



Action Research Report

Restoring drylands, strengthening resilience

**Insights from a Climate-Smart Village in
Htee Pu, Nyaun Oo, Myanmar**

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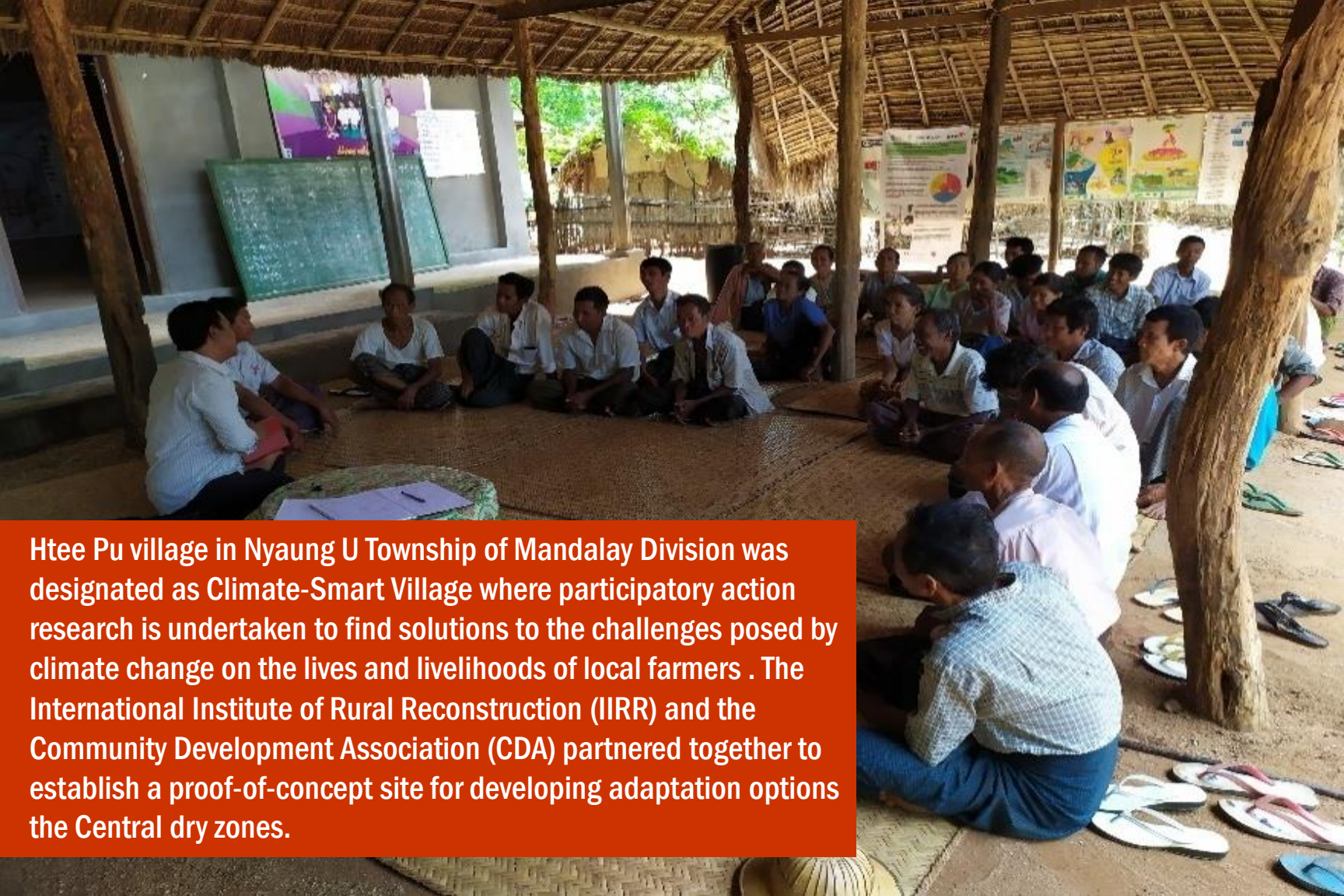


June 2020

Farming communities in the central dry zones of Myanmar have coped with lower rainfall for centuries.

Nowadays, they have to deal with and, cope with uncertainty and variable weather. This includes the irregular onset and non-uniform distribution of rainfall. Prolonged drought is usually noted during the September to May period.





Htee Pu village in Nyaung U Township of Mandalay Division was designated as Climate-Smart Village where participatory action research is undertaken to find solutions to the challenges posed by climate change on the lives and livelihoods of local farmers . The International Institute of Rural Reconstruction (IIRR) and the Community Development Association (CDA) partnered together to establish a proof-of-concept site for developing adaptation options the Central dry zones.

Farmers in Htee Pu village in the Nyaung U township of the dry zone have tailored their farming systems to the low rainfall pattern. This included combining short duration annual crops, raising small and large livestock primarily on crop residues. Off-season there is a reliance on trees, shrubs and farm residues for income, fuel and fodder needs. Nothing is wasted: recycling is practiced by every household.



The current farming system in Htee Pu village features groundnut (peanut) prominently, because of its market potential. This relatively new crop has replaced the diversified cropping systems of the past (which featured drought tolerant crops like sorghum, millets, vinyl legume, horse gram and sesame). Other crops currently grown include pigeon pea, green gram and sesame, all grown between June to September. Because of the limited rain and soil moisture content, only one crop can be grown.



Farmers regularly recycle crop residues valuing all resources they can access. Farmers know that shredding dry and green sorghum can help improve feed quality for cattle.



Local indigenous knowledge helps farmers store peanut seeds for the next season (without spoilage from rancidity).





To capture and harvest early rainwater, farmers typically practice early tillage/land preparation. Composted animal manure is applied for fertilization. However, with years of continuous farming, the soils have degraded. Poor soils, low organic matter, and sandy soil with low nutrient content characterize the soils of the region.



Without adequate tree cover, these soils are further prone to erosion when it rains. From year to year, soil fertility and crop productivity declines. It is a vicious cycle which perpetuates poverty, food insecurity and malnutrition.



There is an urgent need for the regeneration and restoration of these small farms in order to enhance their capacities to adapt to the impacts of climate change in the future.

In the past, sorghum was one of the primary crops used for fodder, for feed and for sale. Sorghum was a reliable crop because of its capacity to resist drought. Sorghum is one of the most water-efficient crops and drought-tolerant of grown cereals. Sorghum has a new market as high nutrient feed for livestock: it is rich in protein, mineral, vitamin and antioxidants. It was therefore considered as a candidate crop for re-introduction in Htee Pu village as an intercrop with groundnut.



The re-introduction of sorghum in Htee Pu CSV included a systematic process for farmers to access varieties that performed well. Available varieties from Nyaung U dry zone agricultural research station were introduced and compared using highly simplified farmer-managed Participatory Varietal Selection (PVS) methods.



Participatory Varietal Selections (PVS) are simple methods to find out which varieties do well in that locale. Usually, two or three seasons are needed to identify what works best. These farmer-managed adaptation trials were used extensively in the identification of varieties.

In the table below is an example of the results of the PVS undertaken on sorghum varieties sourced from the Department of Agricultural Research (DAR) research station for the dry zones.

Activity - Sorghum (PVS)													
Sr	Description	Farmer name - U Phoe Aww						Farmer name -U Sein Ka Lar					
		Variety names						Variety names					
		IS-28747	IS-25264	IS-22616	Shwe Ni	Pyang Nat	ICSV-758	IS-28747	IS-25264	IS-22616	Shwe Ni	Pyang Nat	ICSV-25265
1	Seeds receive date	14-6-2019	14-6-2019	14-6-2019	14-6-2019	14-6-2019	14-6-2019	14-6-2019	14-6-2019	14-6-2019	14-6-2019	14-6-2019	
2	Sowing Date	21-7-2019	21-7-2019	21-7-2019	21-7-2019	21-7-2019	21-7-2019	14-8-2019	14-8-2019	14-8-2019	14-8-2019	14-8-2019	14-8-2019
3	Harvest Date	20-11-2019	20-11-2019	20-11-2019	20-11-2019	20-11-2019	20-11-2019	17.12.2019	17.12.2019	17.12.2019	17.12.2019	17.12.2019	17.12.2019
4	plant height (from ground to tip of the spike)	90.11 cm	87.96 cm	102.22 cm	70.43 cm	127.91 cm	76.8 cm	95.3cm	66.8 cm	101.6 cm	72.9 cm	100.1 cm	77.2 cm
5	Numbers of tillers	no	no	no	no	no	no	no	no	no	no	no	no
6	spike shape (Cylindrical, coical, spindle, club, candle, dumb-bell, lanceolate ob lanceolate, globe and others)	lanceolate	lanceolate	lanceolate	lanceolate	lanceolate	lanceolate	lanceolate	lanceolate	lanceolate	lanceolate	lanceolate	lanceolate
7	spike length	9.02 cm	8.36 cm	9.14 cm	9.9cm	11.63cm	3.06cm	20 cm	14 cm	14 cm	14 cm	15 cm	14 cm
8	spike density (Loose, intermediate, compact)	loose	loose	loose	loose	loose	loose	loose	loose	loose	loose	loose	loose
9	seed shape (obovate, ob lanceolate, elliptical, hexagonal, globular)	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate	ob lanceolate
10	Disease	Cercospora leaf spot	Cercospora leaf spot	Cercospora leaf spot	Cercospora leaf spot	Cercospora leaf spot	Cercospora leaf spot	drought	drought	drought	drought	drought	drought
11	Climate impact (Heavy rain/ drought/ flood)	drought	drought	drought	drought	drought	drought	drought	drought	drought	drought	drought	drought
12	Beneficiaries' preference	prefer	-	-	prefer	-	-	prefer	-	-	prefer	-	-
13	Reasons	Germination is good ,plant is weak and spike is not well performing.						Germination is good ,plant is weak and spike is not well performing.					
14	Recommendation and suggestions	The tested trial is not well growth in this season and have insect infection (birds)											



Bringing back diversification to a farming system is a key element for enhancing resilience of small farms. Adaptation trials are undertaken in close collaboration with the agricultural research stations and with the active participation of farmers. Participatory varietal selections and crop performance trials were undertaken for groundnut, pigeon pea, green grams and sesame.



Adaptation trials were also conducted on the main commercial crop groundnuts. Three varieties were tested, among them the Sinpadaythar-11 variety of groundnut was rated as the best performer, even under unfavorable conditions with intervening drought and pest infection. Eight farmers actively participated in testing three varieties of groundnuts from the DAR, Nyaung U dry zone agricultural research station. An important outcome has been the nurturing of farmer capacities to continue to experiment, to identify promising climate hardy crops for market, food and feed.

Table below is an example of the results of the PVS undertaken on groundnut varieties sourced from the DAR research station for the dry zone.

Activity - Groundnut PVS													
Sr	Description	Farmer name - U Phoe Aww			Farmer name - U Kyaw Phae			Farmer name - U Nyo			Farmer name - U Sein Ka Lar		
		Variety names			Variety names			Variety names			Variety names		
		Sinpadaythar 6	Nyaung Oo G-99	Sinpadaythar 11	Sinpadaythar 6	Nyaung Oo G-99	Sinpadaythar 11	Sinpadaythar 6	Nyaung Oo G-99	Sinpadaythar 11	Sinpadaythar 6	Nyaung Oo G-99	Sinpadaythar 11
1	Seeds received date	9 can	10 can	11 can	9 can	10 can	11 can	9 can	10 can	11 can	9 can	10 can	11 can
2	Sowing Date	18-7-2019	18-7-2019	18-7-2019	9/8/2019	9/8/2019	9/8/2019	6/8/2019	6/8/2019	6/8/2019	18-7-2019	18-7-2019	18-7-2019
3	Harvesting date	26.10.2019	31.10.2019	31.10.2019	9.11.2019	9.11.2019	9.11.2019	5.11.2019	5.11.2019	5.11.2019	9.11.2019	9.11.2019	9.11.2019
4	Germination %	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Fair
5	Plant types (Erect/spread)	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect
6	Numbers of seeds per pods	2nos	2nos	2	2	2	2	2	2	2	2	2	2
7	pod length (cm)	2.32	2.07	2.2	2.23	1.9	2.2	2.4	3.04	2.28	2.16	2.03	2.1
8	pod width (cm)	0.96	0.9	1.1	1	1.23	1	1.12	0.96	1.68	0.96	0.96	1.1
9	seed color (one or variegated)	one	one	one	one	one	one	one	one	one	one	one	one
10	seed length (cm)	1.1	1	1.16	1.13	0.98	1.2	1.36	1.38	1.26	1.15	1.06	1.2
11	seed width (cm)	0.56	0.7	0.96	1.58	0.7	0.8	0.74	0.88	0.88	1	1.73	0.8
13	Maturity date	26.10.19	28.10.19	28.10.19	7.11.2019	7.11.2019	7.11.2019	1.11.2019	1.11.2019	1.11.2019	7.11.2019	7.11.2019	7.11.2019
14	Total Yield	10 pyi	12 pyi	6 pyi	24 pyi	25 pyi	26 pyi	10pyi	11 pyi	14 yi	8pyi	9pyi	10pyi
15	Insects	Few(Leaf binder and miner)	Few(Leaf binder and miner)	Few(Leaf binder and miner)	Most(Leaf binder and miner)	Most(Leaf binder and miner)	Most(Leaf binder and miner)	Leaf binder and miner	Leaf binder and miner	Leaf binder and miner	Leaf binder and miner and Aphid	Leaf binder and Aphid	Leaf binder and Aphid
16	Disease	No	No	No	No	No	No	No	No	No	No	No	No
17	Climate impact (Heavy rain/ drought/)	drought/ Weed			drought			drought			drought		
18	Beneficiaries' preference	Sinpadaythar 11 prefer			Sinpadaythar 11 prefer			Sinpadaythar 11 prefer			Sinpadaythar 11 prefer		
19	Reasons	high yield, resistance ,suitable with local condition			high yield, resistance ,suitable with local condition			high yield, resistance ,suitable with local condition			high yield, resistance ,suitable with local condition		
20	Recommendation and suggestions	they want to sow sinpadaythar 11 with large amount of seed in next year.											



Farmers in the dry zone value eating protein rich legumes. They expressed interest in seeds of Dolichos Lab Lab or Hyacinth bean, a crop which had been “lost” from their farming system. Seeds were sourced from another township. Seeds in the form of mini kits were provided to 50 farmers. The reintroduction of lost crops (the restoration of agrobiodiversity) can be an important component in a resilience building effort. The Lab Lab bean, besides tolerating drought, can serve as cover crop to lower soil temperature and to enhance soil fertility biomass. Dolichos is nutrient dense, a high protein crop that stores well for long periods.



Pigeon pea is another high protein crop and drought tolerant cultivated legume (due to its deep rooting habit). Farmers were encouraged to continue to grow this crop. PVS trials were organized for farmers to identify short duration varieties which “escape” the late –season drought.





50 farmers in 2018 and 2019 received the Nyaung U Shwedingar variety of pigeon pea. Four cans of seeds were provided to each farmer, who tested these using local existing varieties as checks. Farmers chose the shorter duration varieties which escape drought but still provide high yields.



Small and large livestock are a form of capital build up for small farmers. To ensure that the landless, marginal farmers and women also have safety nets, CSA programs can include small livestock such as native chickens, pigs and goats. Improved housing, health care management and locally formulated balanced feeds can enhance productivity.

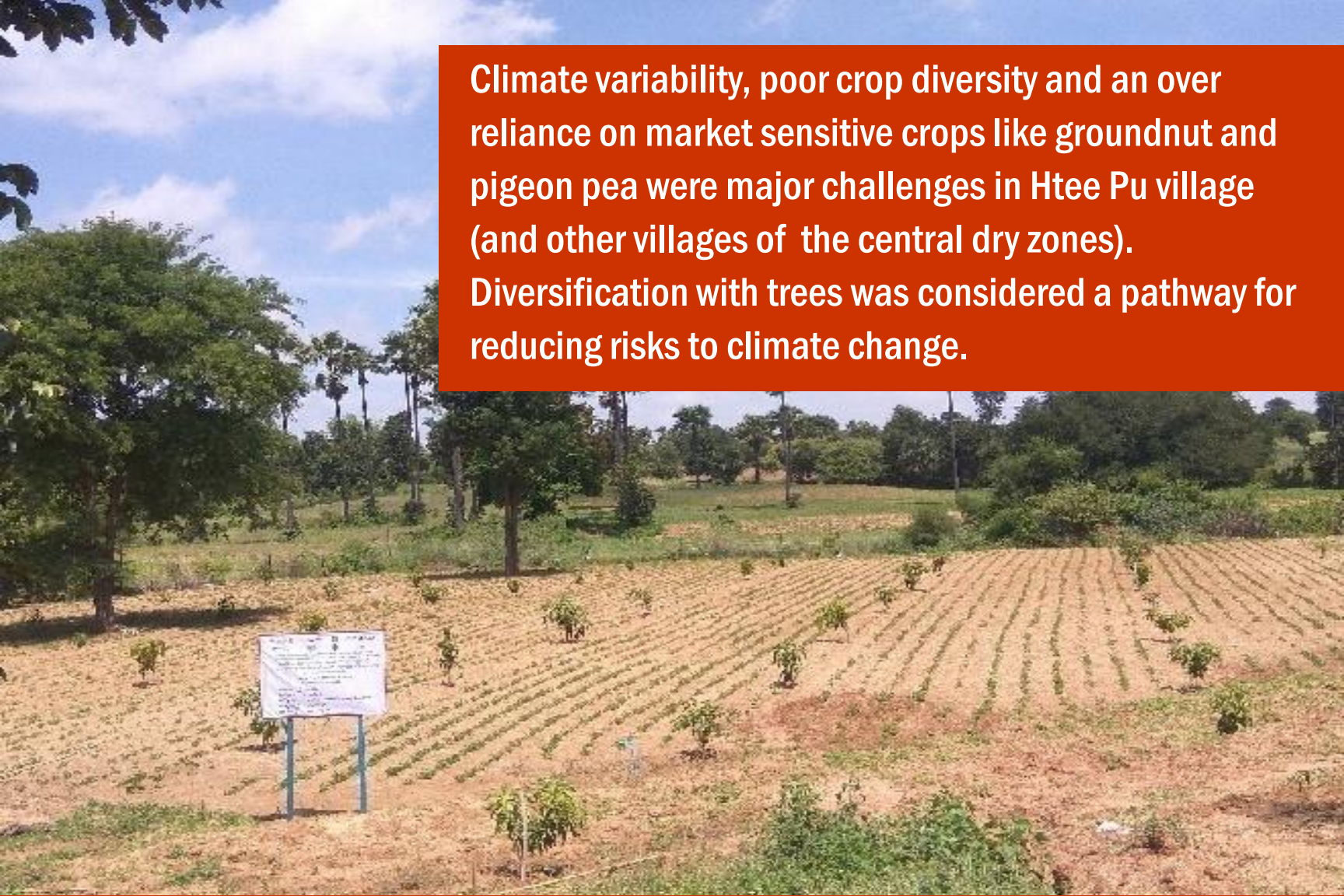
In Htee Pu village, the local breed of cattle and the Bagan breed of goats are valued “assets”. They depend on livestock for tillage, for food, and as source of funds during emergencies. Fortunately, in a typical village in the dry zone the livestock base remains fairly intact. There are worries however, that adverse and extreme weather could prompt distress sales. More feed resources are needed if this rich livestock agrobiodiversity is to be conserved. By featuring its continued use, livestock can be components of resilience building effort.



Small livestock provides an opportunity for project implementers to address social inclusion and equity. More than one third of the households in Htee Pu are landless or near landless. As result of seasonal and semi-permanent migration, many households are female headed. To demonstrate the value of better targeting of women, homestead-based high density fruit tree production and small scale livestock efforts were developed specifically for women.



Climate variability, poor crop diversity and an over reliance on market sensitive crops like groundnut and pigeon pea were major challenges in Htee Pu village (and other villages of the central dry zones). Diversification with trees was considered a pathway for reducing risks to climate change.



Agroforestry-based diversification allows farmers to gradually adapt to a changing environment by the inclusion of economically valuable trees. The sequential inclusion of trees into annual crop systems proved to be a very popular risk aversion strategy.





Trees provide off-season sources of income, food, fodder and fuel.

Diversification with trees and crop diversity can increase farmers' adaptive capacities while reducing the risks of market and crop failure.

Trees are considered important by both men and women.



To support tree-based diversification, IIRR and CDA introduced fruit trees into the existing farming system of Htee Pu village starting with mangoes.

Dryland horticulture methods were used to harvest and conserve water (deep dug pits 30 to 50 cm cube), use of farm yard manure, shading with palm leaves, etc.





Farmers chose to grow mango trees because of their known tolerance to drought. However, they proposed growing the trees within an intercrop with their regular seasonal crops (i.e. their lands were being converted to agroforestry-based systems). The farmers identified a variety that adapted well locally. For assured markets, the farmers suggested the Seintalone variety of mango. The activity was started with 30 farmers. To support further intensification and diversification, guava, pomegranate and custard apple were included as intercrop between rows of mango trees. After the first two years, farmers themselves have started to invest in expansion efforts using their own resources.

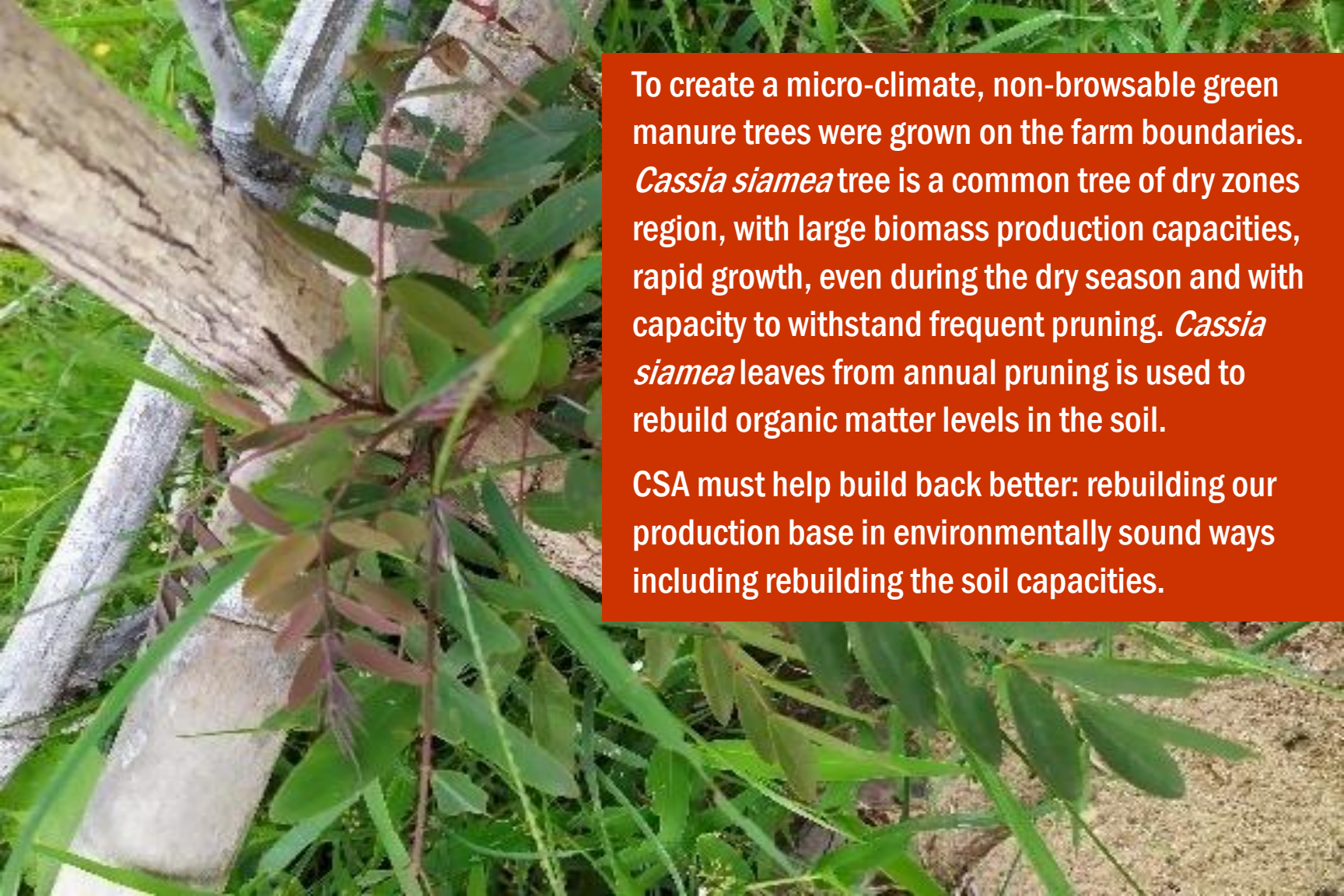


For intensive agroforestry systems, the spacing used was 15 x 15 feet for mango (big canopy tree) and 5 x 5 feet for custard apple and guava (both are small canopy species that cattle do not eat). Annual crops continue to be grown in the interim period. To permit deep rooting of mango trees, pits of 30 cm cube were devised. Deeper pits encourage deeper roots: pits 30 cm to 50 cm deep help trees resist drought better while promoting water harvesting.



Free grazing after the main cropping season is a serious problem in Htee Pu, the resolution of which requires collective action. Among our introduced fruit trees, custard apple was not browsed by animals.





To create a micro-climate, non-browsable green manure trees were grown on the farm boundaries. *Cassia siamea* tree is a common tree of dry zones region, with large biomass production capacities, rapid growth, even during the dry season and with capacity to withstand frequent pruning. *Cassia siamea* leaves from annual pruning is used to rebuild organic matter levels in the soil.

CSA must help build back better: rebuilding our production base in environmentally sound ways including rebuilding the soil capacities.

Homestead areas in the dry zone are relatively large. These “spaces” are controlled and managed by women. Homestead based climate-smart agriculture include small livestock, vegetables and fruit trees, for both income and nutrition. All IIRR CSV programs in Myanmar include this element.



Summary table of homestead food production for women, landless, marginal farmers and women-headed household

CSA Activity	2018	2019	2020
Homestead Vegetables production (vegetables seeds kits, planting materials)	-	20	-
Homestead fruit tree cultivation	25	35	20

Incremental adaptation: Learning along the way

CSA Activity	Livestock	2018	2019	2020
Small scale livestock rearing	Goats	10	-	30
Small scale livestock rearing	Pig		5	-
Small scale livestock rearing	Native chicken	-	5	-
Fodder crops cultivation	Sorghum, millet, Trichanthera	10	20	50

Homestead production is a major element in an income and nutrition diversification effort. Women members from the landless sector, marginal farmers, poor families and women-headed households receive special attention. Preferential targeting helps make CSA socially inclusive. To make such intervention nutrition sensitive, vegetables, fruit trees and small livestock such as goat, pig and native chicken are prioritized. Native breeds are prioritized because of their climate hardy nature.



There are challenges ensuring food security in the dry zone, but surprisingly households continue to value the need for dietary diversity.

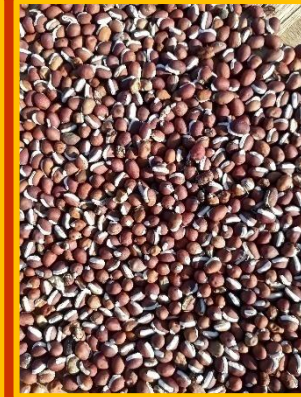
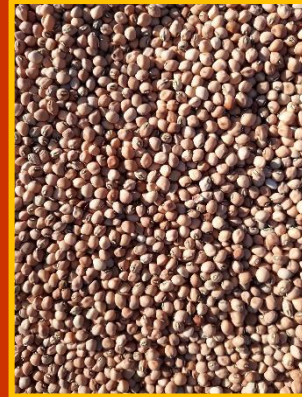
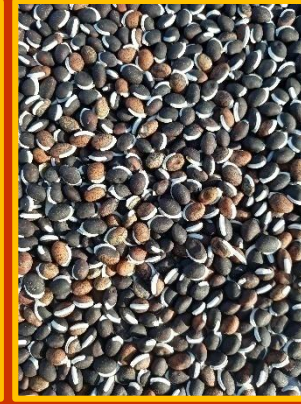


Htee Pu village, in spite of being in the dry zone, has a relatively surprising dietary diversity score, likely because of the nature of their farming system.

Average Household Diet Diversity	
Climate-Smart Village	Mean Household Diet Diversity
Htee Pu	6.5
Sakta	4.98
Masein	6.85
Nyaung Shwe	6.01

The following table presents survey derived information on food consumption.

Consumption vis-à-vis production			
Htee Pu Village	Commonly consumed food groups	Less consumed	Agriculture produce in the past 12 months*
	1. Cereals	Fruits	Cow/Ox
	2. Oils fats	Vitamin A	Chicken
	3. Sweets	vegetables	Ground nut
	4. Other	Meats & eggs	Sesame
	vegetables	White roots and	Pigeon pea
	5. Dark green	tubers	
	vegetables	Milk and dairy	
	6. Legumes, pulses		
	7. Fish and		
	seafood		



The agro-biodiverse rich landscapes of the dry zones must be preserved by continuing to feature them in climate-smart agriculture programming.

Building community capacities, strengthening local food systems, relying on the existent resources base and recognizing the need for being gender and social inclusiveness sensitive are elements of success. Participatory research processes and local learning groups can help local communities take charge of the process of local adaptation. The final direction a CSV takes is ultimately determined by how these empowered communities drive these processes.



CSA programs should demonstrate a social inclusiveness angle, a preference for the poor and vulnerable households, for those who were left behind by mainstream research and development efforts.





Targeting of poor families, including women-headed households is prioritized. The risk of elite capture is reduced if household data serves as basis for targeting.

Community-based adaptation efforts are well underway in Htee Poo. There is no turning back now: the communities are motivated and moving the process along.





In this final year of the IDRC, CCAFS and DAR associated project, the focus will be on expansion of the number of households being reached via the distribution of planting materials, community learning and the tracking of social, nutritional and climate change outcomes.

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“Technical know-how of the experts must be transformed into practical do-know of the people”

Dr. Y.C. James Yen

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