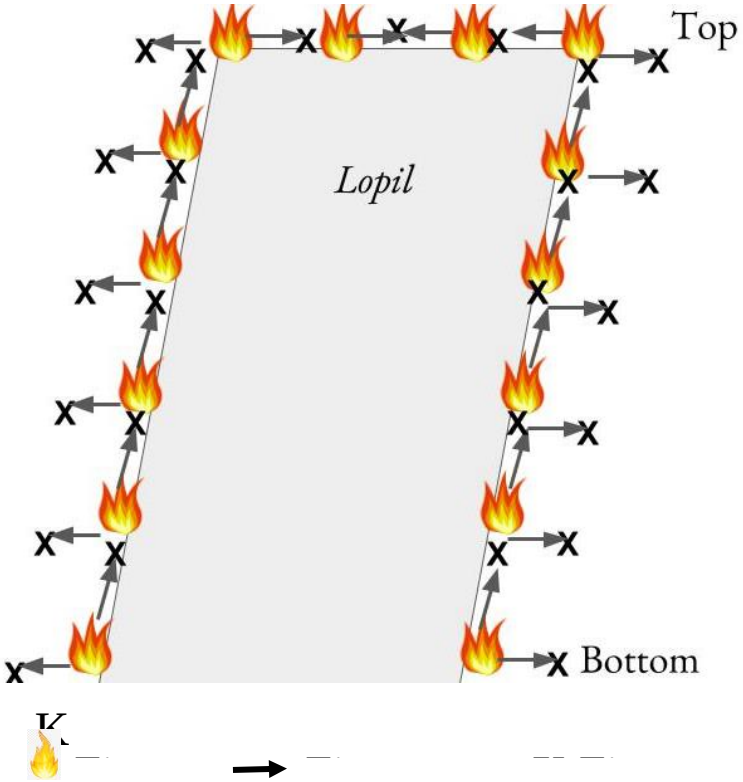


Figure 8 - Firebreak making around a lopil before the whole lopil is burnt

Next, (3) **sowing,** (4) **weeding,** (5) **harvesting,** were organized by groups of households. The research team did not find uniform criteria used by groups of households to form working groups. From the historical interviews conducted with elders, a working group was not dependent on clan: a working group could include both the middle class and lower class members. It also seems that these groups were flexible in terms of member composition depending on the task. Different tasks could mean different group compositions, depending on members' availability and eligibility to be part of a group.

The working groups would first work on plots located on *zo lo* (cold) land, as crops would need further time to settle and grow. Once the first crops (millet, corn, pumpkin, cucumber) were sowed, the group moved to subsequent plots until all the crops were sowed on each plot. One member could cover a four to a five-foot-wide area at once. Working groups included from nine to twenty members.

To benefit from the working group working on their plot, households had to have at least one member in the group. Households that were not able to be part of a working group (no labor force available: accidents, deaths etc.) had to manage all the steps by themselves, and would often have trouble producing enough food to feed their household. As a result, some of the household members would become indentured servants.

Gendered tasks: Cutting and burning were exclusively done by men. After harvest processing & seed selection was exclusively done by women.

Age-dependent tasks: In this period, children did not attend school. All household members were available to participate in the agricultural work. Members above 15 years old would actively participate in the cropping systems, independent members under 15 years old would be in charge of specific tasks such as taking care of the cattle during the day, guarding fields against wild and

domesticated animals (birds, rodents, cattle etc.), and bringing food to elder members staying in the shelter house during peak work weeks.

(3) Sowing step

The crops and number of varieties grown in shifting plots depended on soil composition, elevation of the land, steepness of the slope, incidences of springs and termite mounds, year, and of course, household food preferences. Within a plot, the res several stories of vegetation spatially organized in a thoughtful way of combining legumes and cereals, tall stems and climbing plants. The high level of biodiversity created resilience within the system, protecting communities from famine with crops harvested all year long.

Crop rotation on *lai lo* plots:

Year (1): Millet - Maize - Cow Pea - Soya Bean - *Cang Pang* - Long Bean - Pumpkin - Cucumber - Sweet Potato - Taro - Banana trees

Year (2): Millet - Maize - *Mumg* - *Cang Pang* - Pumpkin - Cucumber - Sweet Potato - Taro - Cow Pea - Pigeon Pea - Sulfur Bean - Soya Bean - Banana tree

Year (3): Maize - Taro - Soya Bean - Pumpkin - Cucumber - Sweet Potato - Cow Pea- Sulfur Bean - Banana tree

YEAR (1)

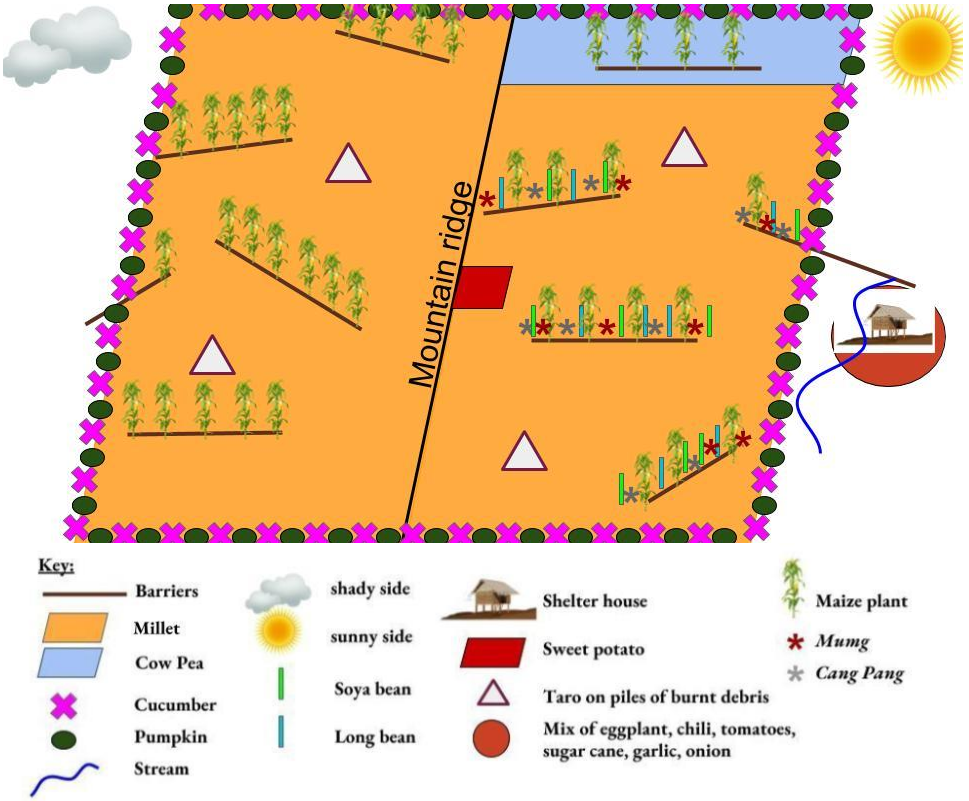
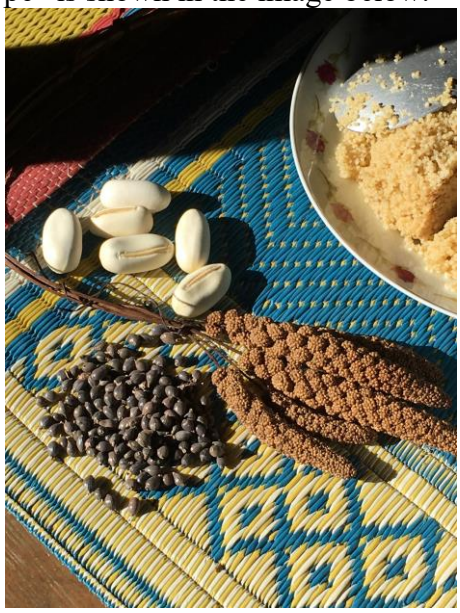


Figure 9 - Spatial organization of a shifting plot in year (1)

Millet:

Millet refers to a variety of grains, some of which are not in the same genus. Millet varieties fell into three different categories: “hard”, “milky”, and “soft”. One type of millet found in Hakha referred to as a “hard type” is shown in the image below.



From top to bottom: Sulfur Bean, Millet, and ‘Mumg’ - photograph by Alyssa Pritts

Millets are the first crop broadcasted: around 4 kg of seeds for 1 acre, all over the field, by one person walking up the slope of the throwing the seed.

Maize:

Many different varieties of Maize were cultivated: white, yellow, red, purple, and mixed colored cobs were all shown and described to the research team.

Multiple varieties of maize hanging to dry - photograph taken by Clarisse Frissard

Maize was sowed by the working group following behind the millet broadcaster. It was sowed above the natural barriers formed by the unburnt trunks and on top of the ash and debris that were pushed against the logs. Using a small hoe, 2 to 3 seeds were put into a hole, around 6 kg of seeds were needed for a 1-acre shifting plot. Maize could also be sowed in between two barriers. In that case, it wasn’t sowed in lines but each plant would be 2 to 3 feet apart from the other ones.

Small hoe - photograph by Clarisse Frissard

Cowpea

Around 0,8 kg of seeds required for the plot, sowed with a small hoe by the working group. Several varieties (with different colors) were described to the research team by the elder farmers interviewed.

YEAR (2)

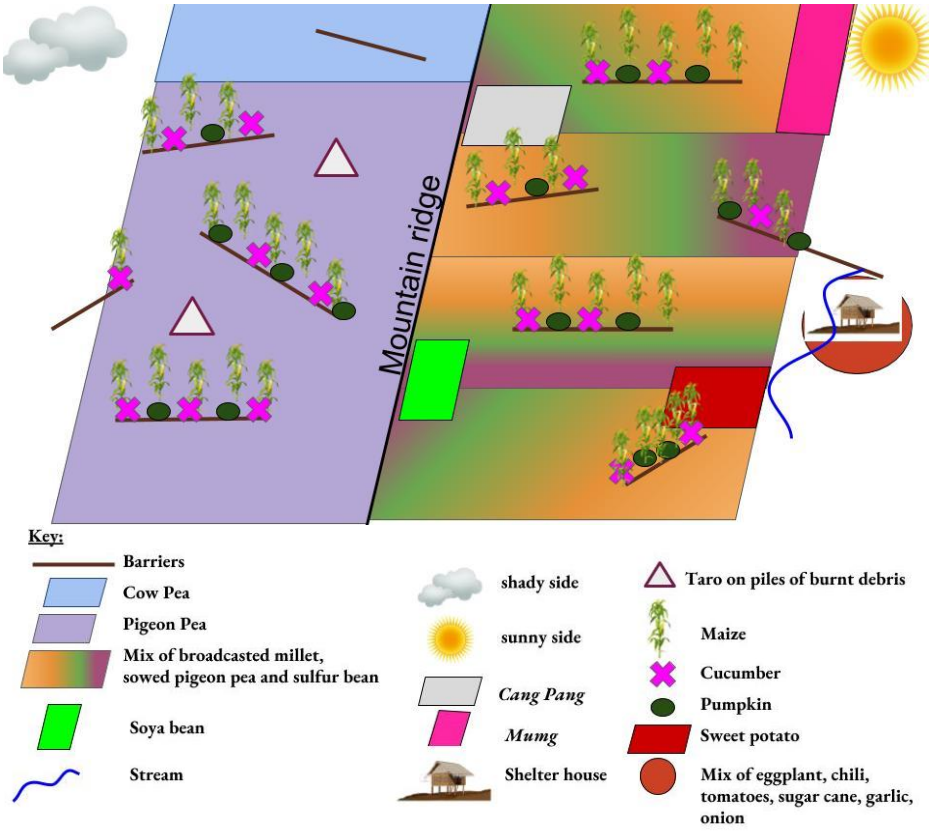


Figure 10 - The spatial organization of a shifting plot in year (2)

Soya bean

Soya bean was grown in specific areas, usually what was defined as “bad” soil by farmers: rocky soil. It was sowed with a small hoe with 2 to 3 seeds/hole. Soya bean was usually sowed in June-July, to avoid too many strong rains that could damage the flowers at setting time.

Pigeonpea

Around 3 seeds/hole sowed with a small hoe.

Left: small hoe, right: big hoe - photograph taken by Clarisse Frissard

A big hoe was used to plow the area of land were tubercules would be planted: sweet potatoes, taro on *lai lo* plots and potatoes on *zo lo* plots. Although there were located within the household plot, no other crops would be grown on these areas and they sometimes would be physically separated from others by bamboo barriers. In year two and year three, taro would be grown on the piles of previous crops residue that had been burnt.

Other grains included *Mumg* and *Cang Pang*. There were also grown in Years one and two. *Cang Pang* is a type of sorghum, and *Mumg* was unable to be identified by the research team. Although it is not cultivated anymore, *Mumg* plants can be found growing wild, they were shown and named to the research team by elder farmers from Sakta village.

Mumg plant - Photograph by Clarisse Frissard

YEAR (3)

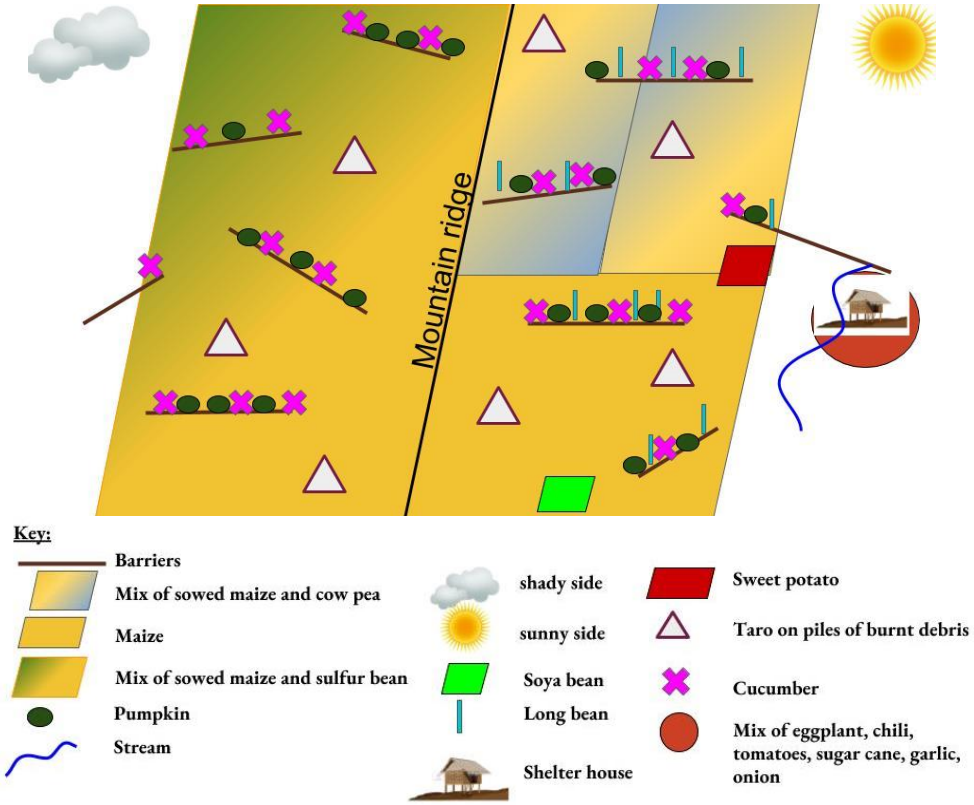
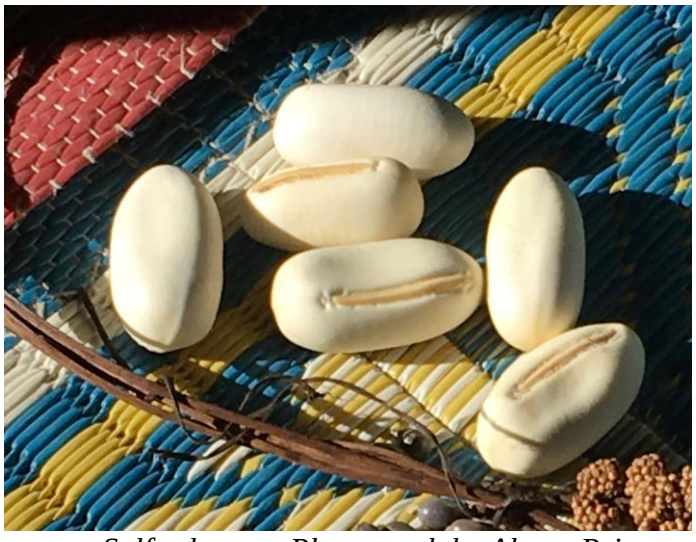


Figure 11 - The spatial organization of a shifting plot in year (3)

Sulfur bean

Around 3 kg of seeds is required for the plot, sowed with a small hoe by the working group. There is only 1 variety (white).



Sulfur beans - Photograph by Alyssa Pritts

Seeds were selected after harvest: (massal selection) the longest pods that contained at least 10 to 12 beans were kept for planting.

As shown in Figures 9, 10 and 11, each plot included a shelter house. It was usually located nearby a stream with vegetables grown around it (tomatoes, eggplant, chili, onion, garlic). If the plot included termite mounds or springs/streams, bananas would also be grown and would still produce during the 4 first years of the fallow period. Villages at the time usually didn't include home gardens. All crops were concentrated in the same area, the *lopil*.

(4) Weeding & guarding step

Weeding around 3 times per season by the working group using a small hoe.
Guarding: task mainly done by members under 15 years old with scarecrows, slingshots… they had to keep wild animals (wild boars, deer, monkeys, parrots, crows, small birds, rodent…) away from the plots.

(5) Harvesting step

Millet: Harvest of millet was done using a sickle. First, the panicles were cut and then put into a small basket carried by each harvester. After harvest, panicles were dried. Women of the household would then step on them to separate the grains from the straw. Then, they would winnow to separate covers and other dust from the grain. Seeds were selected by the women after harvesting during the winnowing by massal selection: heavier and bigger seeds were separated. Seed selection could also involve identifying taller plants with curved panicles (implying heavy seeds) in the field.

Baskets used during harvest to collect the production - photograph by Clarisse Frissard

Grain was then stored in bamboo baskets under the house or within a room in the house.

Maize:
Maize was also harvested by the working group: cobs were cut from the plant and put into baskets. After harvest, covers would be pull down to hang the cobs to fry (either inside the shelter house or directly in the home).

Maize cobs hung to dry inside a shelter house - Photograph by Clarisse Frissard

They would be left hanging for 2 months, after which they were beaten with a stick to make the grain fall off. Grains would be then laid on mats to dry under direct sunlight.

Maize grains left to dry under the sun - Photograph taken by Clarisse Frissard

Seed selection was also done by women of the household. Cobs were sorted out before beating: bigger cobs, with straight lines of seed and no space between the seeds, would be saved for seed. From the selected cobs, only grains from the middle of the cob would be used as seed. Like millet, maize would also be stored within large bamboo baskets under or inside the house.

Apart from vegetables and tubers that would be left in the field and collected only when eaten, all other crops were dried and stored within the compound. Some of them would even be processed after harvest: sesame was turned into oil (around 1.2 kgs of seed is needed for about 1L of oil), sulfur bean was fermented and stored to be eaten over a 1 year period, and a portion of the millet was used to make local alcohol used during celebrations: *zupu*.

d/ Animal husbandry systems of Hakha in the pre-colonial period

In pre-colonial times, Hakha Chin society was not monetized at all. The rare coins found at the time came from neighbouring India and would only be used as wedding presents for the in-laws. Transactions to acquire anything were done through livestock trade. Crops weren't sold nor given (apart from the *bawi*'s household) and were only for household consumption. General wealth was measured through the type of livestock and number of heads owned by a household. This animist society ranked the value of the livestock according to its use for religious ceremonies.

Chickens:

Chickens were important for key ceremonies such as the *chicken kill* ceremony at weddings to ensure heritage transmission. Through the years, the name *chicken kill* has been kept to refer to such ceremonies. However, as the value of livestock evolved through the years, other animals would be ceremonially killed, as people preferred larger sized animals such as pigs. Chickens were eaten by the household once in a while. They were kept in the compound and fed with leftover household food waste.

Pigs:

Considered as the less valuable animal, it wasn't used for any religious ceremony at first. However, as all parts could be eaten, it was the animal "sacrificed" during a *Sawm tuk* celebration. *Sawm tuk* celebrations were held when a hunting group had succeeded in killing a big animal during a "*Tlang Ram Riah"*[15]. Three pigs and a bovine would be killed and eaten in celebration with the entire village. If the bovine was eaten by the whole village without distinction, pigs' parts would be shared according to social rank. The succeeding hunting group had to honor the previous hunting group by giving them parts of the pigs: the heads were exclusively eaten by the members of higher clans belonging to the previous hunting group, whereas middle-class members of the same hunting group would receive the legs. The rest was shared among the lower clans and the rest of the villagers. At the time, pigs were kept under houses, causing in some cases health issues with some reported cases which symptoms described by elders suggest Japanese encephalitis. Pigs were fed with leftover food waste and banana tree trunks. Some households would bring the pigs to the close-by shifting plots after harvest to feed on crop residue.

Cows & Mythons:

In this period, large livestock served solely as a status symbol. They were either killed or given away during particular celebrations. However, only male mythons could be sacrificed for religious purposes. Mythons were the most valuable cattle at the time. Females only had value as reproductive females. Cattle management was the responsibility of active household members under 15 years old. They were responsible to bring the herd every morning to the forest to graze and keep them at a safe distance from the cultivated *lopils*. Every evening, the herd was brought back to the compound to spent the night safely inside. In the summer season, when vegetation growth is at its lowest, cattle foraged young shoots provided by forests.

[15] *Tlang Ram Riah:* refers to a hunt organized communally.

Adult Mython Soe with mixed Calf. photograph by Alyssa Pritts

Bawite & Khuang Cawi

Every two to three years, noble households would organize a celebration for the whole village.
It was a way of showing their wealth. “They wanted to show to everybody how beautiful their wife was. They were the only ones with truly beautiful wives. They could afford them” (elder farmer in Phaipha-B).
But also to prove their care and concerns to poorer households

Bawite: One mython is killed by each noble household, to be eaten by the whole village

This was followed some months later by *Khaung Cawi* where five mythons were killed per noble household and eaten by the whole village

Horses:
Horses were very rare in pre-colonial times. Their population increased slightly during colonial times.

e/ Hakha Township diets in the pre-colonial period

The seasonal calendar of the shifting cultivation system provided a variety of food from diverse food groups all year round. The diagram below illustrates the cropping cycle in the warm land (*lai lo*) shifting cultivation plots.

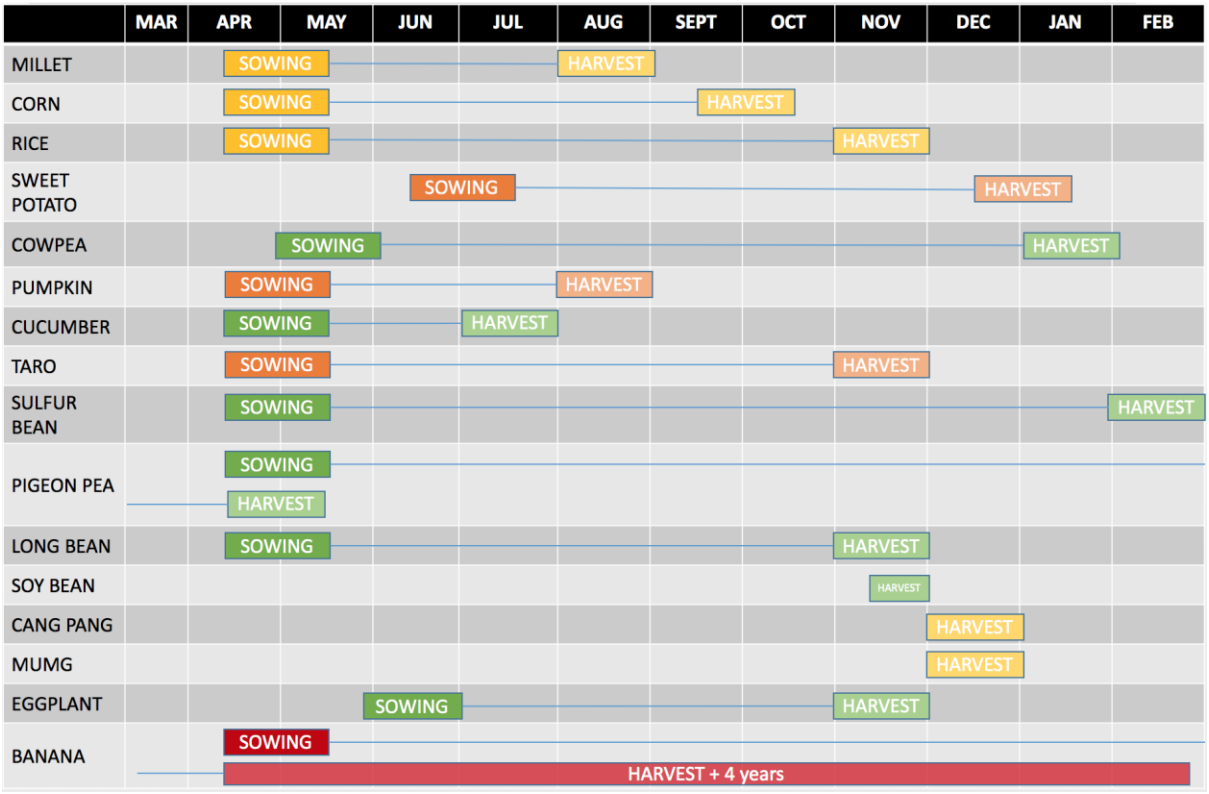


Table 4 - Seasonal calendar of the shifting cultivation system

The colors represent different food groups; cereals, vitamin- A rich crops, beans, peas, and other vegetables, and fruit. It is important to note that this table is incomplete: (1) *Cang Pang* and *Mumg* are no longer cultivated, therefore sowing times were not known (2) wild foods and livestock are not included in the chart, which also provides essential micronutrients (3) some categories such as corn, millet, and cowpea have multiple varieties grown in the same plot, with slightly different harvest times, further diversifying the cropping calendar. Comprehensive historical and current lists of crops in shifting cultivation systems in Chin State do not exist, but shifting cultivation systems have been studied in depth in Asia, and are said to hold over 40 to 90 different varieties and types of crops, essential to a diverse diet (Rerkasen K et. al, 2009). Fallowed land also acts as habitat to wild flora and fauna consumed as food (4) according to the interviews and bibliographical research conducted, rice entered the Hakha diet during the British colonization and the adoption of Christianity.

Millet played a particularly important role in religious animist ceremonies to make *Zupu*, the local alcohol. The *bawi* would have a stock of *Zupu* in their home to host visitors. One interviewee designated millet as "the backbone of Chin society", referring to the grain's long storage capacity of over 20 years, protecting villages from famine.

Maize was eaten every day and generally prepared in three ways:

(1) Pounded and made into soup
(2) Pounded and boiled in water
(3) Pounded, boiled in water and mixed with millet

Since millet and sorghum store for longer periods than maize, maize would be consumed more frequently after harvest until stores ran out. Staple crops were supplemented with a wide array of beans, peas, roots, and tubers, as well as wild foods from the forest.

"U piu", one of the plants collected from the forest for consumption - photograph by Clarisse Frissard

Fish, birds, and mammals were hunted and reported to be abundant and consumed by households every day. Hunting had a social importance within Hakha Chin society. Apart from diet, it was also visible through traditional dances and religious beliefs. It was believed that after death, the social rank of a male spirit would depend on the number and type of wild animals that had been killed by the deceased during his life.

Left: wild boar, Right: wildcat - photograph taken by Clarisse Frissard

Hunting and fishing parties could be collective: *Tlang Ram Riah* ("collective forest hunt") & *Tiva Ram Riah* ("collective river hunt" i.e: collective fishing). Four to five times per year, groups of hunters would hunt large game. The most popular time for a *Tlang Ram Riah* was during the burning step of the *lopil*, as animals would flee the burning area. For *Tiva Ram Riah,* a group of fishermen would block the river with trunks and rocks only leaving a small stream to drain out the water during one day. As the water level decreased, it was easier to see the fish. The surface of the water was then beaten with poison ivy that would knock fish unconscious, thus easily catchable.
These collective hunts and fish parties were codified by a series of rituals and sacrifices.

Hunting and fishing parties could also be individual: *Tlang Ram Veih* ("individual forest hunt") *Tiva Ram Veih* ("individual river hunt"). Smaller wild animals such as birds and rodents would be part of almost every day's diet.

Food Groups	Land Use						Rainy Season						
Cereals		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Millet	SC	C	C	C	C	C	C	C	HC	C	C	C	C
Maize	SC	C	C	C	C	C				HC	HC	C	C
Sorghum	SC	C	C	C	C	C	C	C	C	C	C	C	HC
Mumg	SC	C	C	C	C	C	C	C	C	C	C	C	HC
Roots and tubers													
Taro	SC	C	C	C								HC	C
Vitamin-A rich vegetables and tubers													
Sweet Potato	SC	HC	C	C	C								HC
Pumpkin	SC	C	C	C	C	C	C	C	HC	C	C	C	C
Leafy Greens													
Pumpkin leaves	SC	C			C	C	C	C	C	C	C	C	C
Mustard	SC	C	C	C	C						HC	HC	C
Roselle	SC	C	C	C	C	C	C	C	C	C	C	C	C
Chyote leaves	SC						C	C	C	C			
Other Vegetables													
Eggplant	SC	C	C									C	C
Bitter Eggplant	SC	C	C								C	C	C
Tomato	SC	C									C	C	C
Cucumber	SC							C	C	C			
Tree Tomato	SC	C									C	C	C
Fruits													
Banana	SC	C	C	C	C	C	C	C	C	C	C	C	C
Sugar Cane	SC	C	C	C	C	C	C	C	C	C	C	C	C
Legumes, nuts, seeds													
Cowpea	SC	HC	C	C	C	C	C	C	C	C	C	C	C
Soybean	SC	C	C	C	C	C	C	C	C	C	C	HC	C
Long Bean	SC	C										HC	HC
Sulfur Bean	SC	C	HC	C	C	C	C	C	C	C	C	C	C
Pigeon Pea	SC	C	C	C	HC	HC	C	C	C	C	C	C	C
Spices													
Chili	SC	C	C	C	C	C	C	C	C	C	C	C	C
Garlic	SC	HC	C	C	C	C	C	C	C	C	C	HC	HC
Oils													
Sesame Oil	SC	C	C	C	C	C	C	C	C	C	C	C	HC

Key	
C	**Consumed**
HC	**Harvested and Consumed**
PT	**Paddy Terrace**
SC	**Shifting Cultivation plots**
HG	**Home Gardens**
P	**Permanent Plots**
$	**Market**

Table 5 - Diet diversity availability from Shifting Cultivation Crops (Pre-colonization)

Note: 'Consumed' refers to crops for which the whole production was harvested at once. It could be consumed right away and/or (the surplus) stored in specific storage locations.
'Harvest and Consumed' refers to crops for which the whole production was not harvested but tubers/fruits were harvested following the consumption rate of the *consumption community.*

Home gardens were not a part of cropping systems in this period since villages were not always located near a water source.

Alternatively, crops such as eggplant, tree tomato, chili, garlic, and sugar cane would be planted by the shelter house in the shifting cultivation plots (refer to figures 9-10-11, chapter V.1.c).

2. British Colonization (1885-1948)

The Chin Hills Regulation Act of 1886 annexed Chin State to the British Empire. According to accounts by Sakta villagers, this was met with fierce resistance by Hakha people. In the end, the British were able to take hold of the villages. The British delineated fixed boundaries for village areas that are still used today. Along with colonization came Christian missionaries who arrived in 1889. It was reported that the first couple of converts in Hakha, became Christians in 1912.

a/ Colonization of Hakha began to transform the agrarian system

1. Fixed Village Boundaries

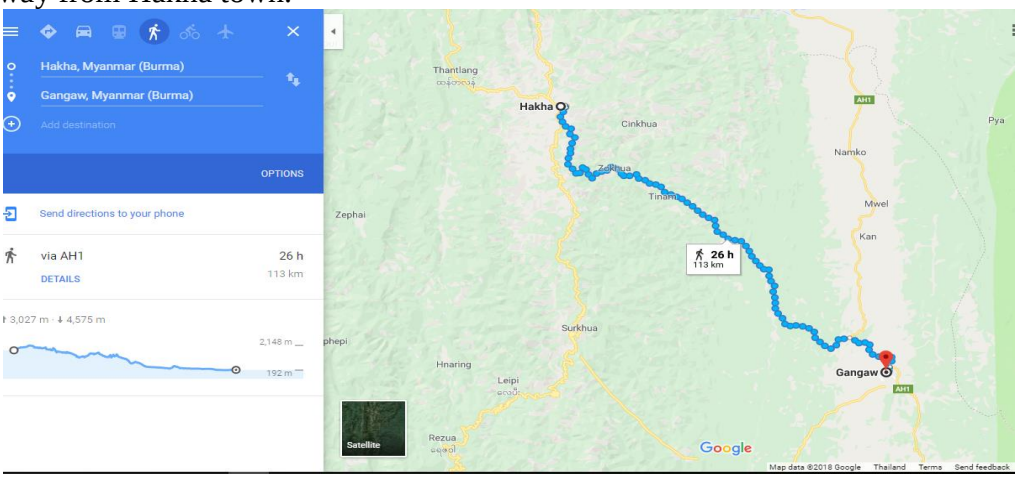
With fixed village boundaries, villages no longer moved to follow the shifting cultivation plots as they moved further from the location of the village. Thus increasing travel time to *lopils*. It was also reported that the "village chiefs that were nicest to the " received the largest village boundaries (Refer to Gret., *Persistence and change in Hakha Chin land and resource tenure*, 2017. for a more detailed discussion).

2. Abolishment of Slavery

The British abolished slavery at the time of colonization. Therefore slaves were gradually absorbed into lower clans. Noble households now mainly depended on the rent paid (with part of harvested crops) by the other households for using their land and numerous livestock they could sell if necessary.

3. Premice of monetization

Before Myanmar gained independence from the British, it was a state of India. At that time, the Myanmar currency was the rupee. Both Burmese and Indian rupees were linked to the Sterling and worth one shilling and sixpence. However, in spite of colonization, Chin State remained one of the most remote places of Myanmar. With no means of transport, monetary transactions were still scarce. The closest market was located in Gangaw (located today in the Magway division), over a 100 km away from Hakha town.



Map 9 - illustrating distance and time from Hakha to Gangaw on foot - Source: maps data 2018 Google

4. World War II

WWII temporarily pushed some villages into the shifting land to escape the war between the British and the Japanese. Occasionally villages would be raided by soldiers. It is the only period where lack of food was reported in Hakha township. During this time, villagers relied on hunted meat, fish and vegetation collected from the forest to survive. The everyday diet consisted mainly on a handful of corn mixed in a big cooking pot filled with boiled water, with wild plants collected from the forest.

b/ The shifting cultivation system of Hakha in colonial times

Month	Agricultural Activity	Labour Organization
November	**Each plot within *lopil* was cleared**: small trees are cut, big trees are pruned, tall grass is cut	**Each household in charge of clearing the plot they would cultivate** (men of the household) ~~**& slaves**~~
March	***Lopils* were burned.** Bigger branches formed natural barriers that will be used to maintain the ash	**1-2 men from each household** (excluding noble households) ~~**& slaves**~~ would burn *lopil* as a village
April	**Sowing** of Millet, Corn, Pumpkin, Cucumber, Pigeon Pea, **(upland paddy)**, various beans and peas (sulfur bean, pigeon pea, long bean), banana plants near termite mounds **Weeding & pushing debris/ash** against the natural barriers	**1 person** in the front **broadcasting the Millet** followed by the **working group sowing the rest**, **weeding and pushing the debris/ash**
May	**Sowing** Cowpea, Taro	**Working groups**
June	**Sowing** Sweet Potato, Soybean	**Working groups**
July	**Harvesting** Cucumber	**Working groups**
August	**Harvesting** Millet and Pumpkin	**Working groups**
September	End of September- **Harvesting Corn**	**Working groups**
October	Continued Harvest of Corn	Working groups
November	**Harvesting (upland paddy)**, Long Bean, Soybean, Taro, Tree Tomato	**Working groups**
December	**Harvesting** Sweet Potato	**Working groups**
January	**Harvesting** Cowpea	**Working groups**

Table 6 - Agricultural calendar of a shifting cultivation system in colonial times

No major changes concerning the agricultural calendar occurred, apart from the introduction of **upland paddy** by a few households in their shifting plots. Paddy required access to flat land with clay soil. This was considered the "best land" and was still owned by noble families. Paddy was

sowed in these particular areas, separated from other crops, with a "palm or half an arm" distance in between each seed, depending on the quality of the soil.

Crop rotation on *lai lo* plots:

Year (1): Millet - Maize - Cowpea - Sulfur bean - Soya bean - (Upland paddy) - Sesame - *Cang Pang* - Long bean - Pumpkin - Cucumber - Sweet potato - taro - Banana trees

/ Year (2): Millet - Maize - *Mumg* - *Cang Pang* - (Upland paddy) - Pumpkin - Cucumber - Sweet potato - taro - Banana trees

/ Year (3): Maize - Pigeonpea - Taro - Soya bean - *Cang Pang* - Pumpkin - Cucumber - Sweet potato

c/ Diet evolution during the colonial period

Our first interviews indicated that rice began to enter the Hakha diet in the 1940s-50s, but only by wealthy households. As upland paddy cultivation was restricted to nobles' plots, it was reported that some villagers started making trips to Gangaw to purchase, or trade goods for rice. The rare households that owned horses in the village would retail: purchase in Gangaw and sell/trade in the village. At the time, though Christianity was slowly developing, rice still represented a small proportion of the diet and was consumed on a very rare basis. It would be eaten in a soup with the chicken broth. Maize and millet were still the staple crops consumed on regular basis.

d/ Colonization Farming Archetypes

This period leaves us with three types of farming systems:

1. *Bawi*- landowners, still do not practice agriculture as they still receive harvested crops from lower clans. Pastoral livestock was still their main agricultural activity.

2. *Middle Clans*- the majority have ancestral land ("purchased" from the *bawi*) livestock.

3. *Lower Clans*- this type now includes former slaves. They still work on the land of the *bawi* and give a portion of harvested crops to noble families.

3. "U Nu Period" (1948-1962)

The agricultural landscape changed rapidly after independence. Shifting cultivation was still the primary means of agricultural production, however, an increasing number of higher clan families began to cultivate paddy terraces. Further encouraging rice consumption, was the stigmatization of millets by the Church. Since millets were used to make alcohol (*zupu*) for use in animist ceremonies, the church discouraged production and consumption. Corn and rice increasingly replaced millets due to the stigmatization of the crop (Gret, 2017). Christianization continued to spread rapidly through the hills, with a direct impact on the cultivation of millets.

Cash crops also entered the Chin landscape as the government began to provide agricultural loans for growing coffee and tea. One interviewee told the research team that he was sent to Sri Lanka by the government as part of the Colombo Plan, to receive training in coffee and tea plantation establishment and management. He explained that it never took off in Hakha, due to Hakha's remote location far from commodity markets. Therefore, these cropping systems will not be detailed hereafter as they are not representative of the cropping systems found at the time. Neighboring townships located closer to Kalay had more success.

The **Colombo Plan** for Cooperative Economic and Social Development in Asia and the Pacific was conceived at the Commonwealth Conference on Foreign Affairs held in Colombo, Ceylon (now Sri Lanka) in January 1950 and was launched on 1 July 1951 as a cooperative venture for the economic and social advancement of the peoples of South and Southeast Asia. (http://www.colombo-plan.org)

Through bilateral arrangements (foreign aid and technical assistance), it was designed to help the states of Southeast Asia to battle communists movements in their countries.

Myanmar joined the Colombo Plan in 1952.

a/ Increasing monetization of Hakha Chin society in the post-colonial period

The first demonetization occurred in 1948. As the Burma Currency Board notes increased in number, it was decided to de-monetize all the Indian rupee currency notes marked « Legal Tender in Burma Only » from 1st July 1948. In July 1952, the Union Bank of Burma Act transferred the sole right of currency issued from the Burma Currency Board to a newly created Currency Department of the Union Bank of Burma with effect from 1st July 1952. At that time, the name for the unit of currency was changed to "kyats" (MMK) and decimalized into 100 pyas.

In Hakha Chin, money became increasingly important as rural households had increasing access to schools and healthcare. Furthermore, money was needed to purchase rice, the preferred staple, since even households with terraces usually could not produce enough rice for consumption every month. Rice needed to be purchased from Gangaw or Kalay for at least part of the year. However, apart from salt and sometimes oil, no other eatable goods would be purchased; consumption of what was produced by the production community was still the main trend.

U Nu period (1948-1962)
Large livestock (very rarely sold or bought, only for major expenses or need for particular work):
Male mython: 30 MMK/head
Female mython: 15 MMK/head
Buffalo (trained to work): 8 MMK/head

Small livestock (main source of cash from agricultural production)
Pig: 3 MMK/head (rarely sold for meat but more likely to fatteners)
Pigglet: 1 MMK/head (sold to pig breeders).
Chicken (rarely sold: everyone had chickens and eggs)

Goods purchased from Gangaw
Salt: 1 MMK/viss
Corn husks sold for rolling cigarettes at 0.5 MMK/viss

For the first time, wage labor was introduced in Hakha Chin. Work in shifting cultivation plots was still organized communally (working groups). However, the emergence of paddy terraces introduced daily agricultural work- building the paddy terraces and also cultivating the paddy (transplanting, land preparation, harvesting, etc). Depending on household needs, daily workers were paid either with rice (½ big tin/day) or cash (2 MMK/day).

Moreover, individualization of land use also developed with the introduction of paddy terraces. Land within *lopils* was part of a communal pool, or, by customary law, noble households owned more land than necessary for their household food consumption. Other households could still cultivate the remaining areas, provided they gave part of the harvest to the noble household that owned the land. When paddy terraces were first implemented, they were built within former *lopils* that were taken out of the shifting cultivation system, and thus no longer burned in the rotation. Nobel households decided to build paddy terraces on part of the land that they owned via customary law. As a consequence, these areas were not available for other households to practice shifting cultivation anymore. In some cases, land could be acquired by other households by paying 20 MMK/acre.

b/ The cropping systems in the post-colonial period

Shifting cultivation system in the post-colonial period

According to the eldest farmers interviewed and writings by Christian missionaries, diversity of crops within shifting plots remained the same as before independence. Only the use of these crops evolved during this period.

Paddy terraces

Paddy terraces were implemented by first households with land near a stream since irrigation was needed for nursery beds and land preparation. The gravitational irrigation system was built by each production community. Over the years, other households built their terraces nearby and benefited from the diverted streams. However, if the water flow of the stream was too low, the first people to establish their terrace had priority for irrigation. Connections between the two plots would be closed to keep the water from moving down to the next plot.

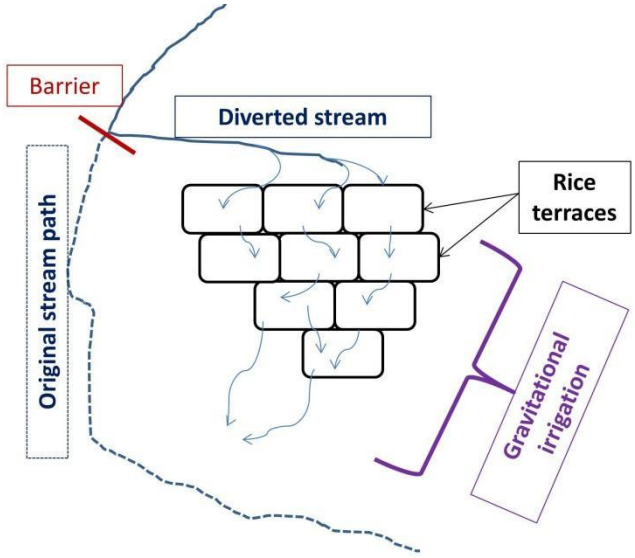


Figure 12 - Paddy terrace gravitational irrigation organization

Paddy terraces were built exclusively with manpower, using cured bovine skins to pull out the dirt and form the terraces. The construction of the terraces required a labor force that needed to be paid either in cash or rice. To build a 150 ft terrace plot, around five man-days were required.

Buffalo skin used to build paddy terraces - photograph taken by Clarisse Frissard

Month	Agricultural Activity	Labour Organization
May	- Nursery beds - Land preparation: **plow & harrow**	3 men (either from household or daily workers) & one pair of buffaloes
June	**Hand transplanting** (1-month-old seedlings). Seedlings planted 8 inches apart, after a 1st big rain	10 woman days (daily workers) for an area of 5 acres
July	1st weeding (by **hand**)	10 man days (daily workers: women or men) for an area of 5 acres.

August	2nd weeding (by **hand**)	10 men days (daily workers: women or men) for an area of 5 acres
September	3rd weeding (by **hand**)	10 man days (daily workers: women or men) for an area of 5 acres
November	Harvesting: 2 ways: either using a **sickle** to cut the plant or pulling the grains into a basket **by hand** (not as common) Threshing: using feet or beating the panicles against a rock Winnowing	10 to 15 man-days (daily workers: women or men) for an area of 5 acres Done exclusively by women

Table 7 - Agricultural calendar for paddy terrace cropping system (post-colonial times)

The introduction of this new cropping system came with the introduction of new tools from lower Burma: **plow** and **harrow**.

From left to right: plow, harrow with metal teeth, harrow with wooden teeth - Photographs by Clarisse Frissard

Paddy cultivation required specific draft animals (buffaloes) that were mainly acquired by noble households. They were purchased from the Burmese side of Chin State (Gangaw or Kalay).

Production was for home consumption and to pay the daily workers.

From left to right: Feet threshing & hand threshing - Photographs taken by Clarisse Frissard

Winnowing - photograph by Clarisse Frissard

Unlike other crops (millet, maize) where seed selection was done during the post-harvest process, seed selection of paddy was done before harvest. Farmers observed the plants in the field: curved panicles were signs of heavy and numerous grains, so would be kept aside for seeds.

Home gardens

As mentioned earlier, village boundaries were fixed during British colonization. As a result, the travel time to a *lopil* was longer for *lopils* that were furthest away since the villages were no longer mobile. Home gardens started to develop in the compounds when the time came to cultivate the *lopils* furthest away (after 10 up to 20 years fallow period) and it was not convenient to have vegetables that far from the household. Moreover, the majority of villages decided on a permanent

location of households to be near a water source, which enabled irrigation for home gardens. Dung was used on the vegetable plot for soil fertility management. It was collected from the large livestock (buffaloes, mythons, horses…) kept within the compound at night.

Common Vegetables grown in home gardens include:

- Cabbage
- Garlic
- Mustard
- Onion
- Chili
- Tomato
- Eggplant
-

Home garden within compound - photograph by Clarisse Frissard

To prevent livestock from entering the gardens, fences were built around them. The bamboo fences served as a barrier against small livestock (poultry) but also against large livestock that was brought back to stay in the compound at night.

c/ Animal husbandry systems in the post-colonial period

The nature and purpose of livestock changed in Hakha with the increased adoption of paddy terraces. Buffaloes were now needed to plow the paddy terraces. In the past, households would prioritize the increase of mython herds as mython's were the most valued meat during ceremonies and a way of showing wealth. At that time, households growing paddy terraces started giving priority to buffaloes. However, it was still uncommon to kill livestock for meat in the absence of a ceremony. Certain ceremonies of inheritance continued despite Christianization, and chickens, cows and mythons would be used in celebrations and funerals. Buffaloes were not used in celebrations or sacrifices since they were introduced only with paddy terraces.

Management of livestock continued as before; large livestock would be brought to the forest during the day and brought back to the compound at night. Dung was collected and used in the home gardens.

During the working months (May - June), buffaloes were the only ones to graze near the paddy terraces on non-cultivated areas of the former *lopil*. No special food was given apart from *zupu* to strengthen them.

d/ Diet evolution during the post-colonial period

Food consumption from cropping systems generally still followed the shifting cultivation calendar and varied by year. However, there were a few variations in the system: (1) although sulfur bean was only cultivated 1 out of 3 years, the fermentation process allowed the surplus to store for at least one year; (2) paddy was either cultivated (upland paddy or paddy terraces) or purchased in Gangaw or through retailers, however, it was not consumed by all households, nor eaten every day.

The shifting cultivation crops consumed by year are outlined as follows, with the bolded crops as the new additions:

Yr 1: Maize, pumpkin, cucumber, millet, pumpkin leaves, garlic, tomato, **sulfur bean**, sweet potato, taro, soy bean, **paddy**
Yr 2: Pumpkin, cucumber, maize, millet, pigeon pea, sweet potato, **paddy**
Yr 3: Pigeon pea, maize, pumpkin, cucumber, taro, soybean, soya bean, sweet potato, **paddy**

According to a comprehensive anthropological study on the social structure of Chin Society by anthropologist F.K Lehman, “Back in the 1950-60s, it seems that shifting cultivation and home gardens generally provided enough for the annual household consumption and that food shortages were rare” (Lehman,1963). According to our interviews, by the 1960s corn was still eaten every day. However, an increasing number of families would buy rice from people who would trade goods (such as corn husks to be used as rolling papers) in Gangaw or Kalay. The purchased rice would be eaten on Wednesdays and Sundays. Rice would be mixed with corn, or sometimes eaten alone.

The average annual consumption of a household with paddy terraces and a *consumption community* of about six members was: 50 big tins of rice & corn, 10 big tins of fermented sulfur beans and 10 big tins of millet. Wild meat such as rats, deer, birds, fish was consumed at least three times per week at this time. Meat would be dried and smoked over the fireplace to be stored. Inner parts would be eaten on the same day the animal was killed.

e/ Post-Colonization U Nu Period Archetypes

Archetypes generally stayed the same in this period, however, households with paddy terraces became increasingly prominent. Paddy cultivation required specific livestock (buffaloes) that were mainly acquired by noble households at that time.

1. *Noble Clan Members with paddy terrace*
2. *Noble Clan Members without paddy terrace*
3. *Middle Clans*
4. *Lower Clans*

4. Socialist Period (1962-1970)

a/ Political and Economic evolution cause change in the agrarian system

As the state took more control of the Chin Hills under Ne Win's rule, the agricultural landscape of Hakha continued to adapt to the social and political environment. The land was officially owned by the state, although shifting cultivation continued to follow customary land laws. However, the political environment coupled with Christianization devalued the status of noble clans within Chin society (Gret, 2017). Therefore, noble clans began cultivating land for themselves. From then on, instead of giving part of harvested crops to the *bawi*, Hakha people would now donate 1/10th of their harvest, "first fruits", or first born livestock to the church they belonged to[16]. The "protection" role assured by the *bawi* in precolonial times transferred to churches. Physical safety (with multiple wars among different chin ethnic groups) was not the issue anymore. Churches acted as a social and economic safety net for vulnerable households, particularly widows who were not able to inherit the land.

The government promoted paddy production heavily during this period, forcing farmers to build paddy terraces, even where the land was not suitable. Although the land was technically owned by the central government, there was an increase in informal land sales- farmers would buy and sell ancestral land for terrace construction informally.

Between 1962 and 1988, Burma experienced three demonetizations, both abrupt and unwarned. These had a direct consequence on households economic strategy: banks did not exist or were still inaccessible at the time by villagers. However, cash was not kept in hand either. Land was difficult to acquire, expensive in the black market and could not be purchased legally. Therefore, cash was converted to livestock. Like previous periods, mythons had the highest purchased value. But, with the increase of paddy terraces, the buffalo population increased as well. Villagers report at this time the emergence of a new trade; traders would purchase buffaloes and cows from lower Burma and sell buffaloes in Chin State and cows across the Indian border state Mizoram. Men practicing only this activity, however, did not survive the multiple demonetizations and only existed for less than a decade. Officially, demonetizations happened to fight black markets. According to local interviewees and ethnic leaders, it was also a way for the central government to keep economic power in their hands, making it easier to fight "rebels" of the ethnic states.

[16] Since the early 1900's, multiple branches of christianity started being implemented in Hakha Chin by missionaries, mainly coming from the United States of America: Baptists, Catholics, Methodists, and Seventh Day Adventists.

b/ Evolution of animal husbandry systems management

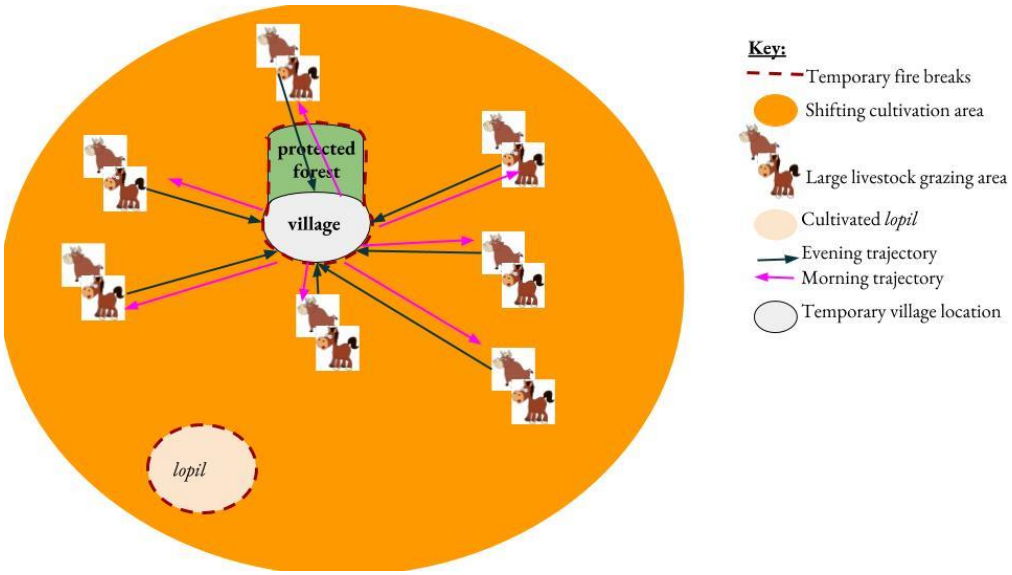


Figure 13 - The spatial oganization of animal husbandry systems before the 1960's

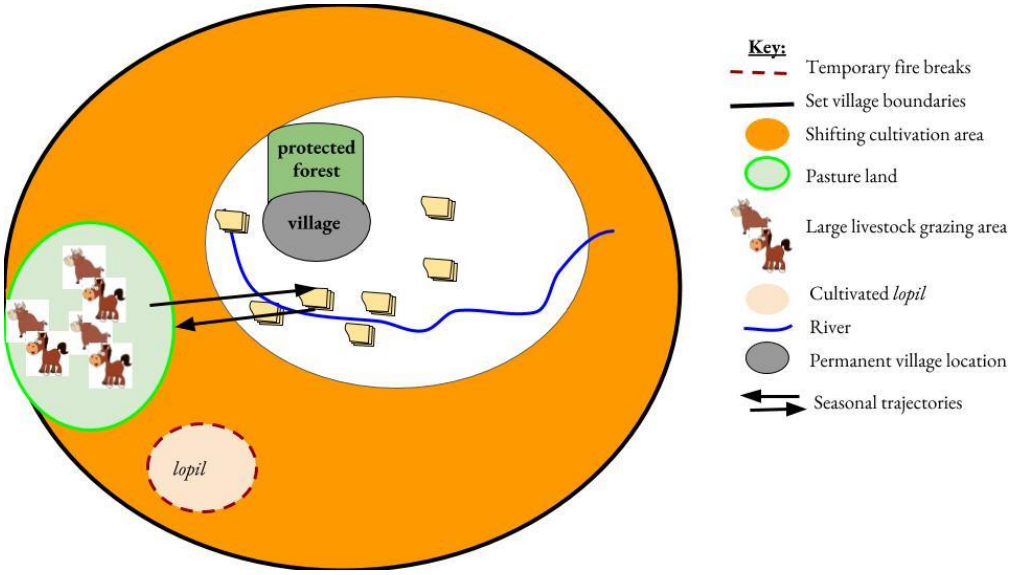


Figure 14 - The spatial organization of animal husbandry systems 1960's

With the major increase of paddy terraces, the spatial organization within village boundaries changed. Land available for grazing reduced, provoking change on how large livestock was managed. Management became semi-collective and seasonal instead of individual and daily. With paddy terraces developing around the village, it was not possible for livestock to walk across the cultivated terraces. Therefore, the village's large livestock was grouped in a pasture area from mid-April to the end of November. From December to mid-April, household's with paddy terraces would bring them to graze on the straws and other debris left on the plots, as well as the surrounding grass. Only buffaloes would be kept near the terraces during land preparation time. Horses would be used during harvest & post harvest times to transport the grains from the plots to the compound, keeping them in the compound at night. Households that did not own horses would carry the harvested grains in baskets on their backs all the way from the bottom of the valley where the terraces were located to the village.

With this new management, two constraints appeared:

(1) Livestock are left to spend the night outside of the village without supervision: casualties caused by wild animal attacks (wolves, bears) drastically increased.

(2) Before, each household had a shepherd to look after the livestock during the day. Now, livestock were left without supervision. Each household would send someone approximately once a month to check on them. Bells were put around their necks to find them easily in the woods of the pasture area). Due to the increasing livestock population, when no natural barriers (such as a river) surrounded the plot, sometimes livestock would destroy shifting cultivation plots near the pasture area. Sometimes livestock owners would compensate the farmer with food or smaller livestock.

c/ Reorganisation of shifting cultivation rotations

Crop rotation on *lai lo* plots:

Year (1): Millet - Maize - Cowpea - Sulfur bean - Soya bean - (Upland paddy) - Sesame - *Cang Pang* - Pigeonpea - Long bean - Pumpkin - Cucumber - Sweet potato - taro - Banana trees

/ Year (2): Millet - Maize - *Mumg* - *Cang Pang* - (Upland paddy) - Pumpkin - Cucumber - Sweet potato - taro - Banana trees

/ Year (3): Maize - Taro - Soya bean - *Cang Pang* **-**

At this time, crop diversity within shifting plots was still as high, and all households still practiced shifting cultivation through working groups. However, crop rotations were reorganized to fit the reduction of the available labor force. Households owning paddy terraces now had their household labor force dedicating part of their time to paddy terrace cultivation. Moreover, some of the members of households without paddy terrace would still participate in its cultivation, daily integrating into the other households *production community* in exchange for payment in cash or rice. On the whole, the labor force of working groups practicing shifting cultivation was not as available as before. As a result, **pigeon pea** that used to be grown in year (2) was now grown in year (1). Pigeon pea is particularly vulnerable to weeds competition. The forest cover enables a significant development of weeds. As a result, weeds are scarce in year (1). They develop more during the second year and even more in the third year, requiring more thorough weeding.

d/ Diet evolution in the 1960's

At this time, interviewees described corn being seen as a "poor person crop" and thus replaced by paddy for daily consumption by households cultivating paddy terraces. In addition to changing food preferences, millet consumption was also impacted by the exponential increase of Christian converts. Millet, traditionally used and valued during animist celebrations (both grains and *zupu* form) lost its high cultural value and was even fed to pigs. When diet consumption was based on the agricultural calendar, no major food gaps were found.

However, the landscape and soils of Hakha were not well suited for paddy production, so yields were not high. Low yield was also caused by poor land selection for paddy terrace construction; the areas of land promoted by the government were not always located near a water source, which was necessary for irrigation for land preparation and seed broadcasting. From the 1960's, it was common for households to run out of rice before the following harvest. An increasing need of money resulted since a large majority of households started to purchase their preferred staple food whereas before, rice was only bought for a few meals, and only salt and sometimes oil would mainly be purchased by households. According to interviewees, a bag of rice (50 kg) cost 18 MMK at the time. Oil, salt and preserved fish could be acquired for a total of 1.5 MMK.

Corn (and to a lesser extent millet) was still consumed by poorer households since all villagers had access to shifting cultivation land.

e/ Socialist Period (1962-1970) Archetypes

Since the social significance of clans faded, archetypes of farmers could now be described by the size of livestock a household owned, and the types of cropping systems it practiced.
Large livestock refers to cows, mythons, buffaloes and to some extend horses.
Small livestock refers to pigs and chickens.

1. ***Large Livestock + Shifting Cultivation + Paddy Terrace***

These households were most likely *bawi* or higher clans, who transformed suitable land close to the village to paddy terraces. They previously owned livestock as a status symbol, and additionally now owned buffaloes to work on paddy terraces. Shifting cultivation was practiced to fulfill other food needs of the household, as well as to produce corn and millet to feed smaller livestock. These households had priority choice in shifting cultivation *lopils* because of their inherited ancestral land.

2. ***Large Livestock + Shifting Cultivation***

These families were most likely middle or upper clans who owned large livestock but did not have suitable land or resources to transform the land into paddy terraces. These families often had ancestral land in *lopils*.

3. *Small Livestock + Shifting Cultivation*

These households did not own large livestock or land to transform to paddy terraces. They practiced shifting cultivation and owned chickens and/or pigs to use in weddings, funerals, and other ceremonies.

5. Socialist Period II 1970-1988

a/ Appearance of new cropping systems: permanent farming

(Refer to Part 1. a/Key concepts for a definition of *permanent crops* in this report)
The government policy of paddy production promotion continued through the 1980s. The government offered loans for paddy production, heavily subsidized fertilizer, and continued to support building paddy terraces in villages. Subsidies were allocated through a point system: 5 MMK/point, with 1 acre = 100 points.

At this time, shifting cultivation began to be demonized by the central government and later by NGOs as well. The practice was blamed for deforestation and erosion. However, even with the promotion of paddy terraces, all households still practiced shifting cultivation, although the system started to be simplified bit by bit. Working groups have less time to devote to shifting plots because other cropping systems required thorough attention. Individualization of work, as well as paid work, became more common during this period.

The government encouraged transitions to permanent farming. Plots in the first halo that hadn't been turned into paddy terraces, began to be cultivated with annual or perennial crops. Along with the paddy terraces, these areas of lands were now also exclusively used by one household.

1. annual crops: ginger, taro, sticky rice, sweet potato, potatoes or other vegetables.

Rotational ginger plot - photograph by Clarisse Frissard

From left to right: cultivated permanent plot and burnt permanent plot after harvest
Photographs by Clarisse Frissard

2. perennial crops such as sugar cane, bananas and in a few cases other fruit trees.

Banana and sugar cane plots - Photograph by Clarisse Frissard

With the development of these new cropping systems, commercialization of crops produced by the household began to appear. This came with a different selling strategy. In the past, households would sell livestock for specific needs. Now, households sold products for cash to buy daily goods. Permanent crops had a monetary value, that crops grown historically didn't have. In this period, fences were built around the area of residence of the communities including part of the 1st halo, to protect permanent plots from wild animals and village livestock herds.

Former fences around a village - Photograph by Clarisse Frissard

During data collection, it became clear that the development of permanent farming was unequal between villages. As the main purpose of these plots was commercialization, villages furthest away from a market (such as Phaipha-B), did not witness the same rapid cropping evolution as other villages such Chuncung, much closer to Hakha and a marketplace. Among the villages studied, Phaipha-B is the village where shifting cultivation is still the most practiced today.

b/ Socialist Period II Archetypes

1. *Large Livestock + Shifting Cultivation + Paddy Terrace*
2. *Large Livestock + Shifting Cultivation + Paddy Terrace + Permanent Crops*
3. *Small Livestock + Shifting Cultivation + Permanent Crops*
4. *Small Livestock + Shifting Cultivation*

6. 8888 Uprising: Human Rights Violations in Chin State (1988 - Present)

a/ General context: causes of major outmigration

In 1988, university students returned to Chin State and formed the Chin National Army to form a resistance against the military regime. In 1991, the military set up a large camp in Hakha. 54 camps in total were established in all of Chin State. Young people in the town would be forced to sleep at the camp to act as translators for the military, and young people in villages were forced to be porters. Pastors were jailed and tortured. Many people fled Hakha at this time due to the religious oppression and lack of economic security.

"Demands for forced labor by the military regularly disrupt people's trade, businesses, and daily work. Chin farmers and their families, who rely on their harvests for sustenance and livelihood, are particularly affected by the regular demands for forced labor. Arbitrary fees and extortion by the SPDC further hinder the ability to own, hold, and dispose of personal property and income." (Human Rights Watch, 2009).

A study conducted in 2010 found that 91.9% of households experienced forced labor and human rights' violations that commonly included "food theft, livestock theft or killing, forced displacement, beatings and torture, detentions, disappearances, and religious and ethnic persecution. Self-reporting of multiple cases of human rights abuses were independently associated with household hunger… The health impacts of these abuses have been marked, and suggest that indirect health outcomes of the abuses of the military regime likely dwarf the mortality from direct killings" (Sollom et al, 2011).

Out-migration catalyzed by social and economic challenges building from 1962 and culminating in the 90s, had marked impacts on the farming systems. Village populations shrunk as economically productive aged people left to find work and safety abroad. Seasonal, permanent, and temporary migration occurred at this time.

Seasonal migration to Mizoram was practiced by young people. Men would work in road construction and timber industries. According to an interview with the VTA of Sakta village, from 1990-1996, 8 out of every 10 young men seasonally migrated to Mizoram from September to December and January to March. Men who were under 20 made 40-50 rupees per day. According to a key informant interview with CHRO, women would also seasonally migrate to India as local traders or working as teachers (Van Biak Thang, CHRO, 2017). The money was used to send family members to school and to purchase rice.

Long-term migration to Mizoram, Malaysia, the United States, and various other countries also took place as people fled Chin State as Refugees. Family members living and working abroad began to send remittances.

As previously described, Chin State contained a high proportion of very young and very old to economically productive persons, bringing the dependency ratio of Chin State to 81.0. Or, in the words of many farmers that the research team interviewed, "too many mouths to feed without enough hands to cultivate and harvest".

b/ Impact on farming systems

1. Shifting cultivation system

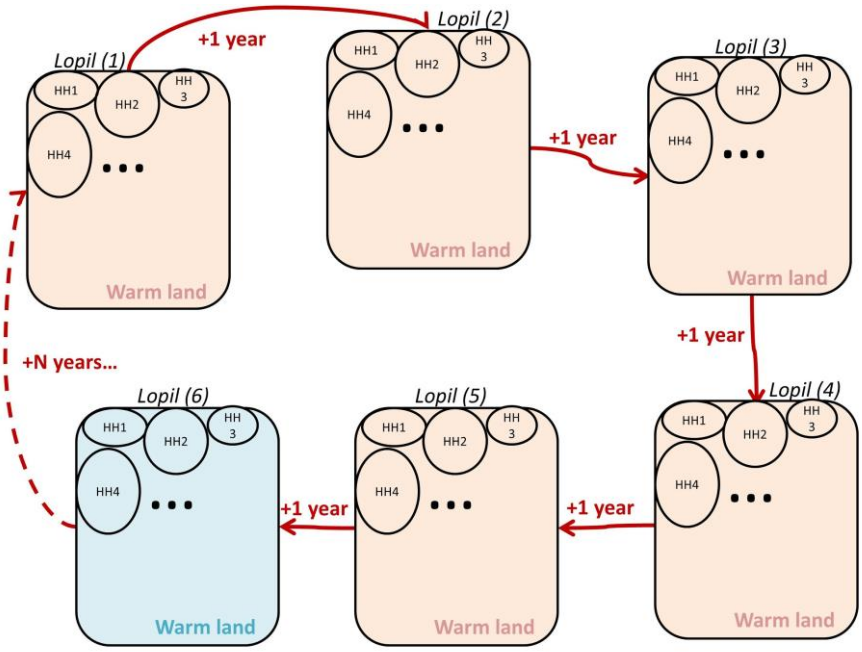


Figure 15 - The temporal organization of shifting cultivation post-1988

Spatial organization of shifting cultivation at a village level is still communal. All households participating in the shifting cultivation cycle in the village cultivate the same *lopil*. Fallow periods remain over 10 years. The number of households practicing shifting cultivation declines in this period. Interviewee's reported that a dwindling household labor force (especially of men for cutting phase of shifting cultivation) coupled with an increased need for cash caused them to switch to other forms of agriculture that are either less labor intensive, more profitable, or both. This includes rotational ginger fields, permanent vegetable gardens, and fruit orchards (mangos, strawberries, bananas, citrus). **As a result, shifting cultivation plots follow one-year rotations on both warm and cold land**, as opposed to three years in the past. Moreover, although *lopils* are still in the 2nd halo of crops, there is no need to cultivate the plot furthest away from the village dwellings. The past few years, due to a decrease of population and a decrease of people practicing shifting cultivation, *lopils* closer to the village have been divided into *sub-lopils* with only part of the lopil being cultivated in a year.

Simplification of shifting cultivation cropping systems accelerates as households with shifting cultivation plots gradually continue to diversify their land use. The diversity of crops grown on the shifting plots has decreased compared to what it used to be in the past. Nowadays, only corn, millet, cucumber and pumpkin are cultivated on warm land and corn and potatoes are cultivated on cold land. In archetypes that practice shifting cultivation and have large livestock, these systems have been simplified to an extreme of only cultivating corn.

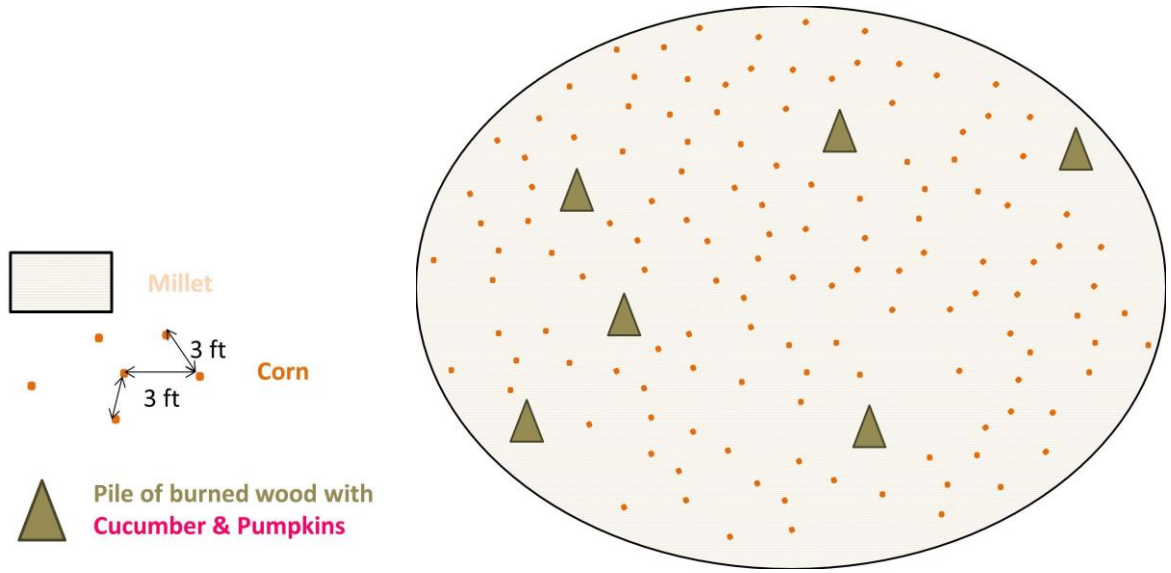


Figure 16 - Spatial organization of a shifting cultivation plot post 1988

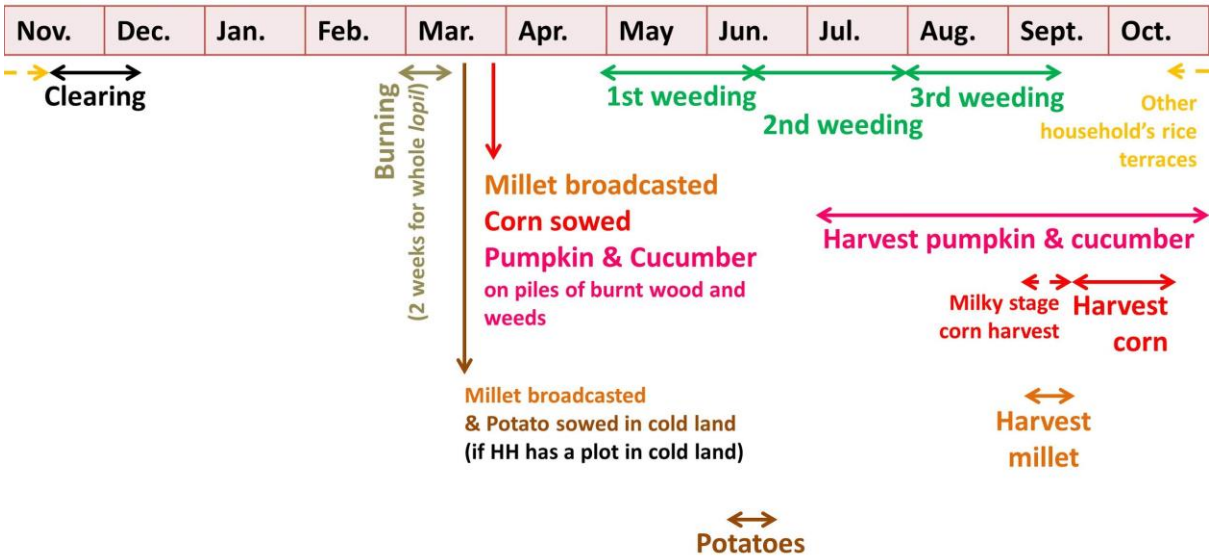


Table 8 - Agricultural calendar of a shifting cultivation cropping system today

On the other hand, work is no longer organized communally by working groups, but individually at the household level. Household agricultural incomes are supplemented in most households by off-farm employment in road construction, timber, or working as laborers in other household's paddy terraces. Now, instead of working in working groups and rotating to different household plots, laborers expect money, rice, or corn in return for their daily labor.

1. Clearing

Tall grass and small trees are cut, large trees are pruned. This step is done exclusively by men. Each household is responsible to clear their own plot.

An average of 35 man days is required for 1 acre.

2. Burning

This step is also done by men. Every household practicing shifting cultivation in the village sends at least one man to make "fire breaks" around the whole *lopil.*
Average of 10 days needed to secure the whole lopil.

3. Sowing

Sowing is done by both men and women. Each household is responsible to sow its own plot. First, millet is broadcasted by one person, followed by other household members that sow corn using a small hoe. Cucumber & pumpkin are sown on the piles of burnt wood and other debris.
Average of 16 man-days needed to sow 1 acre.

4. Weeding

Weeding is completed mainly by women using a small hoe. It is done in average three times per season by the women of the household for the household's plot exclusively.
Average of 45 man-days needed to weed 1 acre one time.

2. Permanent farming

An increasing number of farmers turn shifting cultivation plots located near the village with ancestral claims, or after negotiations with VTA, into permanently cultivated fields.

a. Ginger Fields

Unlike shifting cultivation plots, ginger plots are located in the 1st halo of crops around the village. They do rotate every year but do not include a fallow period in their rotational cycle.
year (1) ginger
year (2) sticky rice or ginger
year (3) taro, sweet potato or ginger
Households divide plots into different areas to include this three-year rotational crop cycle. Households choose land that they have an ancestral claim, or they ask for a new plot from the VTA every year, meaning in one year this household will be using 3 plots of the plot pool located in the 1st halo of crops around the village.

Some farmers also practice monocropping of ginger. They face increasingly disease problems compromising their harvest.

b. Vegetable gardens for cash crop production

Unlike vegetables grown in home gardens for home consumption, vegetables grown in these areas of land are destined to be sold. Preferably to Hakha's daily market but some are also sold at the village level. Prices at village level are often lower than the ones in Hakha that include transportation costs and time.

c. Orchards

i. Banana orchards

In the past, bananas were planted within the shifting cultivation plot near termite mounds and streams. Nowadays, this type of farmers leave the bananas planted on former shifting cultivation plots, caring for them with no intention of integrating it in a shifting cultivation system.

ii. Mango orchards

Some households who have ancestral land in warmer areas have transitioned their land to mango plantations.

iii. Elephant Foot Yam

Elephant Foot Yam production is a developing enterprise in Hakha over the past couple of years. Farmers interviewed do not know the exact yield to expect, and are still experimenting with the best way to cultivate it in their context of land and climate. The interviewees claimed to receive some knowledge support from Chinese experts coming to promote the crop for the Chinese market. Market price is very promising and motivates farmers to invest some time in a crop that is not as demanding in terms of clearing/burning than shifting cultivation plots, or that needs extra land adaptation such as paddy terraces.

3. Paddy terrace

Paddy is only grown during the rainy season. Rain provides the water necessary for plant development. The irrigation system is only used before starting land preparation as it happens at the end of the summer season. Plots are filled with water after land preparation. Water is only drained out of the plot one month before harvest as the grains need to ripe and dry on the plant.

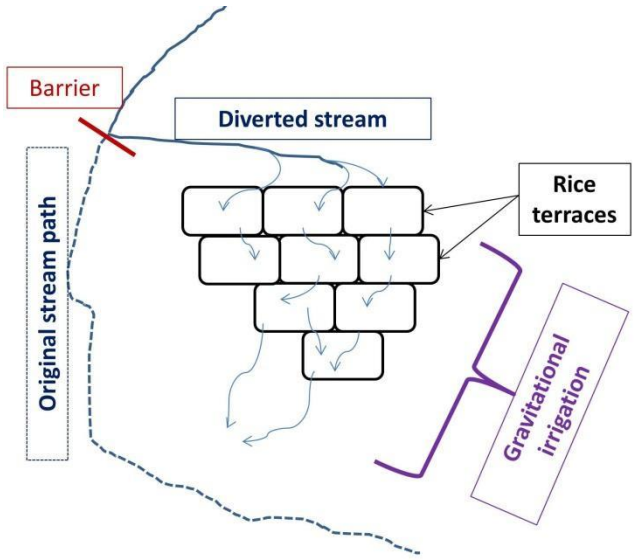


Figure 17 - spatial organization of a set of paddy terraces today

(1) Nursery beds (May)

Paddy is broadcasted on a small area either beside the set of paddy terraces or on an upland area.

(2) Land preparation (April)

The Land is prepared by men, using at least one pair of buffaloes. The day lasts from 5 am until 10 am and again from 3 pm to 6 pm. “buffaloes refuse to work in the middle of the day: it is too hot” (Farmer from Phaipha-B).

One man drives the tool (plow or harrow) + one man drives the buffalo in the front + one man to plow the corners with a big hoe. => If there aren’t enough men in the household to prepare the land, other men are hired.

It takes around one month to prepare the whole set of terraces (around 1 acre) with one pair of buffaloes.

i. Plowing to “break the soil”

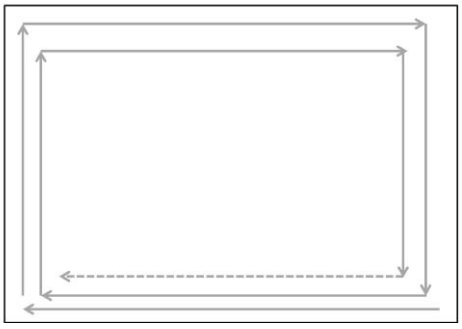


Figure 18 - plowing scheme of a paddy terrace today

ii. Harrow to make soil finer

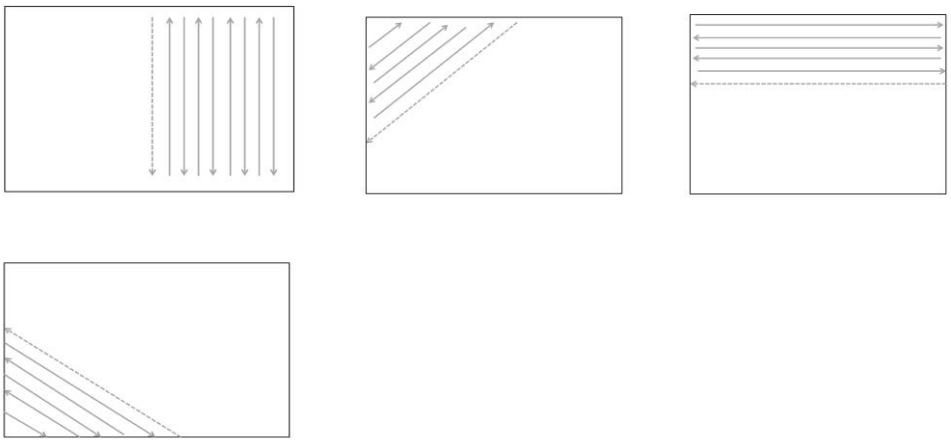


Figure 19 - Harrowing scheme of a paddy terrace today

(3) Transplanting (July)

Transplanting is done by women who are usually hired per day. Transplanting is done by hand.
Average 23 woman days for 1 Acre

(4) Weeding (August and November)

Weeding is done weekly by women using a small hoe.

(5) Harvest/Threshing (End of November, December)

Men and Women both from household and hired help if necessary. The top ⅔ of the paddy plant is cut with a sickle. The cut plants are then piled up into various bunches. The bunches are then brought to a plastic sheet that is spread over a harvested plot. Using a rock, a stick, or inclined panels, the paddy is threshed to make the grains fall off. The grains will then be put into rice bags and carried on horseback to the house where they will be dried in the sun.
Around 27 man days/acre are needed

c/ Current management of the different animal husbandry systems

1. Large Livestock

Large livestock refers to cows, mythons, horses, and buffaloes. Large livestock have two main functions: they are used as a labor force and act as a living bank account. Due to the steepness of slopes and narrowness of mountain paths, machinery is not suitable to be used for farming in Hakha. Therefore, large livestock act as the power to pull plows and carry loads up and down steep mountain slopes. Livestock also act as a living bank account. When a household has extra money, they invest in livestock. On the other hand, when a household needs money for school tuition, a health emergency, weddings, funerals, or a birth, livestock are sold.

i. Cows & Mythons:

Cows and Mython are managed the same way and interbred with each other. If the farmer who owns livestock also owns paddy terrace, then they will move their cattle to the harvested paddy terrace in December. Households without paddy terrace will keep cattle in pasture land all year. Pasture land location is decided by the village as a whole to mitigate damage to crops by large livestock.

Management calendar of cows and mythons owned by households without paddy terrace

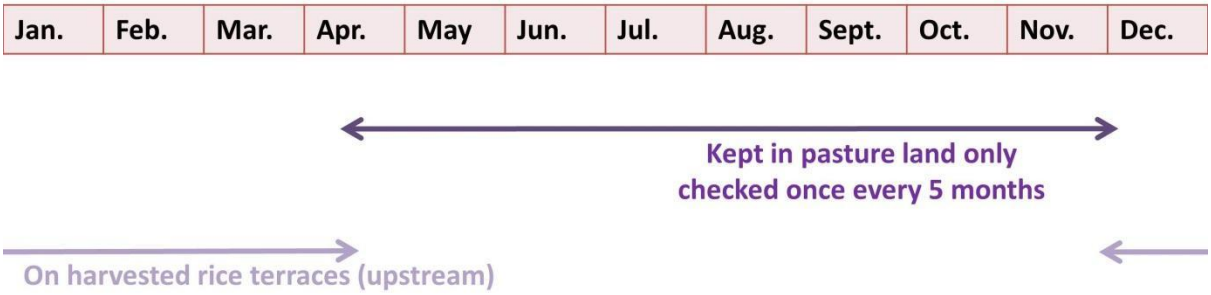


Table 9 - Management calendar of cows and mythons owned by households with paddy terrace today

Feeding of cattle:

During the rainy season, cattle forage for food on pasture land and are fed salt every time they are checked on. According to farmers, cows wander further away from the village than buffaloes. Once paddy terraces are harvested, they are brought to the paddy terraces to eat rice straws. There, cattle are still left to wander wherever they want and are not kept in a particular paddy terrace. Fertility transfer is therefore not really regulated.

Vaccination:
Cows are not vaccinated. The research team was told by the farmers that the main cause of death for the herd was wolves that attack the young calves.

ii. Horses:

Purchased from outside (other farmer or church), farmers will usually buy a female horse in order to get foals and increase the herd. As for the other animals the first foal to be born from the purchased female is given to the church of which the household belongs to. Most of the time, males will be sold and only females are kept to increase the heard. On average, farmers tend to keep a maximum of 4 horses.

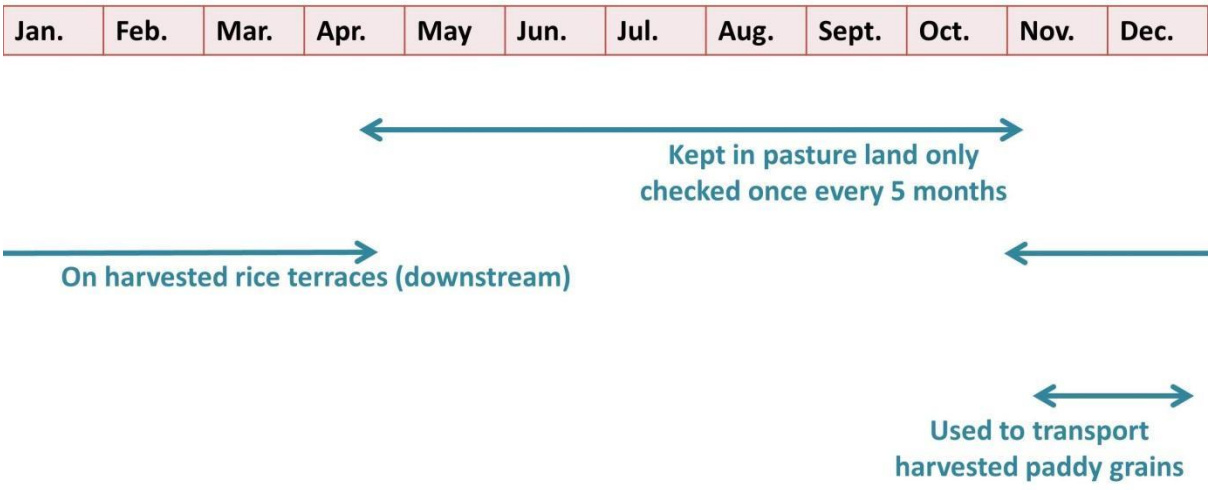


Table 10 - Management calendar of horses today

Horses are used at harvest time in November to carry back the paddy grains from the paddy terraces to the house where they will be sundried. As multiple households have their paddy terraces in the same place, it is common to organize transportation as a group. One member of each household will be responsible to guide the horses back and forth during one day. It is also possible for households not owning horses to profit from their neighbors' horses.

Feeding:
During the paddy harvest work, horses are fed with corn and rice bran in addition to the grass eaten nearby the terraces.

Vaccination:
Horses are vaccinated at least once a year

iii. Buffaloes

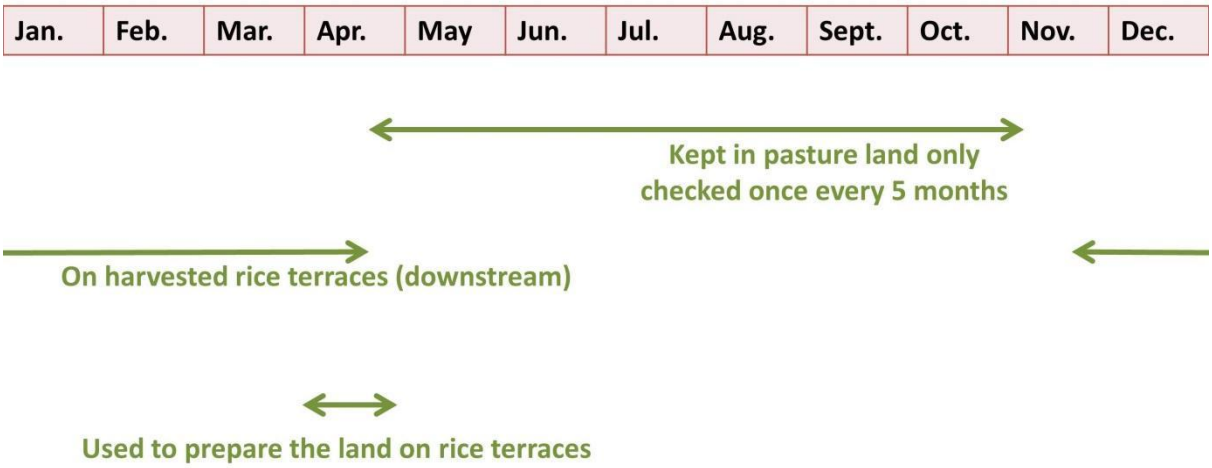


Table 11 - Management calendar of buffaloes today

Unlike horses, buffaloes are not usually fed with anything special during their working period in the paddy terraces. They are given salt like the cows and are vaccinated at least once a year.

2. Small Livestock

Small livestock includes pigs and chickens.

i. Pigs

Pigs are not usually vaccinated. Two different activities exist regarding pigs:

- Pig breeding: farmers have a reproductive sow and sell multiple piglets (2-3 months old) per year
- Pig fattening: farmers buy a piglet (2-3 months old), keep it for a minimum period of 8 months and then sell it.

Breeds: Mainly hybrid (Chin pig crossed with Burmese pig)

Table 12 - Management calendar of pig breeding today

Piggery in Bualtak village - Photograph taken by Clarisse Frissard

Feeding of pig:

1. **Corn** *is grown in shifting cultivation plots or home gardens*
2. **Rice Bran** *leftover after pounding harvested rice*
3. **Chayote** *is grown in home gardens*
4. **Pumpkin Leaves or other leaves from the forest**
5. **Leftover rice and food from household**
6. **Chopped banana Stem**
7. **Low-quality rice** (sold as pig rice) *purchased from Hakha or Kalay*

ii. Chickens

Chickens in villages are called "chin chickens", referring to their particular breed that is different from "Burmese chickens". Although chin chicken meat is more expensive than Burmese chicken, it is rarely sold since the average household does not have enough chickens to make the journey to the market profitable. All households have at least 5 chickens. Chickens are used for household consumption of meat and eggs. Eggs are fed to children and elderly people, but the majority are kept to hatch. There is no management of chickens in villages. They are free to wander around the compound and forage for food.

Feeding:
Chickens are fed corn twice a day, and chicks are fed broken rice.

Vaccinations:
Chickens are not vaccinated. This has caused most households to lose all of their chickens to disease once a year to “bird flu”.

iii. Dogs

Dogs are kept by households as pets, but also consumed by some households in January. They are fed leftover food from household meals.

d/ 1988-2014 Archetypes

Archetypes in this period illustrate the decline of shifting cultivation. Some households with large livestock and paddy terrace no longer cultivate their shifting land. Alternatively, many households transitioned their shifting land into permanent fields. The number of archetypes more than doubles in this period, because households practiced all three types of cropping systems in different numbers and combinations. However, households with only small livestock did not have paddy terraces since large livestock are needed to work paddy terraces. Furthermore, historically, these households did not have ancestral land to establish paddy terraces. Households with large livestock do not practice shifting cultivation as their only cropping system since they have assets to invest in more economically productive means of farming. It is implied that households with large livestock also had small livestock.

1. ***Large Livestock + Shifting Cultivation + Paddy Terrace***
2. ***Large Livestock + Shifting Cultivation + Paddy Terrace + Permanent***
3. ***Large Livestock + Paddy Terrace + Permanent***
4. ***Large Livestock + Permanent + Shifting Cultivation***
5. ***Large Livestock + Paddy Terrace***
6. ***Large Livestock + Permanent***
7. ***Small Livestock + Shifting Cultivation + Permanent***
8. ***Small Livestock + Shifting Cultivation***
9. ***Small Livestock + Permanent***

Although the number of archetypes increases during this period, total number of agriculturally productive people decrease due to out-migration. Many farmers stop shifting cultivation in villages that are located closer to Hakha. Some farmers continue to practice shifting cultivation, but simplify their systems, or add other types of permanent fields. Some farmers with only small livestock also stop shifting and practice only permanent farming.

e/ 2015 Landslide (2015-present)

In 2015, the Post-Disaster Floods and Landslides Needs Assessment (PFLNA) reported that “within the last 7 days of July, over 30 percent more rain fell than in any other month over the past 25 years”. The Chin Committee for Emergency Response and Rehabilitation (CCERR) reports that 6,535 people in Chin State were affected by the landslide, which includes “severe damage and destruction of surrounding farmland”. CCERR estimates 1,060 acres were destroyed in Hakha Township, and 154 livestock were lost (CCERR, 2015). Almost all farmers interviewed in the study had lost some type of land to this landslide, many without compensation from the government or

support from NGOs. The entire village of Bualtak reported having stopped shifting cultivation after the 2015 landslide because the river had widened so much that they were unable to safely cross it to reach the *lopils*. All villages reported losing multiple types of agricultural land in the landslide, including paddy terraces.

In this final period, archetypes of farmers remain the same as the previous period. However, the landslides caused many households to lose part or all of their paddy terraces. Irrigation canals or pipes to paddy terraces were also destroyed in many cases, leaving intact terraces unusable. Access to shifting cultivation land was limited, and livestock were killed. Therefore, households shift between archetypes depending on the damage. Households who lost all of their paddy terraces sometimes resorted to practicing shifting cultivation again (with the exception of those in Bualtak village). Even though at the time of writing three years passed since the landslide, many households have not been able to rebuild agricultural infrastructure lost due to the landslide.

VI. Economic analysis

The goal of the economic analysis is to evaluate the wealth generated by the different farming systems, to characterize how this wealth is then allocated, and to compare the economic performances of each system. It is done through data collected reflecting the functioning of the farming system in an average year. We will first present the methodology used to build the models as wells as its limits. Then we will analyze the economic results obtained to discuss the viability and resilience of these farming systems.

1. Modeling methodology

As explained in the agrarian diagnosis methodology, the economic analysis of farming systems is done through archetypes. These archetypes are built based on the farming systems. They do not represent individual situations that we came across but are made to illustrate a representative situation. They are used to describe the functioning of each farming system and to provide economic data to and compare. Therefore, the economic data are not data from an individual farming household but reflect the reality of the set of farming households within the same farming system. The research team modeled the economic results of each farming system.

The research team collected data about each cropping system during the one on one interviews that reflected an "average year" (not exceptionally bad nor exceptionally good). This average data was used to analyze the archetypes. Questions included the quantity and cost of planting material, yield, quantity lost in storage, quantity consumed per day (or season), cost of inputs, etc. For each of our farming systems, we were able to collect the data from different farmers, allowing us to triangulate the information.

The productive capacities of the animal husbandry systems are very low; the data (births, deaths, sales, kills) of one year does not reflect their management logic (herd increase/decrease, sales strategy). In order to compare the different animal husbandry systems and different farming systems, this data will be expressed yearly. Meaning that in the economic analysis: fractions of animals will be sold per year etc.

a/ Pricing systems

Prices of the different goods used for our analysis are the prices of the year 2017 expressed by the farmers we interviewed. This information was also completed by the prices collected among retailers at the Hakha daily market. Prices of crops fluctuate depending on proximity to harvest. For rice, prices depend on the seasonality of the variety. For varieties that can only be harvested once a year, the prices will increase as harvest time approaches; whereas varieties that can be harvested twice will have less price fluctuation. For the economic analysis, the research team decided to consider the value of the rice produced to be the same as the rice they would have bought to eat if they didn't grow any **(opportunity cost)**. People purchase rice from Hakha that is grown elsewhere in Myanmar where there are two seasons of paddy cultivation. According to rice retailers in Hakha, rice price is more or less stable throughout the year: 560 MMK/kg (1 big tin of rice = 10.5 kg)

Livestock prices depend on the livestock, the age, gender, corporal state and breed.

b/ Calculating wealth created: measuring the net added value.

In order to evaluate the wealth generated by the farming systems, **Net Added Value (NAV)** was calculated as follows:

Net Added Value (NAV) = (GP/acre - Proportional IC/acre)*area - Non Proportional IC - Capital Depreciation

Gross Product (GP): All the productions are measured. It also includes the production consumed by the household, meaning productions used by the household that they would have needed to buy otherwise. Prices of the self-consumed products vary according to the month in which they are consumed.

The production consumed by the livestock is not taken into account in the **Gross Product (GP)** calculation. However, feed consumed by the livestock is noted with a price of 0 MMK/unit in the intermediary costs as there is no need to buy it from outside. Part of the crops will be part of the process to make another final product (meat, eggs…) within the agricultural year that will have a value. It is **intra-consumed by the farming system.** The herd increase, meaning births that contribute to increasing the size of the herd, are also taken into account in the Gross product.

Seeds, on the other hand, are considered the final product for the agricultural year. Their value is therefore taken into account in the calculation of the **Gross Product**.

Percent GP self-consumed includes both livestock and crops. Generally, Chin households consume the crops produced, and if money was needed livestock was sold. Which is why usually the %GP self-consumed is lower than the **% crops GP self-consumed.** This tendency, however, is less true now that cash crops and particularly orchard cultivation are increasing.

Finally, every household has a home garden in their compound with roughly the same vegetables (mustard, garlic, onion, cabbage, tomatoes). This home garden has an importance nutritionally but will not be decisive in the economic differentiation between the archetypes. Due to lack of time, the research team decided to overlook home gardens in the economic analysis.

Intermediary Costs (IC): All the goods and services that were consumed in a year produce the Gross Product. Services include the daily wages paid (in money or in kind) for the help received for certain tasks (mainly paddy harvest and paddy transplanting).

Proportional Intermediary Costs: all goods and services in proportion to the area

None of the farmers interviewed used any kind of chemical inputs on their crops due to accessibility & cost.

Non-Proportional Intermediary Costs: all goods and services non-proportional to the area

Capital Depreciation (CD): Capital includes storage buildings, draught animals and tools pulled by animals (plow, harrow, etc)

NAV / active member measures the wealth generated in a year by one active member of a household of a certain farming system.

The **Gross Added Value (GAV) = (GP/acre - Proportional IC/acre)*area - Non-Proportional IC**; of each crop when divided by the area of the crop grown, enables us to compare the economic performance of each crop and their opportunity costs.

c/ Distribution of wealth created: distribution of net added value and measure of net agriculture household income

The wealth generated is then shared among the actors that have participated in the production process: remuneration of the external labor force (salary), remuneration of borrowed capital (loan interests), remuneration of the land borrowed (land tenure fees).

Gross Household Agricultural Income = NAV - Salaries - Loan Interests - Land tenure fees

Salaries: refers to the payment of people hired for an agricultural season. As mentioned earlier, people hired for punctual tasks are counted as services in the intermediary costs.

Loan Interests: In Chin State, none of the farmers interviewed take loans to purchase inputs to produce. Access to inputs is limited. Furthermore, they are too expensive for most farmers to afford.

Land tenure fees: In practice, some farmers will pay usage rights (in kind) to the customary owner of the land. Noble clans in the past will maintain their livelihood by perceiving a fraction of the harvest of their customary tenants. After the landslide of 2015 and the destruction of a certain number of paddy terraces, some households use the paddy terrace from households that migrated to Hakha. In exchange for the usage of the land, they give them part of their yearly harvest.

Finally, wealth is also distributed through donations. There is no "official" agricultural income tax and none of the farmers interviewed paid taxes to the Government. However, there is a very strong community redistribution system at the village level. Every household gives part of their harvest to the Church- around 1/10th of the harvest for consumed crops, the equivalent of 1/10th for cash crops paid in money, the first animal born of their animal husbandry. Households also give part of their harvest to relatives. Unlike donations to relatives (which can be variable according to the household and the year), donations to Church (whichever Church) have a stable rate: 1/10th of each production given either in grains/fruits or in money. The social stigma of this donation is such, that no household (even if extremely poor) evades it. In this economic analysis, it was decided to consider this donation as a **tax** since it is a recurring fixed payment. In the calculations, it will thus be included in the wealth generated by the household (**Net Added Value**) but will afterward be subtracted to give the **household's agricultural income**.

Net Household Agricultural Income = Gross Household Agricultural Income - Church donations - Relatives donations

The Net Household Agricultural Income then measures the wealth generated and kept by the household of a certain farming system.

Net Household Agricultural Income / agricultural active member shows the wealth generated and kept by each active member of a household of a certain farming system.

d/ Typification of the farming systems studied

Farming systems			**Archetype**
Animal husbandry systems		**Cropping system**	
Large reproductive Livestock + Small Livestock	Buffaloes: <10 heads Mythons: <5 heads Cows: <5 heads Pig fattening: 1	Cash crops (permanent vegetables) + paddy terrace	**I.1.a**
	Buffaloes: <10 heads Mythons: <5 heads Cows: <5 heads Pig fattening: 1	Cash crops (orchard) + paddy terrace	**I.1.b**
	Buffaloes: <5 heads Pig breeding: 1 sow	No cash crops. Paddy terrace + shifting cultivation	**I.2**
	Buffaloes: <5 heads Horses: <5 heads Cows: <5 heads Pig breeding: 1 sow	No cash crops. Paddy terrace	**I.3**

	Buffaloes: <5 heads Horses: <5 heads	Cash crops (permanent vegetables) + paddy terrace + Shifting cultivation	**I.4.a**
	Buffaloes: <5 heads Horses: <5 heads	Cash crops (orchard) + paddy terrace + Shifting cultivation	**I.4.b**
	Cows: >20 heads	Cash crops (permanent vegetables)	**I.5**
Small Livestock only	Pig breeding: 2 sows Chicken: flocks of 20	No cash crops. shifting cultivation	**II.1**

Table 13 - Farming systems archetypes found in 2017

2. Results per archetype

Note: The conversion rate used for this report applies to the period between October 2017 and February 2018 (1 USD = 1327 MMK)

a/ Large Livestock + Permanent + Paddy Terrace (archetype I.1)

For every four members in the household, there are only two agricultural active members.
On average: One acre of paddy terrace that provides enough rice to last the whole year with an average household consumption of 1.3 kg/day and an average yield of 861 kg/year.

In this archetype, two sub-types were identified **depending on the kind of "permanent farming" done by the household:**

a. Permanent vegetable plots (I.1.a)

With vegetables grown **in the same place** every year: ginger mixed with corn (50 ft²), cabbage, onion and garlic. All these crops are mainly for sale. Households also have a home garden for their home consumption.

b. Orchards (I.1.b)

Households began to plant orchards a couple of years ago, as a way to cope with outmigration and aging of the labor force. The reference here is a mango orchard as it is the only crop for which farmers had data to give. All the other trees planted are not bearing any fruits yet.

For this archetype, horse herd isn't reproductive but only used for work. **Therefore, horses will be counted in the depreciation section** (like a tractor, they have a purchased price and decrease in value as they grow old). Food and vaccines are considered in the **non-proportional intermediary costs** because do not depend on the areas of a specific crop.

Both cow and mython herds are very slow to increase. Their main function is to serve as a bank (store extra income and take out cash when needed). Based on the interviews it was considered that one cow could give birth to a calf once every two years. The "wolf factor" was also taken into account since it drastically limits the increase of the herd (half of the calves die). "The increase" refers to the number of calves/year that is added to the heard once the sufficient amount of calves to renew the herd has been considered. Bovine's average lifespan is of 18 years. It was considered that one cow (male or female) was sold every three years for financial needs and that one small cow was bought every six years. Regarding mythons, the same birth rate was applied: one calf every two years per female. There are no sells for mythons, only a very small increase rate due to wolves' attacking calves. A mython's lifespan is approximately 19 years.

Chickens are not vaccinated and have a very high death rate due to disease. Therefore, there is no flock increase and no chicken meat consumed by the household either. On average, four eggs/household are eaten in a week by all the family members (children and adults).

Pigs: only fattening activity. No reproductive herd. One piglet is bought and kept for 8 months to be fattened up and sold at a higher price either for the meat or to a farmer with another animal husbandry system that will fatten it even more.

i. Sub-type: Large Livestock + Permanent vegetable field + Paddy Terrace (archetype I.1.a)

	NAV	% GP self-consumed	NAV/active HH member	Agricultural household income after church donations	Agri. household income after church donations / active HH member	Number of days possible to eat own rice
MMK	5478450	53%	278000	5144034	2572017	365
USD	4128		424	3876	1938	

Table 14.a - Economic results archetype I.1.a

survival threshold (USD/year)	456.25
Agri. household income after church donations / active HH member	1938

Table 14.b. Agricultural household income per active household member archetype I.1.a

ii. Sub-type: Large Livestock + Orchards + Paddy Terrace (archetype I.1.b)

survival threshold (USD/year)	**456,25**
Agri. household income after church donations / active HH member	**1612**

Table 15.a. Agricultural household income per active household member archetype I.1.b

	NAV	% GP self-consumed	NAV/active HH member	Agricultural household income after church donations	Agri. household income after church donations / active HH member	Number of days possible to eat own rice
MMK	**4501848**	**14%**	**2250924**	**4278632**	**2139316**	**365**
USD	**3392**		**1696**	**3224**	**1612**	

Table 15.b - Economic results archetype I.1.b

b/ Large Livestock + Shifting Cultivation + Paddy Terrace (archetype I.2)

In this archetype, there are seven household members with five agriculturally active members.

On average, this archetype cultivates 1.1 acres of paddy terrace but that only provide enough rice for 182 days, with an average household consumption of 4.62 kg/day of rice and an average yield of 1081 kg/year.

Large livestock consist of a reproductive herd of buffaloes, that are mainly used for work. Moreover, wolves still have a huge impact on the potential increase of the herd which is roughly maintained to its level of five heads: two males (lifespan 20 years) and three reproductive females (lifespan 18 years). The females' lifespan is considered to be shorter as they are the ones preferably used to work on the fields (more docile).

For this archetype, cattle isn't used as a bank but has a true production status.

Regarding small livestock, none of the farmers of this type vaccinate their pigs or chickens. As a consequence, it was estimated that 50% of the piglets died every year and over 50% of the chickens die of chicken flu every year. Chicken meat will only be self-consumed by the household (not sold) and only 50% of the eggs will be eaten, the rest are kept to renew the flock. None are sold either.

	NAV	% GP self-consumed	NAV/active HH member	Agricultural household income after church donations	Agri. household income after church donations / active HH member	Number of days possible to eat own rice
MMK	2499269	42%	499854	2368160	473632	182
USD	1883		377	1784	357	

Table 16.a - Economic results archetype I.2

% crops GP self-consumed
82%

survival threshold (USD/year)	456.25
Agri. household income after church donations / active HH member	357

Table 16.b. Agricultural household income per active household member archetype I.2

c/ Large Livestock + Paddy Terrace (archetype I.3)

In this archetype, there are six household members, four of which are agriculturally active.

This archetype has an average Paddy Terrace size of 1.6 acres. However, this archetype is one of the types that donate the most to their relatives (25% of the production). They are still roughly able to consume their own production of rice all year long (363 days) with a household consumption of roughly 1.4 kg of rice per day.

Apart from a home garden, no other crops are grown by these type of farmers. For them, around 64% of the crops GP is self-consumed. The other 36%, are exclusively donated either to the Church

or to relatives. None have a cash-generating function.

% crops GP self-consumed
64%

For this type, cattle have two main functions. They have a banking function (cows and mythons) and only sold when specific amounts are needed for special events, emergencies, or school fees. They also serve a labour force function (buffaloes and horses) and production function. Piglets are sold every year, and one pig kept for 1.5 years to be fattened up. Chicken is for self-consumption, as chicken meat is eaten 2 to 3 times per month. All eggs are kept for the chicks and renew the flock.

	NAV	% GP self-consumed	NAV/active HH member	Agricultural household income after church donations	Agri. household income after church donations / active HH member	Number of days possible to eat own rice
MMK	3767368	13%	941842	3676110	919028	363
USD	2839		710	2770	692	

Table 17.a - Economic results archetype I.3

survival threshold (USD/year)	456.25
Agri. household income after church donations / active HH member	692

Table 17.b. Agricultural household income per active household member archetype I.3

d/ Small Livestock and Shifting Cultivation (archetype II.1)

This archetype has an average household size of seven household members, four of which are agriculturally active members.

The only cropping system practiced by this archetype is shifting cultivation, which is practiced on an average of 2 acres of land. All crops grown (corn, soya bean, potato, sweet potato, taro, sulfur bean, upland paddy, pigeon pea, pumpkin and cucumber) are for home consumption except for corn that is only for the small livestock consumption. As a matter of fact, it is not even donated to relatives, unlike all the other ones.

No large livestock for this type of farmers. Only pigs and chickens that have a cash-generating function. Indeed, they are the only production sold by the household apart from some pigeon pea. All the eggs are kept to renew the flock and only 3-4 chickens/year are eaten by the household.

% crops GP self-consumed
82%

	NAV	% GP selfcons umed	NAV/active HH member	Agricultural household income after church donations	Agri. household income after church donations / active HH member	Number of days possible to eat own rice
MMK	2742400	66%	685600	2591397	647849	23
USD	2066		517	1953	488	

Table 18.a - Economic results archetype II.1

survival threshold (USD/year)	456,25
Agri. household income after church donations / active HH member	488

Table 18.b. Agricultural household income per active household member archetype II.1

e/ Large Livestock, Paddy terrace, Shifting Cultivation and Permanent field (archetype I.4)

This archetype has an average of seven household members, with three agriculturally active members per household. For this archetype of farmers, 2 undertypes were identified according to the type of permanent fields that they grow (**permanent vegetable plots, Elephant foot yam).**

Elephant foot yam is a recent crop in the area. It has only been grown by farmers since for the past few years. None of the farmers encountered were able to give us accurate data regarding yields as none had harvested their plot yet. Therefore, it was chosen by the research team not include this crop in the economic analysis as it is a transitioning phase of a farming system but not yet an ongoing farming system.

Sub-type with permanent vegetable plots (archetype I.4.a)

survival threshold (USD/year)	**456.25**
Agri. household income after church donations / active HH member	**564**

Table 19.a. Agricultural household income per active household member archetype I.4

	NAV	% GP self-consumed	NAV/active HH member	Agricultural household income after church donations	Agri. household income after church donations / active HH member	Number of days possible to eat own rice
MMK	**2592229**	**68%**	**278000**	**2244392**	**748131**	**365**
USD	**1953**		**424**	**1691**	**564**	

Table 19.b - Economic results archetype I.4

f/ Large livestock & Permanent field (archetype I.5)

Average household members: six with two agriculturally active members

	NAV	% GP selfconsumed	NAV/active HH member	Agricultural household income after church donations	Agri. household income after church donations / active HH member	Number of days possible to eat own rice
MM	**486778**	**26%**	**2433893**	**4574564**	**2287282**	**0**

K	**6**					
USD	**3668**		**1834**	**3447**	**1723**	

Table 20.a - Economic results archetype I.5

survival threshold (USD/year)	**456,25**
Agri. household income after church donations / active HH member	**1723**

Table 20.b. Agricultural household income per active household member archetype I.5

3. Comparative Economic Analysis

Archetype	Rice Sufficient (Yes/No) (Days covered)	% GP Consumed	% Crops Consumed	% of agricultural income per active member that exceeds Survival Threshold (% above threshold, 100% is threshold)
Large Livestock + Shifting Cultivation + Paddy Terrace (archetype I.2)	No (182)	42%	82%	78%
Large Livestock + Orchard + Paddy Terrace (archetype I.1.b)	Yes	4%		353%
Large Livestock + Permanent Vegetable + Paddy Terrace (archetype I.1.a)	Yes	53%		425%
Large Livestock + Paddy Terrace (archetype I.3)	Yes	13%	64%	151%
Large Livestock + Paddy Terrace + Shifting Cultivation + Permanent (archetype I.4)	Yes	68%		124%

Small Livestock + Shifting Cultivation (archetype II.1)	No (23)	66%	82%	107%
Large livestock + Permanent Field (archetype I.5)	No	26%		378%

Table 21 - Comparison of economic results between the archetypes regarding consumption

Only three archetypes were not rice sufficient: Those who have no paddy terrace and those who practice shifting cultivation and have a paddy terrace. However, this does not imply that they do not consume rice. The economic analysis took into consideration only agricultural activities. Qualitative interviews revealed that most households receive some sort of off-farm income- whether it by via farm or off-farm labor and/or remittances. According to interviews, the main uses of remittances was purchasing rice, sending children to school, and health-related expenses.

Archetypes that include shifting cultivation have the highest proportion of self-consumed crops. The archetype with the lowest proportion of GP consumed are that with large livestock (since livestock are usually used for power and as a bank account), orchard (high-value crops that are sold), and paddy terrace (consumed). These are also the households with the highest positive value above the survival threshold. This is because of the high-value crops that are produced.

However, what the economic analysis does not show is the quality of diets consumed. Although the archetype with permanent orchard has the highest agricultural household income, the diversity of the diet could be significantly lower if the household does not purchase nutritious food with the money made from selling the fruit. A deeper analysis would be needed to understand how money earned is allocated in the household.

Archetypes		Cropping systems	Area (acres)	Average production staple crop per year (kg/year)	Average sales per year (USD/year)	Donations per year (10% for church) and relatives (% per harvest or sales)	Land tenure costs (yes/no)
Cash crops	I.1.a	Permanent vegetables	1	0	1,097	10%	no
		Paddy terrace	1	861	0	16%	no
	I.1.b	Orchard	0.75	0	842	10%	no
		Paddy terrace	1	861	0	16%	no
	I.5	Permanent vegetables	1	0	2,171	10%	no
	I.4.a	Permanent vegetables	0.5	0	665	10%	yes
		Paddy terrace	1.5	1,313	0	29%	no
		SC: corn	1	420	0	11%	no
		SC: millet	1	105	0	12%	no
	I.4.b	Orchard	0.5	0	31	10%	yes
		Paddy terrace	1.5	1,313	0	29%	no
		SC: corn	1	420	0	11%	no
		SC: millet	1	105	0	12%	no
	I.3	Paddy terrace	1.6	1,628	0	35%	no
	I.2	Paddy terrace	1.1	1,083	0	18%	no

No cash crops		SC: millet	1.5	788	0	19%	no
	II.1	SC: upland paddy	2	158	0	43%	no
		SC: millet	2	273	0	19%	no
		SC: pigeon pea	2	246	0	10%	no

Table 22 - Comparison of economic results of the cropping systems

Note: Church donations (10%) were considered as a tax in this study and were therefore deduced from the household agricultural income. For staple crops, the percentage donated is calculated according to the amount produced and given in-kind by the households. For cash crops, the percentage donated is calculated according to the amount sold and given in cash

Archetype	**Animal husbandry systems**		**Average sales/year (USD/year)**
I.1.a	**Large reproductive Livestock + Small Livestock**	Buffaloes: <10 heads	1556
		Mythons: <5 heads	0
		Cows: <5 heads	125
		Pig fattening: 1	150
I.1.b		Buffaloes: <10 heads	1556
		Mythons: <5 heads	0
		Cows: <5 heads	125
		Pig fattening: 1	150
I.2		Buffaloes: <5 heads	856
		Pig breeding: 1 sow	269
I.3		Buffaloes: <5 heads	211
		Horses: <5 heads	14
		Cows: <5 heads	126
		Pig breeding: 1 sow	565
		Buffaloes: <5 heads	158

I.4.a		Horses: <5 heads	102
I.4.b		Buffaloes: <5 heads	158
		Horses: <5 heads	102
I.5		Cows: >20 heads	528
II.1	**Small Livestock on**	Pig breeding: 2 sows	482
		Chicken: flocks of 20	1.70

Table 23 : Comparison of the yearly sales of the animal husbandry systems

Note: Livestock (especially large livestock) is not sold every year but when financial needs occur or in some cases to replace old ones. The average annual income received by the household from livestock sales was therefore calculated based on the frequency of sales reported during the interviews allowing the research team to estimate an annual income.

Archetypes	Average number of active members	Average acreage (total) / active member (acres)	Economic results: yearly agricultural income after church donations per active member (USD/year per active member)	Survival threshold (USD/year per active member)
I.1.a	2	1	1,918	456.25
I.1.b	2	0.9	1,390	456.25
I.5	2	1	1,699	456.25
I.4.a	3	1	558	456.25
I.4.b	3	0.9	287	456.25
I.3	4	0.4	683	456.25
I.2	5	0.5	352	456.25
II.1	4	0.5	481	456.25

Table 24 - Comparison of the agricultural annual income per active member of the different archetypes

Note: the agricultural income shown in this table does not include other sources of income perceived by the household, nor does it include remittances.

VII. Diets Today

The nutrition transition in the Asia-Pacific region refers to decreased consumption of local staples such as starchy roots and pulses and cereals, as well as the increased consumption of animal products, refined cereals, vegetable oils, and processed foods (Downs, S). These changes are associated with cancers, cardiovascular disease and diabetes in the region. In rural Hakha, the nutrition transition at its early stages can be observed, with the exception of an increased consumption of animal products. Meat, fish, dairy and egg consumption is reported to be very low among most households, especially among women.

Hakha diets today consist primarily of white rice, with other food groups eaten in *much smaller proportions* on the side. When a group of farmers was asked if they would increase their vegetable consumption if they had unlimited vegetables, they responded they would not, preferring to eat white rice. Diet diversity scores in Hakha township are found to be quite high, at 7.6 (MIID, 2017). May- July, the largest nutrient gap exists, caused by a scarcity of dark leafy greens and other vegetables in the diet that contain key micronutrients. However, qualitative interviews suggest that the availability of micronutrients in the environment is not the only cause of poor nutrition- dietary habits and local food preferences play a large role in household food consumption and allocation. Therefore, poor nutrition is likely to be an issue of consuming proper quantities of each food group, and diversity within food groups. The seasonality of vegetables available for consumption also could be a detriment to proper nutrition in the region.

Food Groups	Land Use						Rainy Season						
Cereals		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice	*RT*	C	C	C	C	C	BC	BPC	BPC	BPC	BPC	C	C
Maize	*SC/HG/P*	C	C	C	C	C	C	C	C	HC	HC	C$	C$
Roots and tubers													
Taro	*SC/HG*	C	C									C	C
Potato	*SC*	C	C				C	C	C	C	C$	C$	C$
Vitamin-A rich vegetables and tubers													
Sweet Potato	*SC/ HG*	C	C									C	C
Pumpkin	*SC/HG*	C	C	C	C	C	C	C	HC	C	C	C	C
Leafy Greens													
Pumpkin leaves	*SC/HG*	C			PC	PC	PC	PC	C	C	C	C	C
Mustard	*HG*	C	C	C	C								C
Roselle	*HG*	C	C	C	C	PC	PC	PC	C	C	C	C	C
Chayote Leaves	*HG*						C	C	C	C			
Other Vegetables													
Eggplant	*HG*	C	C								C	C	C
Bitter Eggplant	*HG*	C	C								HC	C	C
Cabbage	*HG/P*	C$	C	C	C$								C$
Celery	*HG/P*									C	C	C	C
Onion	*HG/P*	HC	C	C$	C$	C$	C	C	C	C	C	HC	HC
Lettuce	*HG/P*	C	C									C	C
Tomato	*HG/P*	C									PC	C	C
Cucumber	*HG/SC*							C	C	C			
Tree Tomato	*HG*	C									C	C	C
Fruits													
Banana	*SC/P*	C$	C$	C$	C$	C	C	C	C	C	C	C	C
Sugar Cane	*P*	C	C	C	C	C	C	C	C	C	C	C	C
Legumes, nuts, seeds													
Cowpea + Black Gram	*SC*	C	C	C	C	C	C	C	C	C	C	HC	HC
Chickpeas	*$*	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Spices													
Chili	*HG*	C	C	C	C	P	P	PC	C	C$	C$	C$	C
Garlic	*HG/P*	HC	C	C	C	C	C	C	C	C	C	HC	HC
Ginger	*P*	C	C	C	C	PC	PC	PC	PC	PC$	PC$	PC$	C$
Tumeric	*P*	C	C	C	C	PC	PC	PC	PC	PC$	PC$	PC$	C$
Oils													
Peanut Oil	*$*	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Sunflower Oil	*$*	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Palm Oil	*$*	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Sesame Oil	*SC*	C	C	C	C	C	C	C	C	C	C	C	HC

KEY	
C	Consumed
BC	Bought & Consumed
BPC	Bought, Produced, and Consumed
C$	Consumed and Sold
HC	Harvested and Consumed
RT	Rice Terrace
SC	Shifting Cultivation Plots
HG	Home Garden
P	Permanent Plots
$	Market

Table 25 - Diet diversity availability from cropping systems calendar (2017)

Cereal Crops

Households consume two meals per day, with a bowl of **rice** being central to both. Households that do not grow paddy (belonging to the archetypes II.1 and I.5) must purchase rice from Kalay or Hakha. There are also households that do not produce enough rice for their yearly consumption (archetypes I.2), experiencing a gap up to 6 months where they must purchase rice from Kalay or Hakha. Households also supplement rice consumption with consumption of corn or millet.
Note: The typification of the households surveyed show the diversity of farming systems. However the research team has not quantified how the proportion of households in the area that belong to each archetype.

Corn is mainly consumed in the form of soup, on average 2-3 times per week. **Millet** was reported to be consumed 2-3 times per year, saved for special occasions. Since most households do not cultivate millet, the millet they consume has been stored in baskets under the house from when they practiced shifting cultivation.

Cereal crops are in abundance in December after harvesting new grains. Stores are lowest in April-August.

Roots and Tubers

Potato is grown on cold land in shifting cultivation plots and consumed **June- February**.

Taro is grown in shifting cultivation plots, in rotation on permanent plots, or in home gardens. Taro is increasingly fading from chin diets. Taro is also consumed **November- February.**

March-May a food gap exists in this food group. Some households with income and access to markets purchase potatoes from Hakha.

Vitamin A rich vegetables and tubers

Sweet potato is grown in shifting cultivation plots, and to a lesser extent home gardens. Some farmers with paddy terraces plant the sweet potatoes in a plot near the terraces to eat as a snack during harvest time. Some people reported eating sweet potatoes on Sundays as a snack with neighbors. Sweet potato is harvested and consumed **November - February**.

Pumpkin is grown in home gardens and shifting cultivation plots. It can be consumed all- year round due to its ability to store for long periods of time. However, interviews show it is not a preferred food of many families, as they consume on average **6-10 fruits per year**. Some families feed the pumpkins to pigs rather than consume them in the household. However, according to our interviews, families who still depend primarily on shifting cultivation consume more pumpkins than those who no longer practice shifting cultivation.

This food group can be available year-round since pumpkins can store year-round, however, does not contain preferred food in the Hakha diet.

Dark green leafy vegetables

Mustard can be cultivated and consumed for seven months, **October- April**. Sometimes households will ferment or dry the mustard leaves to store them for longer. It is mainly used to make soup.

Roselle leaves are consumed **December - April.** One interviewee stated that Roselle used to be available all year round in the past, but now can only be consumed for 6 months. Other data collected by MIID states Roselle is still available all year round. It is mainly used to make soup.

Pumpkin leaves, Pea leaves, and Chayote leaves are also consumed throughout the year.

This group contains very important micronutrients. Leafy greens in the Hakha diet are mainly boiled in water to flavor soup.

Other Vegetables

Fresh vegetables must be consumed or sold within days after harvesting. Therefore, this category has the shortest consumption period, averaging 4 months.

Cabbage is grown mostly as a cash crop in Hakha. Households keep cabbages that are not suitable for market. Cabbage is consumed and sold **December-April**.

Lettuce is consumed **November- February**.

Celery is consumed **September- December**.

Eggplant is grown in home gardens and consumed **October- February**. Bitter Eggplant is also grown as a cash crop as well as consumed from **October- February.**

Tree tomato and tomatoes are grown in home gardens and consumed **October- April**.

Cucumbers are grown in home gardens and in shifting plots, and are consumed **July-September**.

Onion is can be consumed the entire year.

April-September a six-month gap exists for most vegetables. This is the largest gap of any category. Lack of irrigation in the dry season prevents households from producing vegetables. Only when households have access to markets can they supplement their vegetable consumption during these months.

Fruits

Bananas are available all year round in Hakha and grown widely. They are sold as a cash crop and grown on shifting land, fallow shifting cultivation land, permanent orchards, and in home gardens. Many different varieties can be found.

Sugarcane is mostly sold as a cash crop, however, is also consumed year-round by the families that produce it.

Mangos, guava, strawberries, papaya, apples, grapes, and various citrus are also grown in some cases as cash crops and consumed by households seasonally. However, consumption by household is varied and minimal.

Legumes, nuts, and seeds

Cowpea and black gram are the most common legumes grown and consumed in Hakha. A MIID diet diversity survey found that Chickpeas are also bought and consumed by villagers. Beans and peas are harvested November through January but consumed year-round due to long storage capabilities.

Pigeon peas are cultivated, however, according to our interviews, are only sold as cash crops.

Half of the respondents in the MIID baseline survey conducted in 2017 had consumed this category of food in the past 7 days.

Spices

Chili, garlic, ginger and turmeric are cultivated and stored at various times of the year and available all year round.

Oil

Sunflower oil, peanut oil, palm oil, and sesame oil are used for cooking in Hakha. They are purchased from the market. Some farmers still cultivate sesame and press the seeds into oil. Oil cakes are fed to pigs.

Meat

Domesticated Meat

Chicken is reported eaten 1-4 times per month. Some families have reported consumption of chicken to be as low as 4 times per year.

Pig, Cattle, Buffalo are still only killed for celebrations and funerals, or to sell the meat for needed cash.

Wild Meat

Hunted meat is still consumed in Hakha. However, populations of wild animals are reported to be declining. Households report eating *all* types of meat (wild and domestic) once per week at most.

The most common type of wild meat consumed is rats. Wild boar, deer, and wild birds are also consumed.

It is important to note that even when meat is consumed in a household, intrahousehold allocation of meat is uneven. According to a qualitative study on nutrition practices by MIID, "Even though women prepared the food, they would prioritize giving food to their husbands, and rather eat leftover rice and only little amounts of meat. Men, in general, ate more than women as they had to accomplish "hard work"…Women also eat less than men and less meat/fish, sometimes receiving the left-over pieces only after the male head of the household has eaten" (Pistor, 2017).

Eggs

According to our interviews, eggs are mainly fed to children, the elderly, and sick people. According to data collected by MIID, 72% of households had consumed eggs in the past 7 days. However, the survey did not specify which member of the household had consumed the eggs.

Fish

Fish consumption is seasonal, mostly consumed from February to April. According to interviews, fish populations have declined in the rivers in recent years. Some villagers suspect it is because "road construction and landslides are pushing too much dirt into the rivers". Others believe new fishing practices such as dynamite use has sharply reduced fish populations.

Milk

Milk and other dairy products are not part of the diet in Hakha. Livestock are kept very far from the village, and therefore collecting milk is not feasible. Now, powdered milk is sometimes consumed by children.

Sweets

Packaged sweet bread, instant noodles, coffee mix, tea mix, and soft drinks can be purchased in villages and are consumed as snacks and treats and served to guests.

Pre-Colonization (<1885)	British Colonization (1885 - 1948)	Post-Colonization (1948 - 1962)
Diet follows the shifting cultivation calendar - Staple crops: **Maize: daily consumption** **Millet: daily consumption** once no more maize remains in storage + during specific ceremonies + to make local alcohol *zupu* used in ceremonies - Complemented by legumes, fruits and vegetables cultivated according to the year (1), (2) or (3) - Wild meat and fish : **daily consumption** - Breeded animals: **only for special ceremonies/celebrations**	Diet still follows the shifting cultivation calendar with integration by some households of upland paddy and/or trading in Gangaw market (1940s-1950s) - Staple crops: **Maize: daily consumption** **Millet: daily consumption** **Rice: rarely consumed and by a few households only in small quantities** mixed with chicken broth - Complemented by legumes, fruits and vegetables cultivated according to the year (1), (2) or (3) - Wild meat and fish : **daily consumption** - Breeded animals: **only for special ceremonies/celebrations**	Diet still follows the shifting cultivation calendar but the establishment of paddy terraces by some households - Staple crops: **Maize: daily consumption** (50 Big Tins yearly for a household of 6 members) **Millet: daily consumption** (10 Big Tins yearly for a household of 6 members) **Rice: rarely consumed and by a few households only in small quantities** mixed with corn - Complemented by legumes, fruits and vegetables cultivated according to the year (1), (2) or (3) - Wild meat and fish : **at least 3 times/week** - Breeded animals: **only for special ceremonies/celebrations**

Table 26 - Summary table of main diet evolutions in the area from pre-colonization to post-colonization (1962)

Socialist Period (1962 - 1988)	From uprising (1988) to landslide in 2015	Present
The demonization of shifting cultivation systems: decreasing number of households practicing it + increasing number of households with paddy terraces + increase in cash crops cultivation and rice purchase from markets - Staple crops: **Maize: preferably fed to animals** **Millet: very rarely consumed** and mainly by households with shifting	Simplification of shifting cultivation systems and decreasing number of households practicing it + increasing number of households with paddy terraces but badly affected by the landslide of 2015 + increase in cash crops cultivation and rice purchase from markets	- Staple crops: **Maize: preferably fed to animals. Eaten 2-3 times per week** by households without easy access to rice **Millet: very rarely consumed (2-3 times per year)** and mainly by households with shifting cultivation plots and without paddy terraces. **Rice: daily consumption** (average of 97 Big Tins per year for a household of 6 members)

cultivation plots and without paddy terraces.
Rice: daily consumption
- Complemented by legumes, fruits and vegetables in smaller portions on the side
- Wild meat and fish : **at least 3 times/week**
- Breeded animals: **only for special ceremonies/celebrations**
		- Complemented by legumes, fruits and vegetables in smaller portions on the side
		- Wild meat: **Once a week at most**
		- Fish: With a reduction of fish in the rivers, fishing parties are only authorized from February to April
		- Breeded animals:
		  - **Chicken meat:** from 1-4 times per month to 4 times a year
		  - **Chicken eggs:** for the children, the elderly and the sick
		  - **Pig, Large livestock:** celebrations

Table 27 - Summary table of main diet evolutions in the area from socialist period to the present day (2017)

Note: The quantity daily consumed by households in present times varies according to the household. The research team came across different strategies to try to diminish the food gap. On average, paddy yields are of 91 Big Tins/acre. The area of paddy produced by a household rarely exceeds two acres and is mainly one acre. Some households will have a high daily consumption of rice (consuming 138 big tins of an acre per year for a household of six members) and therefore relying on purchased rice for almost half of the year. Whereas other households will have a reduced daily consumption of rice (down to 55 big tins of rice per year for a household of six members), enabling them to reach a full year of rice sufficiency.

VIII. Major transitions over the past 100 years in Hakha villages studied

1. Changes in Staple Grains and the simplification of shifting cultivation systems

The transition from millets, sorghum, and maize to primarily white rice could have impacts on nutrition, as outlined in the table below. Many millets contain high levels of essential protein, vitamins, and minerals as compared to rice. Diversifying staples ensures the consumption of a wide array of micronutrients.

Nutritional content in 100 gms of dry Grain	Protein (in gms)	Carbohydrates (in gms)	Fat (in gms)	Minerals (in gms)	Fiber (in gms)	Calcium (in mgs)	Phosphorous (in mgs)	Iron (in mgs)	Energy (in kCals)	Thaimin (in mgs)	Niacin (in mgs)
Foxtail	12.3	60.2	4.3	4	6.7	31	290	2.8	351	0.59	3.2
Little	7.7	67	4.7	1.7	7.6	17	220	9.3	329	0.3	3.2
Kodo	8.3	65.9	1.4	2.6	5.2	35	188	1.7	353	0.15	2
Proso	12.5	70.4	1.1	1.9	5.2	8	206	2.9	354	0.41	4.5
Barnyard	6.2	65.5	4.8	3.7	13.6	22	280	18.6	300	0.33	4.2
Sorghum	10.4	70.7	3.1	1.2	2	25	222	5.4	329	0.38	4.3
Pearl	11.8	67	4.8	2.2	2.3	42	240	11	363	0.38	2.8
Finger	7.3	72	1.3	2.7	3.6	344	283	3.9	336	0.42	1.1
Paddy Rice	6.8	78.2	0.5	0.6	1	33	160	1.8	362	0.41	4.3
Wheat	11.8	71.2	1.5	1.5	2	30	306	3.5	348	0.41	5.1
Quinoa	14	64	6	*	7	36	457	4.6	368	0.36	*

Compiled from a study published by the National Institute for Nutrition, Hyderabad and other sources for Quinoa.

Table 28 - Nutritional content of different millets compared to that of paddy rice, wheat and quinoa - https://millets.wordpress.com/health/proximate-composition-of-small-millets-wheat-and-rice-per-100g/

Food Groups	Land Use						Rainy Season						
Cereals		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Millet	SC	C	C	C	C	C	C	C	HC	C	C	C	C
Maize	SC	C	C	C	C	C				HC	HC	C	C
Sorghum	SC	C	C	C	C	C	C	C	C	C	C	C	HC
Mumg	SC	C	C	C	C	C	C	C	C	C	C	C	HC

Table 29 - Cereal crops in the past

Food Groups	Land Use						Rainy Season						
Cereals		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice	RT	C	C	C	C	C	BC	BPC	BPC	BPC	BPC	C	C
Maize	SC/HG/P	C	C	C	C	C	C	C	C	HC	HC	C$	C$

Table 30 - Cereal crops in 2017

Not only did the number of cereal crops decline, but the intraspecies biodiversity of these crops has also declined (with the exception of rice). In historical interviews, some elder farmers could name over 10 varieties of millet cultivated in the past. Now, only one or two are cultivated. Sorghum and *Mumg* have disappeared from cropping systems in Hakha. Both types of biodiversity- interspecies and intraspecies- create resilience in cropping systems; protecting communities against pest and disease decimation, weather shocks, and providing a wide array of micronutrients. Furthermore, both millets and sorghum perform better than maize and rice under drought conditions, heavy rainfall, and in storage. They also grow on poorer soils and are useful crops for farmers with limited access to fertilizer (Kerr, 2016). However, social stigmatization of millet and political promotion of rice, coupled with high labor demands of shifting cultivation systems and a flavor preference for rice, drove the transition away from cultivation these crops in Hakha.

As shifting cultivation systems simplify, other crops such as sweet potato, taro, pumpkin, sulfur bean, and cowpea are becoming less frequently consumed. A marked reduction in legume cultivation can be observed as shifting cultivation is replaced with other types of cropping systems.

Biodiversity in shifting cultivation systems also hold agronomic benefits. For example, shifting cultivation systems combine maize, various legumes, and pumpkin and cucumber. Maize, as a C4 grass is highly efficient at converting sunlight to energy. The legume family (beans) has the unique ability to capture and use atmospheric nitrogen. The maize and beans capture the majority of sunlight in the system, and the rest filters down and is captured by the pumpkin and cucumber that grows on the ground.

Homegardens and permanent fields have incorporated some of these crops historically grown in shifting cultivation plots, as well as added new crops, such as cabbage, onion, and celery. However, as previously mentioned, the frequency of consumption of nutrient-rich crops traditionally in shifting cultivation plots (sulfur bean, pumpkin, taro, sweet potato, millet, long bean, soybean, pigeonpea) are fading from local diets in Hakha.

2. Wild meat and fish populations decline

Historically, households would consume some type of wild meat or fish every day. Now, households report this number falling to an average of once a week to as low as few times a year. Furthermore, populations of wild animals and fish are reported to have declined drastically. More research is needed to document animal populations in Hakha.

3. The increase of grazing livestock

Over the years, the purpose of livestock, its position in the villages areas and the way it was managed evolved. The population of livestock has increased substantially over the past 40 years. Farmers, especially those still practicing shifting cultivation, struggle as livestock often destroy their crops. As it is hard to prove whose livestock destroyed the crops, and people do not want to walk the long distances to the shifting cultivation plots to assess damage, it is often left uncompensated. There is great interest in expanding livestock herds, so this is likely to continue to be a major issue in the future that will need to be addressed at the community level.

4. The reorganisation of work & agricultural workload of rural mothers

Through the historical evolution, we observed the evolution from a communal work organization with working groups to an individualized work organization. The capacity of cultivating properly a plot doesn’t depend on the only member's physical strength (and them belonging to a working group) but on the household economic capacity to hire external .

Out-migration and off-farm labor opportunities for men, has caused women to take on the majority of the agricultural workload. The KAP survey conducted in Hakha by MIID notes that women are “overburdened with accomplishing a **quadruple role** including agricultural subsistence economy, productive work, community work and reproductive work” (Pistor, 2017). The study further states that on top of this burden, they are then excluded from controlling, accessing, or owning resources that would reduce this burden such as motorbikes, land, birth control, etc. Burdens do not only impact the well-being of women, but also of their children.

Often, women cannot exclusively breastfeed their children for the recommended six months because they have to go back to the fields to sow, harvest, and sell crops or collect firewood for cooking. As crops, tools, and firewood must be carried by women in baskets on their backs up and down steep mountain slopes, it is impossible to also carry a baby. Children are left at home with elderly or disabled household members or relatives.

5. Land Tenure Insecurity

Land allocation and appropriation (informal or ruled by customary law) also evolved with political and economic influences. Whereas before, the whole set of land was managed collectively at the village level, today more and more areas of land are managed at the household level with the "*dumanization"*[17] phenomenon.

Shifting cultivation systems managed by customary land use tenure in Hakha guarantee every village member, regardless of socioeconomic status, have access to a large enough area of land to feed their household[18]. Shifting cultivation is especially important for the most vulnerable households, that do not have the economic means to transform the land into paddy terraces or permanent fields or orchards. However, in 2012 the government passed the Vacant, Fallow and Virgin Land Management Law which stipulates that any land the government deems fallow can be sold to companies or individuals. Shifting cultivation land is particularly susceptible to these concessions since fallow land is integral to the sustainability of the system and the government does not recognize shifting cultivation (Gret , 2017). As the region opens up to investment, this system faces threats from the government who legally can allocate land to investors (local, national, and international investors).

The National Land Use Policy (NLUP) passed in 2016 recognized land use rights for ethnic nationalities. Article 64 states, "Customary land use tenure systems shall be recognized in the National Land Law in order to ensure awareness, compliance and application of traditional land use practices of ethnic nationalities, formal recognition of customary land use rights, protection of these rights and application of readily available impartial dispute resolution mechanisms." However, approximately 10 months after the NLUP was passed, an "obscure, yet powerful commission in the National Parliament, known as the *Special Commission for Analysis of Legal and Special Issues*" submitted a memo to Parliament claiming the law was unconstitutional (WRM, 2017). The special commission stated the NLUP is an infraction of Article 37 of the 2008 constitution (written by the military), which states that the State is the original owner of all natural resources above and below the land.

As customary land law is not recognized under the current land law, villagers in Hakha do not have long-term security on any type of land. This has already caused conflicts of the government grabbing land to sell to local cronies (Interview, Hrang Kil, 2017).

[17] *"Dumanization"* phenomenon refers to land being cultivated in permanent farming and not having fallow periods (Gret, 2017).

[18] Today, labor force limits productive potential of land. Furthermore, crop diversity and association in the past reduces the agronomic benefits of diversity in the same area of land (i.e association of cereals and legumes for nitrogen, lower pest and disease pressure, etc- which in turn increases yields).

Farmers protest local government claim of over 40 square acres of land belonging to villages around Hakha. Sign states "Those who do not respect ancestral land are our enemies"
Photograph by Alyssa Pritts

Legal recognition of customary land tenure in Hakha would protect land from investments that permanently deforest lands, such as logging, mining and conversion of forests to cash crops and plantations (Costenbader, J, et al., 2015).

6. Monetization of work and food

Through the years, Hakha Chin evolved from a society based on food agriculture and collective work to paid daily workers and bought staple foods. The various demonetizations limited however the monetization of society, as well as the remoteness of the villages and the complicated access to banks. Most of the farmers interviewed, still invest their savings into livestock (large or small).

7. Water Shortages

Farming systems in Hakha almost exclusively depend on rainfed irrigation. This limits production of nutrient-rich vegetables in the dry season. Furthermore, water shortages can also impact the ability for household members to practice hand washing, as water is more likely to be used for cooking and drinking.

8. The resilience of Farming Systems

Farming systems today are marked by a shrinking labor force and in turn high labor costs. With high transportation costs, it is not feasible for most farmers to pay high labor costs. If trends of continue, it could be expected that farmers choose less labor-intensive farming systems such as orchards and elephant foot yam production. However, since crops involved in these forms of farming take years to mature, it is important for farmers to have land tenure security. Furthermore, this could further the deterioration of agrobiodiversity in the landscape.

IX. Conclusions

Since the late 1800s, the agrarian system of Hakha has radically evolved in response to political, social, economic, and demographic drivers. Out-migration is placing pressure on the farming systems, as economically productive people continue to leave and the workforce ages. An exclusively shifting cultivation agrarian system has evolved with these drivers to incorporate other farming systems including permanent orchards, paddy terraces, rotational ginger fields, and vegetable gardens. Impacts of these transitions include changes spatially and temporally of land management/ tenure, biodiversity, and has had a marked change in the diets of the people who depend on these systems for their daily subsistence. As Chin State has the highest levels of stunting of children in all of Myanmar, it is pivotal to understand how the transformations in the agrarian system impacts the diversity of food available to rural households.

This study found that the diversity of cereals and legumes has decreased in the diet of rural people in Hakha. Vegetable diversity has increased. However, a priority is placed on cash crops such as cabbage, onion, and garlic. Fruit production is diversifying, however, a focus on post processing of fruit to wine has been observed. Wild meat consumption has declined with a perceived declining population of game and fish. Consumption of animal-based products such as eggs and meat is low, and dairy products are virtually absent from the Hakha diet.

Agrarian systems are intrinsically linked to the health and well-being of the people who cultivate them, and the health and resilience of the environment they are situated in. Agricultural and health policies should support and promote diversification of cereals, as well as nutrient-rich vegetables and legumes in the diet. A special consideration of women's limited time and access to resources should be taken in the design and implementation of these programs. The voices and aspirations of rural youth should also take a central focus in future research, as they are the future cultivators of the agrarian system and the environment it depends on. Ensuring Chin people secure land tenure recognized by the government is necessary to protect the food and environmental security of the region.

Recommendations for future studies

After analyzing the farming systems that exist in Hakha Township, the research team came up with a list of study topics that could further aid in understanding food and nutrition security in villages.

1. Intra-household food allocation
2. Aspirations of youth in villages
3. Understanding local definitions and perceptions of diet diversity
4. Study of forest evolution over time using satellite images and linking them with land use (agriculture, timber…)
5. Survey of wild fish and animal populations in the Chin Hills

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