

# ANNEX 12A: PROFILE OF HTEE PU CLIMATE SMART VILLAGE

International Institute of Rural Reconstruction;

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RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security



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International Development Research Centre  
Centre de recherches pour le développement international



# CLIMATE SMART VILLAGE PROFILE

## Htee Pu Village

Nyaung-U Township, Mandalay Region



## Introduction

Myanmar is the second largest country in Southeast Asia bordering Bangladesh, Thailand, China, India, and Laos. It has rich natural resources – arable land, forestry, minerals, natural gas, freshwater and marine resources, and is a leading source of gems and jade. A third of the country's total perimeter of 1,930 km (1,200 mi) is coastline that faces the Bay of Bengal and the Andaman Sea. The country's population is estimated to be at 60 million.

Agriculture is important to the economy of Myanmar, accounting for 36% of its economic output (UNDP 2011a), a majority of the country's employment (ADB 2011b), and 25%–30% of exports by value (WB–WDI 2012). With abundant land, water, and cheap labor, agriculture is a major driver of the Myanmar economy. However, only about 18% of the country's total land area of 68 million hectares is used for crop production and only 18.5% of this is irrigated. This leaves significant room for expansion in this sector.

Climate change is an established phenomenon in Myanmar, evidence shows an increasing temperature over time. Based on the country's experience, adverse impacts of climate change are increasing incidence of drought, flooding due to heavy rains, stronger cyclones, and salinization of farms in the delta region. As an agricultural country with a large percentage of smallholder farmers, Myanmar's food security, nutrition, and livelihoods are bound to be greatly affected by the threat of climate change. In 2016, the Myanmar government launched the Myanmar Climate Smart Agriculture Strategy to serve as the country's directions towards building resilience in agriculture. A key component of the strategy is the promotion and practice of community-

### Basic Village Profile of Htee Pu Village

Name of Village Tract	Htee Pu
Name of Village	Htee Pu
Households in Htee Pu village	275
Total Population in Htee Pu village	1,180
Female in Htee Pu village	603
Male in Htee Pu village	577
Distance from Nyaung Oo airport to Htee Pu village	22 miles

Source: Village Tract Administrator (U Lwin Ko)

based approaches achieving climate resilience in agriculture.

With support from IDRC and CGIAR global research program climate change, agriculture and food security (CCAFS), IIRR and its local NGO partners is implementing climate smart villages (CSV) to demonstrate community-based adaptation in agriculture in different agro-ecological zones in Myanmar. This document is the result of a desk research that IIRR commissioned to develop profiles of each CSV in the project. The purpose of this document is to provide the reader background information as to the agriculture, livelihoods, nutrition, gender and climate change context of each CSV.

Population above 18 years is the highest with 930 comprising of Male 450 and Female 480. Population under age 5 is found to be the lowest. In the older ages, Female population is more than that of Male (Table 1).

**Table 1: Population of Htee Pu village (2018 May)**

Category	Male	Female	Total
Under 5	32	27	59
5 and 12 Years	57	42	99
12 and 18 years	38	54	92
above 18 years	450	480	930

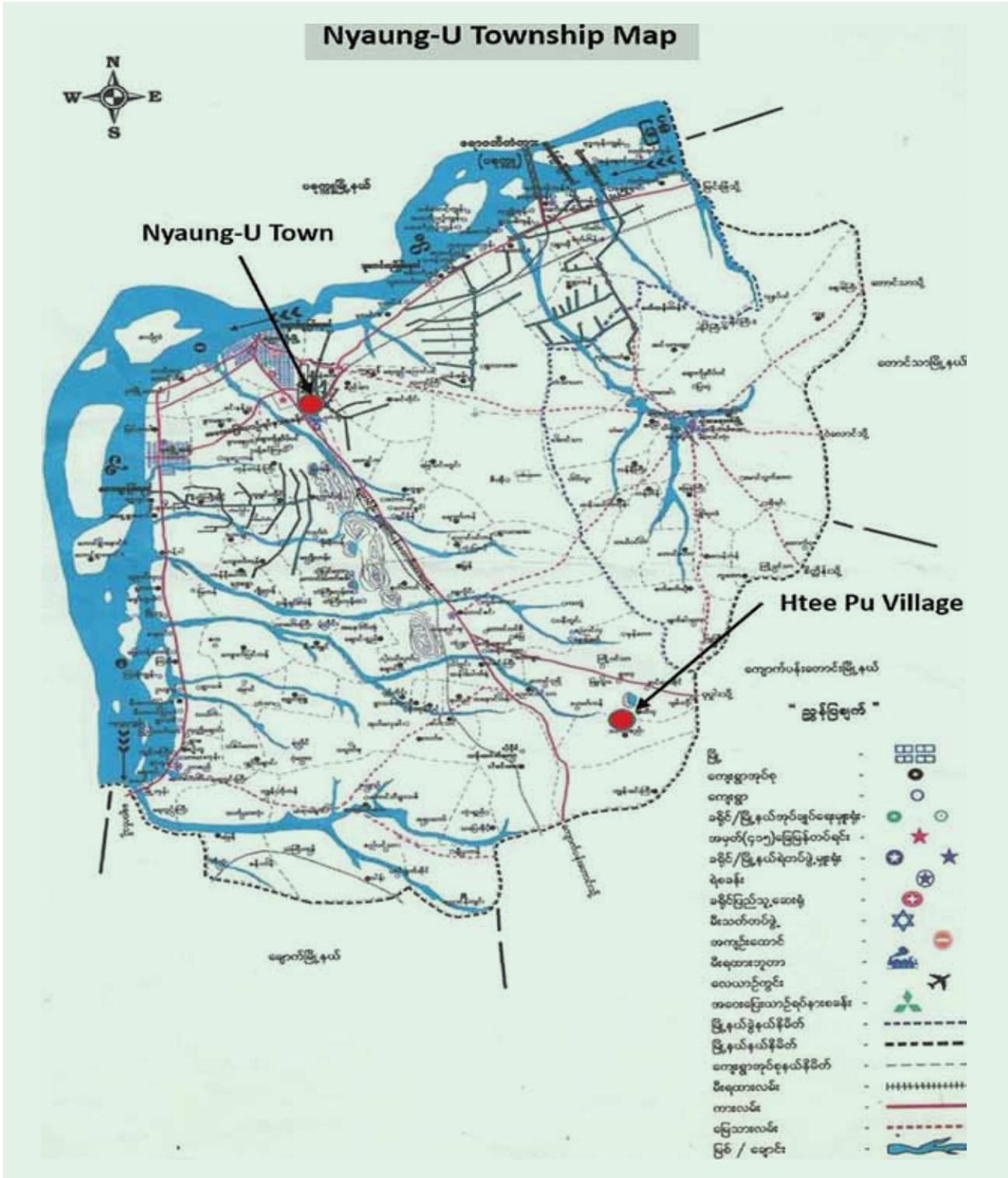
Source: Nyaung Oo Township Administrative Office.

## Poverty

Poverty levels within the Dry Zone as indicated in 2010 JICA study was 33 percent for farm households, and 55 percent for rural landless households (LIFT, 2015).

Poverty Incidence of Mandalay Division (where Nyaung Oo township is located) indicated in Integrated Household Living Condition Survey (2009–2010) is 26.6 % with 14.1% in urban households and 31.6% in rural households (IFC, 2017).

In terms of housing material, 76 % of the households in Mandalay division has bamboo walls and less than 45 % has Dani/ Theke/ Leaf Roof. Earth floor is found in 16 % of the households living inside Mandalay division (IFC, 2017).



### Climate Profile

Across the Dry Zone, water is scarce, vegetation cover is thin, and soil is degraded due to severe erosion. The region is characterized by low annual rainfall that ranges between 508 and 1,016 mm per annum with high variability and uneven distribution. The monsoon rain is bimodal with

a dry period during July when dry desiccating winds blow from the south. The undulating land, composed mainly of sandy loam with low fertility, is subjected to severe erosion under rain and strong winds. The average mean temperature in the Dry Zone is about 27°C and the temperature often rises to about 43°C in the summer period. This dry environment with its other natural

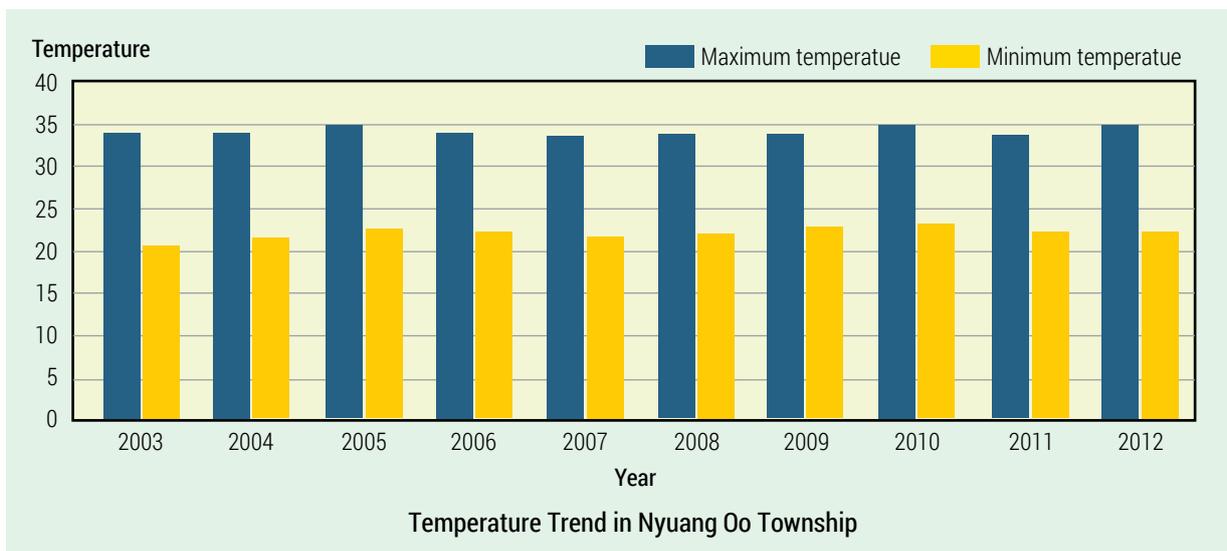
limiting factors has led to conditions of growing food insecurity and severe environmental degradation (UNDP, 2014).

Nyaung Oo township is in Dry Zone which has highest temperature among all of the regions of Myanmar. Hence, the max temperature is generally around between 33 degree Celsius and 35 degree Celsius. Minimum temperature is about 10 degree differences with Max temperature. Temperature is not fluctuated much in this area

whereas, just slight variation among the average maximum temperature and average minimum temperature over 9 year-period (Figure 1).

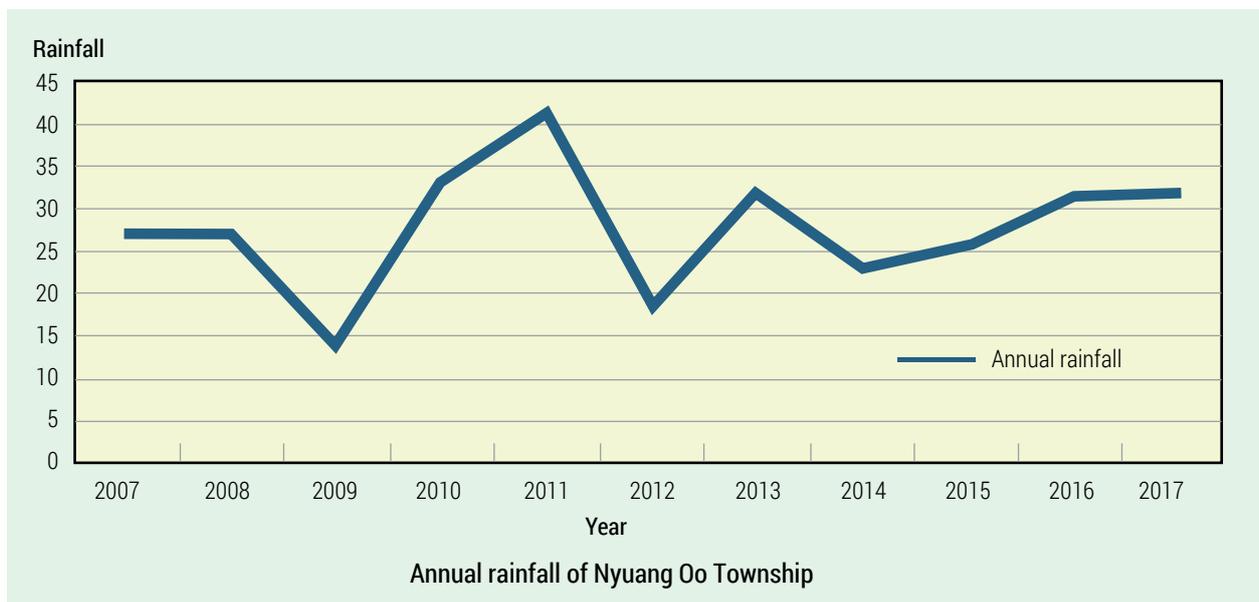
Rainfall intensity in Nyaung Oo is very low compared to other townships of Dry Zone – less than 40 inches per year. According to 10 year time series data, it can be observed that rainfall is erratic in Nyaung Oo township. The highest is at 2011 with 40.3 inches and the lowest is in 2009 with 13.4 inches (Figure.2)

**Figure 1: Temperature Trend in Nyaung Oo Township from 2003 to 2012.**



Source: Department of Meterology and Hydrology, Nyaung Oo Township.

**Figure 2: Rainfall Trend in Nyaung Oo Township from 2007 to 2017.**



Source: Department of Meterology and Hydrology, Nyaung Oo Township

## Livelihoods

The major economic activities in the Dry Zone are subsistence farming such as paddy, sesame, pigeon pea, groundnut, and small scale livestock rearing. Agricultural productivity is low and the farmers are heavily dependent on products from the natural forest especially fuel wood, pole, post and fodder to support their living and livestock. Many landless people are working as seasonal farm labourers, migrating to urban regions during non-planting time to find temporary employment (UNDP, 2014).

Low agricultural profitability is a critical constraint to farming communities in the Dry Zone. Poor access to supplemental sources of water amplifies the impact of erratic rainfall on crop production. Though inputs of all levels of quality are generally available, most farmers cannot afford suitable ones and have difficulty differentiating between good and bad quality inputs. Inflexible loan repayment terms for inputs force farmers to sell their output at harvest, which floods the market and reduces incomes. The income for many farming communities is low, which, in turn, stifles their ability to invest in productive assets and skills. These conditions create a foundation of vulnerability, leaving communities unable to adapt to shifts in market conditions such as variability in crop prices, environmental conditions such as pest and disease outbreaks, and erratic weather patterns such as floods or drought (Mercy Corps).

Institutional support for farming communities across the Dry Zone is low. One of the primary causes is an absence of accountability measures and mechanisms for inclusive decision-making within government support structures. Though improving, civil society remains fragmented and weak, and is still in the early stages of being able to effectively leverage and represent community needs in ways that produces meaningful policy, statutory, budgetary, and regulatory reforms. Importantly, the ability for farmers and laborers to associate is inhibited, which limits their capacity to establish better leverage in the marketplace. As a result, agricultural policies, services, and land and management arrangements are not effectively reducing the high levels of poverty found in agricultural communities, nor reducing the impact of land degradation on critical ecosystem services (Mercy Corps).

### Percent of households in Htee Pu engage in livelihoods

Livelihood Activity	Percent household
Agriculture/Farming (all crops)	50%
Livestock (Goat and Cattle mainly, some few rear pig)	15%
Landless engage in wage work	25%
Harvesting-processing toddy palm	10 %

Source: Htee Pu Village Tract Administrator, Nyaung Oo Township

Lack of access to land is a constraint for some households in the rural areas of the Dry Zone. More than half the households in the survey villages had no agricultural land. For them, agricultural labour, employment in nonfarm businesses and migration, for at least one or more household members, is the best option for improved livelihoods and resilience (Mercy Corps).

Most households with land own draught cattle. For poorer and landless households, the raising of small ruminants and poultry provide an important source of income. Low access to animal health services and fodder availability leads to high losses from disease and increased risk of overgrazing on the predominantly common grasslands. Improved pastures require tenure security and more advanced knowledge of animal nutrition. Animal owners try to increase the number of animals they have to maximise benefit from the limited fodder base available, while the value of the common land for livestock is decreasing. This increases the risk of ongoing environmental degradation with the impact from shocks (weather, market) accentuated by the sometimes oversized herds and resulting in significant losses (Mercy Corps).

The trade of animals and animal products faces many obstacles that constrain farmers in searching for the best markets for their animals. Administrative red tape at local, regional and national level, e.g., the slaughtering licence system, forces farmers to accept reduced market prices. There are no local farmer organizations to support collective procurement and marketing of animals and animal products, and there has been little effort to establish breeder associations at a local level (Mercy Corps).

Off farm employment by family members in 55 percent of households is an important augmentation of household incomes for many poor families. A high percentage of farm households are also engaged in casual agricultural labour, the demand for which increases during periods of peak farm production. The opportunity to pursue extra wage income coincides with the on farm production needs of poor farm households. Access to affordable finance is limited with formal credit utilised by only 19 percent of adults in Myanmar. Further, almost 90 percent of the total MADB loan portfolio is directed at a single crop (rice), and 97 percent is distributed over only four crops. Non-crop lending (e.g., term loans for farm machinery) accounts for less than 1 percent of the total. The high-cost borrowing is additionally linked to the indebtedness found among many households with a quarter of all households owe debts equivalent to more than four months of total household income. Both the high cost of borrowing and indebtedness impose constrain productivity by limiting investment in farm production and nonfarm businesses (Mercy Corps).

In the Dry Zone, all crops are exposed to significant intra-annual price fluctuations around the harvest cycle. Rice is currently freely traded but its export is tightly controlled. As a result, price fluctuations are largely synced to availability. Prices are highest at harvest when the markets are flooded. Edible oil prices are known to fluctuate widely, caused by the relationship between domestic production variations and import volumes of palm oil. Reliance on single export markets also contributes to volatility. Though pulse production, primarily for India, has been a successful income stream for Dry Zone farmers, it exposes them to the risk of price instability related to external political, social, and economic conditions (Mercy Corps).

In the context of low profitability, undiversified production, and repeated exposure to environmental and market shocks, many households are experiencing a deepening cycle of debt, which acts to further reduce their ability to cope and adapt. This issue is exacerbated by poor access to low-interest rates, unresponsive repayment schedules, inflation related to input costs and food, production shocks, land degradation, and low profitability.

For example, debt has significant impact on earnings because many existing credit options require repayment at harvest time. As a result, farmers are forced to sell their crops when prices are lowest, rather than wait until the market is not saturated. And with an increasing debt burden, farmers and laborers become increasingly impacted by acute shocks that affect production quality and quantity such as low rainfall or pest infestations. Reduced access to flexible credit options reduces the capacity of farmers to invest in effective technologies and practices that will help them to increase soil and water productivity. Poor practices can contribute to erosion, salinization, and other mechanisms that drive land degradation. Indebtedness also reduces the capacity of farmers to invest in and use supplemental irrigation water. This limits the capacity of farmers to mitigate the impact of the highly erratic Dry Zone climate system, leaving them exposed to persistent drought events. Current data indicates that 79% of Dry Zone households are in debt that is large in absolute and relative terms. Farming households typically have larger debts than non-farm households. when the debt burden becomes unmanageable, households have reduced input purchasing power (including the ability to hire sufficient labor), are more likely to engage negative coping strategies that degrade the environment, are not able to invest in productive assets, and have reduced access to emergency lines of credit. There are fewer households with regular (over year) debt among farming households, which indicates that they have better access to emergency credit than non-farm ones (Mercy Corps).

## Agriculture

The primary crops grown in the Dry Zone are rice (22% rainfed and 29% irrigated of the national total), oil crops (89% of sesame, 69% of groundnut, 70% of sunflowers), and pulses (93% of pigeon pea and 97% of chickpea). According to GoM land use classifications, the majority of farmland is designated for production of field crops (68%), irrigated rice (12%), rainfed rice (9%), and garden/upland crops (5%). Average farm size is small, but larger than the national average. More than half of farms are less than five hectares (54%) and 83% are less than 10 hectares. 37 percent of farmers have small land holdings of less than two hectares (5 acres). These small

holdings require households to look for additional income sources. Access to stored water for crop production, a potential critical mitigation strategy against the scarcity and variability of rainfall in the Dry Zone, is low (Mercy Corps).

Like regular access to water sources, differences in access to markets leads to significant disparity in the livelihoods choices and outcomes amongst Dry Zone farming communities. Access to good road infrastructure reduces transport costs, which keeps their farming outputs competitive and puts places these communities in a stronger negotiating position because they can bargain with a larger set of buyers. However, a significant number of Dry Zone communities lack good quality road links to township and state capitals, which puts many communities at a significant comparative market disadvantage (Mercy Corps).

Historically, agricultural policies in Myanmar have been narrowly focused on maximizing the production of paddy crops through intensification in order to keep the price and availability of rice low in Myanmar. The long-term result has been significant gains in paddy production but reduced farmer incomes because commodity prices have not kept pace with input costs (Mercy Corps).

Restrictive export controls create excess supply in the domestic market, which keeps crop prices low. This benefits national consumers but inhibits the income of farmers, particularly smallholders (Mercy Corps).

Moreover, agricultural extension offices still frequently instruct farmers to follow the central government's annual agricultural production plans, so crop selection remains constricted which limits the flexibility and choice of farmers (Mercy Corps).

Inhibited and irregular farm incomes limit the purchase and effective use of quality inputs, including seed, fertilizer, pesticide, and labor. Most products are imported from China and quality controls are all but nonexistent. Moreover, due to a lack of extension services, many farmers lack the ability to effectively apply inputs such as fertilizer and pesticides. Incorrect (unsystematic) use of pesticides, particularly of poor chemical composition, can degrade soil quality and increase the impact of infestations by killing predatory insects (such as wasps and spiders). Another important consequence is that residue

levels are too high to meet export standards. In addition, there is reduced availability of certified seed varieties for many crops. This is a result of a restrictive certification process, low production capacity of public seed multipliers, and undeveloped and inadequate private-sector import markets. Many farmers plant saved grain from the previous harvest rather than invest in existing genetically robust seed options. The resulting production is less than that of certified seed because it does not respond as well to inputs or improved water control and is less resistant to pests and disease. There is also currently a farm labor shortage, particularly during peak season, which is exacerbated by regionalization, urbanization, and low crop profitability, which in turn places a low ceiling on farm wages (Mercy Corps).

The farmers from Dry Zone face the challenges of poor road and communications infrastructure, poorly developed market information systems, low levels of agriculture technologies and farm mechanization, as well as lack of input supply, agricultural extension and support. Limited knowledge and coordination among different stakeholders on climate-resilient agriculture also restricts their capacity to respond to climate change impacts (Mercy Corps).

The main crops in the Dry Zone are pulses, beans and oilseeds which are produced for local and export markets. The marketing of these crops is widespread, even among those households holding less than one acre of land. Many of these small holder farmers sold at least part of their output and rates are higher for households with more land. Marketing structures and value chains are well developed in the Dry Zone and offer smallholders easy access to markets for their crops. However, nearly 90 percent of all households sold their crop within one month of harvest and only around 10 percent participate in group marketing activities. The necessity to repay loans and the lack of storage capacity at farm and village level puts high pressure on farmers to sell their produce at or close to harvest. Waiting for the prospect of better prices, common later in the season, is not an option (Mercy Corps).

In Htee Pu village, according to the village administrator the farmers are growing Pigeon Pea, Tomato, Sesame and Groundnut as their primary crops.

**Figure 3: Cropping Pattern of Htee Pu Village.**

Crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Pigeon Pea						■	■	■	■	■	■	■
Groundnut						■	■	■	■	■		
Sesame					■	■	■	■	■	■		
Tomato					■	■	■					

Source: IIRR ICDA Participatory Vulnerability Assessment, 2016.

Dry Zone agriculture is mainly rain-fed and hence, Htee Pu farmers grow the crops in the rainy season mostly especially tomato and groundnut.

In the case of Pigeon Pea, which is drought resistant, its season is prolong and harvested in December. Below are the cropping calendars for each of these crops.

**Figure 4: Sesame seasonal calendar: Activity-wise Calender for Htee Pu Village.**

Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Buying seeds		↔										
Ploughing and Tilling		↔										
Weeding		↔										
Sowing				↔								
Seedling					↔							
Thinning						↔						
Harvesting									↔			

Source: IIRR ICDA Participatory Vulnerability Assessment, 2016.

Pigeon Pea has long cultivation period. Also, the preparation period takes time some few months - from January to May (Figure 5).

**Figure 5: Activity-wise Calendar for Pigeon Pea.**

Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Seed		↔										
Plough		↔										
Weeding		↔										
Sowing			↔									
Got seedling				↔								
Inter-cultivation				↔								
Harvesting											↔	

Source: IIRR ICDA Participatory Vulnerability Assessment, 2016.

Preparation time for growing Groundnut is found to be short – only one month. The growing period is in Rainy season and harvested after 5 months from start growing time (Figure 6).

**Figure 6: Activity-wise Calendar for Groundnut.**

Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Buying seeds			↔									
Land preparation			↔									
Dry Weeding		↔										
Sowing			↔									
Intercultivation				↔								
Weeding					↔							
Spraying pesticide							↔					
Harvest									↔			
Drying									↔			
Selling										↔		

Source: IIRR ICDA Participatory Vulnerability Assessment, 2016.

Preparation period is moderate taking about 2 months. Growing period is in the middle of Moonsoon season and harvested before the onset of winter season. Since tomato is perishable crop, it is not kept in the hand of the farmers for long time. It is sold immediately after harvest (Figure 7).

**Figure 7: Activity-wise Calendar for Tomato.**

Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Seed					↔							
Seedling						↔						
Land preparation					↔							
Dry Weeding						↔						
Sowing							↔					
Intercultivation								↔				
Weeding									↔			
Spraying pesticide								↔				
Harvesting									↔			
Selling									↔			

Source: IIRR ICDA Participatory Vulnerability Assessment, 2016.

Sesame and groundnut are important crops mostly grown for their oil which is an important component of the Myanmar food system. For this Htee Pu village tract, the government claims that is it 138% oil secure – meaning they have enough food oil available for the population.

Population	4558
Quantity of harvested Groundnut	2553 baskets
Quantity of Harvested Sesame	1995 baskets
Oil available from harvested oilseed crops ( groundnut and sesame)	62 Metric Tons
Requirement of Oil for food consumption	45 Metric Tons
Surplus of Oil	17 Metric Tons
Food (Oil) Security	138 %

Source : Department of Agriculture (DOA), Nyaung Oo township.

## Soil Conditions and Desertification

In Htee Pu village, the Department of Agriculture describe the soil as “stony soils”.

Desertification is intensifying in the Central Dry Zone and productivity of agricultural land is declining as a result. Dry Zone soils are generally sensitive to degradation due to a combination of low base fertility, high base salinity, low organic content, exposure to brief periods of intense rainfall, and low annual rainfall totals. The primary drivers of desertification are deforestation, erosion, and salinization. Increasing deforestation is largely attributed to demand for fuel wood and agricultural land. Soil erosion, particularly severe in upland areas, is largely as a result of high intensity rainfall and rapid surface runoff. Wind erosion is widespread throughout the Dry Zone, as evidenced by sandy soils, which are very common. All types of erosion are exacerbated by deforestation. Increased soil alkalinity in the Dry Zone is primarily caused by the use of saline groundwater for irrigation. Additional causes of reduced soil productivity include fertilizer and pesticide misuse, and overcropping (Mercy Corps).

## Land Use and Tenure in Htee Pu Village Tract

In the present, only about one third of total land area within Htee Pu village tract is the cultivated area. Comparing with the last year, the growing area was found to be increased significantly and fallow land area to be decreased significantly (Table 2).

The recently enacted Farmland Law (2012) aims to improve the legal rights of farm owners, and the associated formal land registration process is currently in the late stages of implementation in the Dry Zone. Customary land laws (particularly in the peripheral upland Dry Zone areas) have historically come into conflict with the official registration system and associated land classifications. Moreover, many elements of the land registration process remain unclearly defined (such as the taxation), which is creating uncertainty amongst farmers. Another key shock that affects Dry Zone farmers is land confiscation, which can be caused by factors such as debt, dispute, or industrial agricultural development. Land disputes occur as a result of poorly defined ownership and indebtedness. Land confiscation also occurs in the Dry Zone as a result of state-sponsored agriculture projects, private agro-industrial projects, large industrial development projects, military settlements, large public infrastructure projects, urban expansion, and private land speculation. Corruption, coupled with private sector exploitation, is believed to be the number one source of land confiscations in Myanmar (Mercy Corps).

## Food Security

Food insecurity is a primary constraint for Dry Zone communities. The situation is characterized by a reliance on market purchase for food access in a context of low, undiversified, agriculture-based incomes, high debts, and reliance on credit. On average, over half of total household spending is for food purchases (53%). Spending on education, health, and transport is very low in

**Table 2 : Land Utilization in Htee Phu Village Tract.**

No	Land Type	Current Year		Previous Year	
		Acres	Percentage	Acres	Percentage
1	Paddy Land				
2	Upland				
2(a)	Net grown area	4913	42%	4826	41%
2(b)	Fallow Land	98	1%	184	16%
3	Horticultural Land				
4	Taung Ya				
5	Other	6663	57%	6664	53%
	<b>Total</b>	<b>11674</b>	<b>100%</b>		

Source: Department of Agriculture (DOA), Nyaung Oo township<sup>8</sup>

terms of absolute and proportional investment, indicating minimal means to access affordable service options (Mercy Corps).

Households generally report adequate food utilization, dietary diversity, and consumption. However, nearly 40% of households have difficulty meeting their food needs on an annual basis. The primary reported coping strategy is a reduction in portion size (27%). As a result, Dry Zone communities experience significant challenges in meeting their nutritional needs. The situation is characterized by high rates of low birth weight, wasting and stunting in children, and high rates of under-nutrition in mothers, with an indication that the nutritional status of mothers who are pregnant or lactating is worse than those who are not. The rate of wasting is of 'high' public health concern (WHO 2000), and the rate of stunting is of 'medium' public health concern (WHO 1995 cited by Mercy Corps).

The Food Consumption scores indicate that the most households in Dry Zone are probably consuming adequate diets in terms of recent frequency of consumption of a diverse range of nutritious foods (WFP, 2013).

Positive nutrition-relevant practices are revealed by the survey in rural Dry Zone, such as almost universal breastfeeding of children to 2 years of age; a range of good preventative and curative health practices; small family sizes and average age of first delivery after the adolescent period and adequate meal frequency for older children and some indicators of adequate food access (WFP, 2013).

17 percent of households as severely food insecure and a further 24 percent as moderately food insecure. Food insecurity is particularly evident among young children, with wasting estimated at almost 14 percent and stunting at over 30 percent in 2013 (LIFT, 2015).

Overall, 82 % of the households had appropriate diet. Food Stocks and Food gaps are lowest in Dry Land Farming Zone. Wage laborers and petty traders are most affected by food gaps. Hunger was very rare across Dry Zone areas (around 2 % of HH) (WFP, 2013).

Although crop production was cited by almost 58 percent of households as an income source,

casual labor was almost as high, at 55 percent in Dry Zone (LIFT, 2015).

Percentage of Food insecure households in dry land farming area of Dry Zones is lower (18.5%) compared with those of hilly farming area (25.5 %) but higher than that of flood plains/ irrigated area (15.3%). Poverty and food insecurity was more pronounced in small scale farmers and landless (WFP, 2014).

Low incomes and low income diversity make food insecurity a primary constraint for Dry Zone communities. Household debt is high and 35 percent of loans are reportedly used to buy food, the highest of proportion for any of Myanmar's main agro-ecological zones<sup>4</sup>. WFP (2014) data demonstrates that 18 percent of households are classified as food insecure with it being most pronounced amongst wage labourers and smallholder farmers (<2acres). Households report purchasing food from markets up to two hours away and journey times lengthen in the rainy season. There is little availability of fresh vegetables in many villages (LIFT, 2015).

## Nutrition

For the Dry Zone as a whole, the prevalence of wasting is 13.9 percent and stunting is 30.8 percent (WFP 2013). Both these indicators are categorised as a serious public health issue by WHO. Stunting can be caused by long term poor access to adequately diverse foods, infection and poor health environment of both the mother and child. Low birth weight babies represent 17.2 percent of the total highlighting both mothers' low weight gain and the fetus' weak development during pregnancy (LIFT, 2015).

Nearly 90 percent of children aged 6-24 months do not have a nutritionally adequate diet and illness appears to be a major contributing factor of malnutrition related to long term exposure to poor sanitation and hygiene (LIFT, 2015).

In dry land farming area of Dry Zone, stunting rate is higher compared with irrigated/ flood plain zone (WFP, 2013).

Sickness is one driver of under nutrition and rate of recent sickness were quite high, with more

than a quarter of children reported to have illness; fever, cough and diarrhea manifest in about one in 10 children, particularly in the under two years olds (LIFT, 2015).

## Climate Change Risks and Impact

In Myanmar's semi-arid Dry Zone, climate change adversely affects poor rural families whose livelihoods and welfare depend on agricultural activities (LIFT, 2017).

Highly variable rainfall is a significant stress to farming in the Dry Zone, which is primarily rainfed. As a result, farmers are highly susceptible to climatic variability, particularly the beginning and end of the monsoon season and the duration and timing of the mid-season rain gap. Farmers report a shortage of water that affects crop production approximately every three years on average. The result is recurring shocks in the form of both drought and floods. Low seasonal rainfall totals limit crop selection, production yields, and quality, particularly towards the center. In recent years, a statistically significant reduction in June rainfall totals has also occurred, which has increased the risk of drought conditions during the primary planting season. Exacerbating the situation is insufficient crop water management. At present, the volume of water used for irrigation in the Dry Zone is low compared to total runoff, and crop water productivity is generally poor. Moreover, the management of existing irrigation water systems is inadequate with little capacity to equitably, sustainably, and efficiently provide water to farmers. As a result, few farmers take advantage of small-scale supplemental irrigation techniques and technologies and existing large-scale irrigation systems reach a small number of intended users (Mercy Corps).

Dry Zone farmers are exposed to several types of plant diseases and pest infestations that can reduce or completely destroy a season's worth of income. The generally hot and dry climate reduces the exposure of Dry Zone farmers to pests compared with other agro-ecologic regions, but infestations still occur when favorable conditions exist (such as cloudy with standing water). As a result, farmers use pesticides and fertilizer, which can be challenging to access, increase input costs, and reduce profits. Common pests of Dry Zone

crops included pot borers (chickpeas), aphids (sesame), army worms (nuts, beans, sesame), and boll worms (cotton) (Mercy Corps).

Climate and environmental stress are also drivers of migration for employment. Internal migration is a coping strategy and there is substantial off-season migration by the landless to Shan state to work as agricultural labourers. Many from the Dry Zone also go to work on construction sites in Yangon and Mandalay (LIFT, 2015).

Fragile ecosystems rendering livestock rearing – a high risk activity in Dry Zone. Overwhelming majority of livestock rearing in Myanmar is constituted by Dry Zone and among them, about 90 % of the livestock owners in Dry Zone are small scale or landless. Poor management grazing system on fragile ecosystems exacerbate the overall vulnerability of the region and its residents. Subsistence –level livestock rearing is often free-ranging and it exerts tremendous pressure on remaining vegetation (UNDP, 2014).

Access to safe and reliable water, for both agriculture and livestock, and for domestic use, is a key constraint to livelihoods and wellbeing. The failure of rains and/or seasonal scarcity stretches coping strategies and can lock households into a cycle of poverty and vulnerability. Many farmers manage the weather risk by reducing agricultural inputs and using less labour intensive cultivation methods to minimise losses when crops fail (LIFT, 2015).

Climate change effect, together with the impact of extractive farming practices, is accelerating the degradation of soils and the loss of vegetative cover. If ignored, the result could be significant desertification of the central Dry Zone (LIFT, 2015).

Climate change projections for the Dry Zone predict a general increase in temperature, an increase in rainfall variability during the rainy season, an increase in the risk of flooding resulting from a late onset and early withdrawal of monsoon rains, and an increase in the occurrence and intensity of extreme weather events, including cyclones/strong winds, flood, intense rains, extreme high temperatures and drought. Increasingly erratic rainfall and temperature will complicate already low water availability (LIFT, 2015).

Existing historical data and climate projections indicate that variability and the intensity of rain events will continue to increase, which will further drive erosion and reduce soil quality in the Dry Zone (Mercy Corps).

In Htee Pu village, the community has experienced a number of extreme events since 1998 to the present years. These events shown in Table 3 are as follows:

**Table 3: Historical Climate Change Impact in Htee Pu village.**

Year	Extreme Events	Effects
1998	Lack rain and scarcity water	Food scarcity
2010	Cyclone (rain and windy)	Forest are destroyed
2010	Drought	Livestock and agriculture water was insufficient
2012	Drought	Farm are destroyed and faced water scarcity
2015	Drought	Water Scarcity

Source: IIRR ICDA Participatory Vulnerability Assessment, 2016.

The interval between the years with the adverse impact of climate change become shorter during the recent years. Drought is found to be the frequently suffered impact for the communities of Htee Pu village.

## Coping Mechanisms to Climate Change Impacts

In initial discussions with villagers from Htee Pu, a number of current coping mechanisms and some ideas for future coping were also identified. Villages to cope do the following strategies to address the effects of climate change – Selling of their properties – gold and livestock, lending money from the money lenders with interest, migration (Table 4).

## Gender Dimension in Dry Zone

In the Dry Zone, unlike many other parts of the country, women spend significantly more days engaged in farm labour than men do<sup>13</sup>, both in the monsoon season (about 30% more days) and the dry season (50% more). This is particularly true for weeding, pest control and harvesting, although women are equally involved in soil preparation as men are. However, as in other parts of the country, women tend to receive lower wages for their farm labour than men do, usually 75% of the men's daily wage. Women are also generally responsible for caring for small livestock, vegetables cultivation and post-harvest activities such as winnowing, grinding and husking. They are also primarily responsible for collecting water, fuel wood and forest products. Women's use of poor quality technology and equipment presents further difficulties; more valuable productive assets are usually controlled by men (LIFT, 2015).

**Table 4: Coping strategies applied by Htee Pu villagers to overcome the Climate Change impacts.**

Year	Impacts	Coping mechanism	Perceived future strategies
2010 2015	Draught created water scarcity and so that animals are dead	They sold their gold, livestock They migrated to other places for working They lend loan money with interest	They thought they should grow perennial crop and should make livestock farming
	Draught was occurred and no tomato crops were grown by that time	They used their collected money They lend loan money with interest	They wanted to learn technique concern with agriculture and livestock farming for better solution  They thought they should grow perennial plants  They need next tube well to get enough water for agriculture purpose

Source: IIRR ICDA Participatory Vulnerability Assessment, 2016.

Women have more difficulty accessing credit from MADB, with less control over collateral and fewer networking opportunities with informal lenders. Coping strategies and attempts to diversify household income streams are often based on activities/products deemed of lower value such as compost making, trade in firewood and small-livestock rearing. Gender power relations affect the realities of women's engagement with economic actors and results in fewer opportunities for leadership in community structures and organizations (LIFT, 2015).

The female-headed households are more likely to be poorer than male-headed households. It is observed that the gender inequality in the distribution of income in the rural dry zone is substantial. The men headed receive higher average per capita income than female headed households because female headed households have poor livelihood resources (land, cattle, and capital) and they rely on low wage agricultural laborer as a major source of income. Therefore raising per capita income of the low-income rural households (especially female headed households) demands the promotion of employment-generating activities. Furthermore, the promotion of human development programmes (literacy campaign, access to universal primary education, and skill-enhanced trainings) is needed to uplift the female-headed households' living standard (Kyaw and Routry, 2006).

Female-headed households are considered more vulnerable to shocks than male-headed households. For example, female-headed households are amongst those most affected by food insecurity (IFC, 2017).

About 25 % of total households is female headed households in Mandalay division in which Nyaung Oo township is situated (IFC, 2017).

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## Support Programs in Htee Pu village tract

The Department of Agriculture (DOA) provides the agricultural extension knowledge for growing of dry land crops in Htee Pu village tract with good agricultural practices (GAP). Table 5 shows the accomplishment of cultivated area of crops in this

**Table 5: Villages under Good Agricultural Practices (GAP) Activity.**

Crop	Expected to cover in the current year			Grown acres	Grown %
	Village Tract	No of farmers	Acres		
Rainy season Sesame	Htee Pu	250	1689	1115	66%
Rainy season Groundnut	Htee Pu	250	509	509	100%

Source: Department of Agriculture, Nyaung Oo township<sup>5</sup>

fiscal year with GAP support of DOA, Nyaung Oo township (DOA).

Although every farmer grow sesame and groundnut in rainy season, the growing area of groundnut is much lesser than of sesame. It may be due to high investment cost to grow the groundnut. In addition, sesame is easy to grow and the farmers do not need the intensive management practices like groundnut. Farmers generally consider those points in selecting the

crops to grow (Table 6). Another activity of DOA, Nyaung Oo is assisting the farmers to get access the good quality seeds.

Aside from the DoA, a number of local NGOs and INGOs are also providing support to the farmers of Htee Pu to address the multi-faceted issues of climate change, poverty and environmental degradation. These organizations and their programs are indicated below.

**Table 6: Implementing INGOs and NGOs list in Htee Pu village**

Name of NGO/ INGO	Programs	Implementation Period
UNDP (Lead Firm)	Addressing Climate Risk to Water Resources and Food Security (UNDP and IPs – CESVI, NAG, CTA, FBD, Rine)	
CESVI (as IP of UNDP)	1. Agricultural Training Provision 2. Agro Forestry Demo Plot Establishment by mixed growing of Mango, Thana Kha and annual crop (Groundnut) 3. Support of Thresher to the farmers	2016 June – 2019 June
CTA (as IP of UNDP)	Livestock support	2016-2018 Dec
Rine (as IP of UNDP)	Early Warning System Development	
Farm Business Development (as IP of UNDP)	Soil Conservation Project	
NAG (as partner of UNDP)	Agro forestry Activity 750 plants of Tha Na Kha to each of two farmers Mango(25 plants), Shaw Phyu(25 plants) , Guava (20) plants , and Lime (20) plants to each of 5 farmers	2016 June – 2019 April
IIRR	25 Mango plants are distributed to each of 25 farmers	2017 start

Source : CESVI – INGO, Nyaung Oo Township

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