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Action Research Report

Incremental Community Based Adaptation in the Highlands of Myanmar, Chin State

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Abstract

The International Institute of Rural Reconstruction (IIRR) undertook participatory action research in Myanmar to establish climate-smart villages (CSVs) in four unique agro-ecologies. This research was funded by CGIAR-CCAFS and the International Development Research Center in Canada (IDRC). Sakta Village is one of these four CSVs operated by IIRR and its local partner, Karuna Mission Social Solidarity (KMSS). It is located at Hakha Township in the north-east of Chin State situated 1,800 meters (6,000 feet) above sea level.

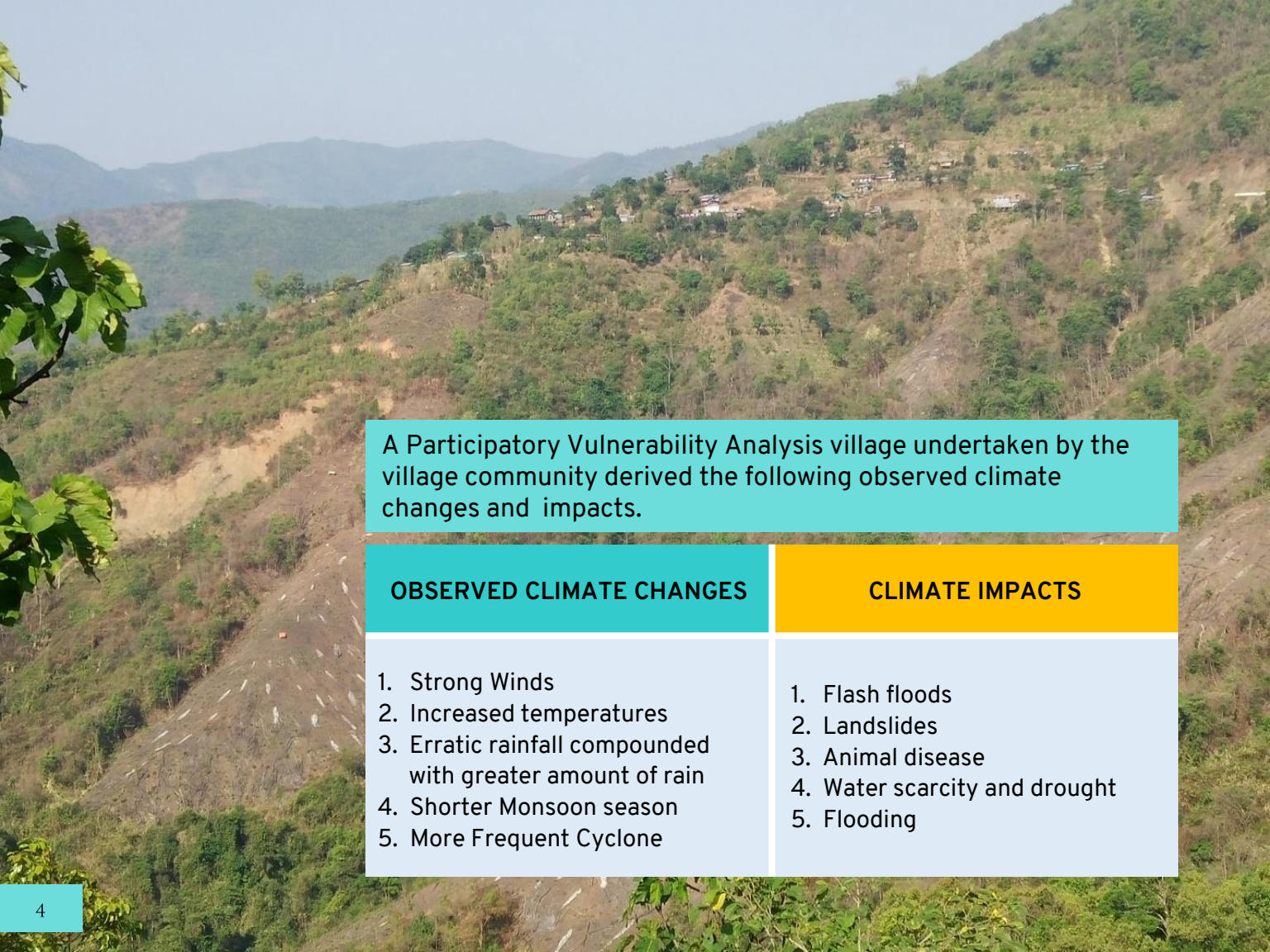
The population is largely dependent on agriculture-based income undertaken using mostly shifting cultivation methods. Sakta has faced the impacts of climate change which include flash floods and landslides, strong winds, increased temperature and, erratic rainfall. Land degradation due to over exploitation of forest and land resources including short-fallow shifting cultivation practices, threaten agricultural production with yields already starting to decline. Climate change is exacerbating poverty and hunger. Under these circumstances, Climate smart agriculture (CSA) has emerged as a viable approach to protect landscapes, associated ecosystems, local agrobiodiversity and community food production systems.

After assessing local priorities and local knowledge, IIRR together with the community members identified and introduced 10 CSA options for Sakta Village. The number of participating households grew from 135 in 2018 to 158 in 2019 and 236 in 2020. Agroforestry-based diversification based on economically valuable trees helped farmers to gradually adapt to a changing environment. Avocado, orange, and plums were found to be suitable with these high elevation sites. Home gardens emerged as an attractive CSA option, because it built on local knowledge. Mechanisms for local financing or natural- asset building were popular in homesteads.

Chin land, located at the southern part of north western Myanmar, bordering with India and Bangladesh, is dominant with mountains and terrain covered by natural forest .It is located more than 1800 meters above sea level. Hakha is the capital city of Chin State located in the north-east of Chin State of 1,800 meters (6,000 feet) positioned on a small highland plateau. Chin is one of the least developed areas of Myanmar with, the highest poverty rate of all of the States and Regions of Myanmar. Poverty Incidence of Chin State is estimated at 73.3 % with a high, 80% rural poverty incidence, and 52.1% urban poverty incidence (ADB, 2012). Chin is the part of Myanmar that has the highest rates of poverty. The rate of landlessness is associated with poverty, being higher among poor than non-poor households at 8.4% and 7% respectively (IFC, 2017). The lack of roads and condition of the roads results in difficulties and high expense to transport goods to markets.

Sakta village has 219 households with a population of over 800 individuals. It is under the administration of Hakha City, is situated along the side of Hakha-Matupi Road and 20 miles from Hakha. It is also one of the Climate-Smart Village project sites operated by the International Institute of Rural Reconstruction (IIRR) and Karuna Mission Social Solidarity (KMSS-Hakha).

Temperature varies from 40° F to 84° F. A wet season has at least 0.04 inches of liquid or liquid-equivalent precipitation. The wetter season lasts four to six months, from May to September, with a greater than 18% chance of a given day being a wet day. The drier season lasts as much as seven months, from September to May. Sakta has faced the impacts of climate change which include flash floods and landslides, strong winds, increased temperature and, erratic rainfall, compounded with a greater amount of rain falling within a short period. Farmers are now more vulnerable than in the past.



A Participatory Vulnerability Analysis village undertaken by the village community derived the following observed climate changes and impacts.

OBSERVED CLIMATE CHANGES	CLIMATE IMPACTS
1. Strong Winds 2. Increased temperatures 3. Erratic rainfall compounded with greater amount of rain 4. Shorter Monsoon season 5. More Frequent Cyclone	1. Flash floods 2. Landslides 3. Animal disease 4. Water scarcity and drought 5. Flooding

Change in the Perception of Households to Changes in the Environment

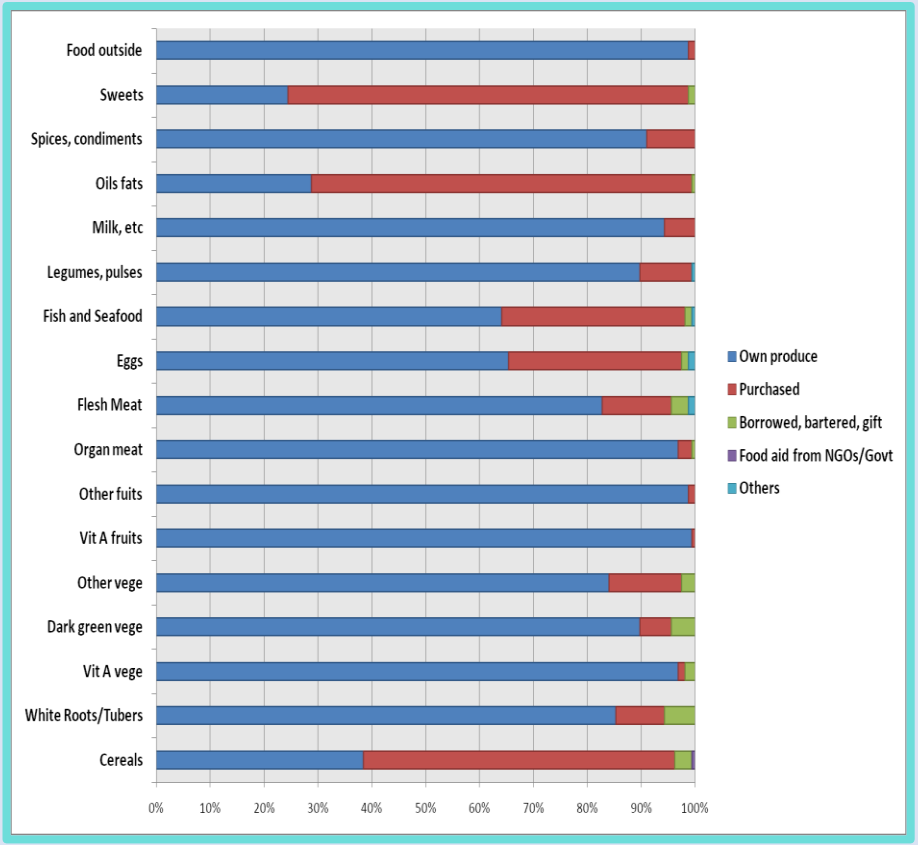
Changes in the Environment Experienced	Sakta		
	2018 (%)	2020 (%)	McNemar's (p-value) [a]
Too much rainfall causing flooding in the village and in the farm	80.56	26.79	0.000**
Too less rain making it difficult to grow crops and animals as well as secure water for the household	62.04	50.89	0.194
The rains are not coming as we expected, sometimes they come late and sometimes they come early	65.74	44.64	0.006**
The daytime temperature is getting hotter than before	83.33	67.86	0.040*
Some new pests and diseases are happening to the crops, animals and to people	53.7	41.07	0.169
The weather and climate conditions are getting better now that we can now grow more and new crops in our farms	16.67	12.5	0.584

[a] McNemar's test was conducted to determine if there is a significant difference on the proportion (increase or decrease) over time. * statistically significant at 5% ** statistically significant at 1%

Both in 2018 and 2020 household survey data of IIRR indicated that in Sakta, the most perceived climate change impact they experienced is the increase of daytime temperature. In 2018, there is too much rainfall while in 2020, there was too less rainfall experienced by the villagers.

Agriculture (upland rice, corn, vegetables) is the primary livelihood activity. Others include casual labor, livestock, hunting, small skill fisheries and serving as civil servants. Farmers rely on shifting cultivation. Forest decimation and land degradation threaten agricultural production, with yield declines being a common indicator of resource degradation. Small-scale livestock are important for food security and as emergency sources of funds. Native chicken and pig are the primary livestock, but some farmers also own Mythum (Gayal), a semi-domesticated animal found only in Chin and Nagaland.

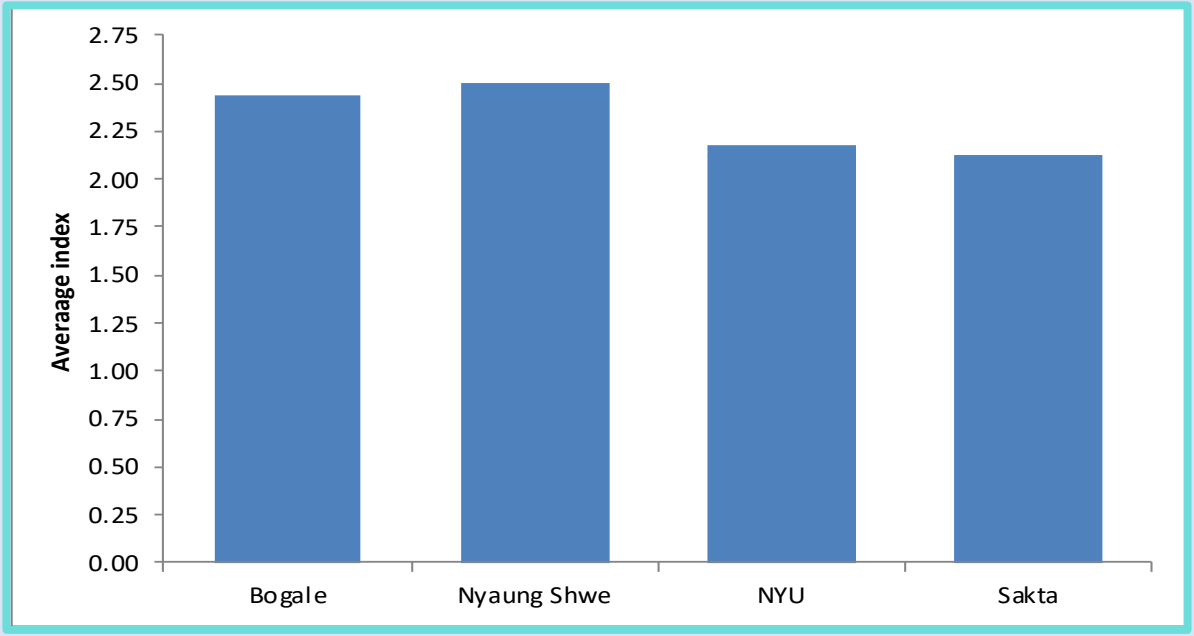
A local food system: Sakta relies heavily on food grown or secured locally



The project's baseline and end-line survey suggests that the community in Sakta village mostly sourced their food materials from their own produce (except for sweets, oils and fats and cereals). Cereals especially rice is sourced from outside because the production of the households is not enough for needs. This offers an opportunity to explore and adopt practices to improve the productivity of cereals (rice and maize) to ensure year-round availability. The survey results indicated that a significant number of households are not consuming most food groups recommended by nutritionists.

Average index on the female respondent's perception on the extent of control and power over household assets

According to the same survey results indication in Sakta village, the general perceptions of men on the role of women is still mainly that women's primary role is to be responsible for domestic work and being able to accumulate and control productive and other assets is important in any effort to economically empower women.



CSA OPTIONS	WHY CLIMATE-SMART?	NO. OF FARMER COOPERATORS/ HOUSEHOLDS IN SAKTA CSV		
		2018	2019	2020
1. Participatory Varietal Selection (PVS)	Enable the farmers to identify which varieties work in a specific climate scenario.	10		
2. Diversification of farm production with vegetables; legumes and crop trials for new introduced crops	Minimizes the risk of losses in case climate variability reduced yields of main crop.	10	56	45
3. Integration of fruit tree into farms (avocado, mango, banana, jackfruit, oranges)	Minimize the risk of losses; trees are more tolerant to variability of rainfall and temperature; sequester more GHGs	68	49	40
4. Planting of legume trees in farms and along boundaries (Alnus spp, Casia spp, Gliricidia spp) to serve as green leaf manure sources	Manages soil degradation and erosion; minimizes dependence to artificial inputs, sequester more GHGs	2	1	2

CSA OPTIONS	WHY CLIMATE-SMART?	NO. OF FARMER COOPERATORS/ HOUSEHOLDS IN SAKTA CSV		
		2018	2019	2020
5. Homestead level semi commercial production of vegetables, fruits and cash crops	Addresses household food security and under nutrition in times of climate change stresses	10	25	41
6. Small livestock production in homesteads	Served as emergency assets in case of climate change shocks, provide opportunities for women	20	12	90
7. Small scale aquaculture (homestead and farm ponds)	Diversify income sources, provide opportunities for women	15	15	18
8. Decentralised : Community-based animal propagation centers (pig, chicken, duck and fish)	Provide sustainable sources of stocks for HH level livestock production	2	2	1
9. School gardens (:vegetables, fodder, fruit trees) : food education for youth	Served as source of planting materials, education tool for students on CSA	1	1	1
10. Improving water harvesting and storage facilities	Reduces the risk of water shortages in dry conditions	1	1	1

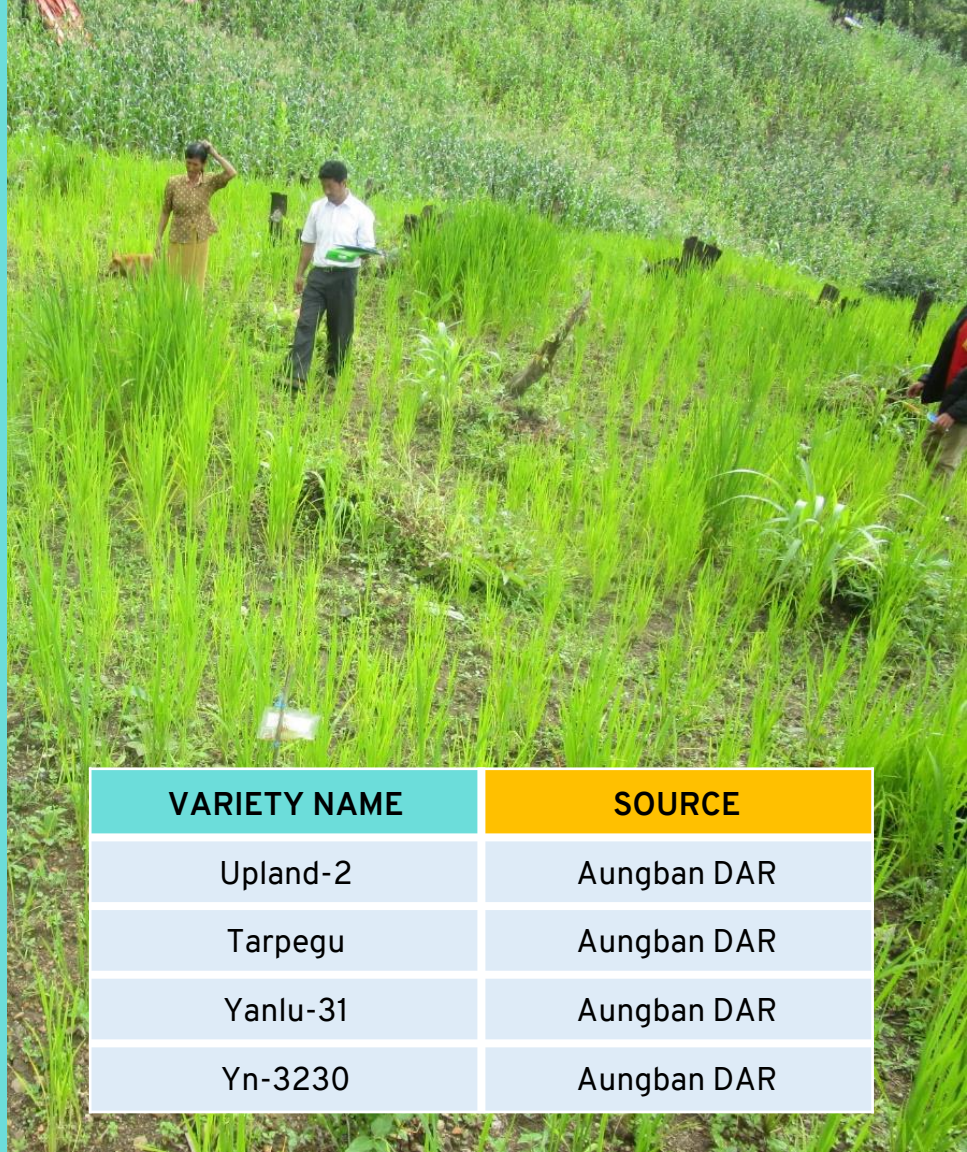
CSA Options, Results & Outcomes

PARTICIPATORY VARIETIES SELECTION

Most of households in Sakta village, make their living from agriculture, cultivating upland rice, maize, corn, and millets in their traditional practice of plots under shifting cultivation, a rotating seasonal cycle of cleaning land for cultivation by cutting and burning existing vegetation. Farmers rely on shifting cultivation as a major livelihood approach for a long time mainly dues to declining soil fertility and weed infestation (that surfaces after two or three years). Forest decimation and land degradation threaten agricultural production with yield declines being a common feature.

Though the government is encouraging farmers to cultivate their crops by developing semi-permanent farms and sloping agricultural land technologies, mostly the better-off farmers are able to follow and practice these recommendations. Though rice is a staple diet for the Chin community, they also consume maize and corn. Nowadays, the farmers from Sakta village are growing less upland rice because of labor scarcity, lower yields and heavy work load with lower returns.

Relying on Participatory Varietal Selection (PVS) processes farmers helped identify for stress tolerant and high yielding varieties of existing field crops in CSVs. Farmers had a chance to compare and eventually to select varieties suitable for their conditions. In Sakta village, upland rainfed rice is mainly cultivated in shifting cultivation lands. Rice production is mostly for home consumption. In an effort to raise upland rice productivity and, in close collaboration with researchers from Aungban DAR, five upland rice trials were undertaken to improve the productivity of upland rice varieties with selected improved varieties from Aungban DAR.



VARIETY NAME	SOURCE
Upland-2	Aungban DAR
Tarpegu	Aungban DAR
Yanlu-31	Aungban DAR
Yn-3230	Aungban DAR

Based on the preference ranking exercise (yield, adaptability, performance and eating quality), Yanlu-31 and Tarpegu varieties were considered the best performers in the first year. However, in the past 3 years, farmers in Sakta village were more interested on elephant foot yam cultivation instead of upland rice cultivation because of market opportunities. Most farmers aim to own large elephant foot yam farms.

The number of upland rice farmers are dropping in Sakta village. However, they still grow maize and corn for their home consumption and livestock are still important crops. Nowadays, the farmers in Sakta appear to have stopped cultivating upland rice and the varieties that the project introduced may have disappeared (though the project needs to ascertain if the poorer farmers in more remote areas still grow upland rice. Also, the project only did one round of trials and this might not have been targeted to the right geographies and socio-economic groups, e.g. farmers from other villages near Hakha region still grow upland rice (Hakha & Thantlang Townships, etc.). KMSS might consider exploring upland rice in those areas. After all, rice is imported into Chin State, indicating there is a demand for rice. Ways to improve the productivity of upland rice needs to include better management practice (e.g. systems of rice intensification) and improved varieties (from Aungban research station).

DIVERSIFICATION OF FARM PRODUCTION WITH VEGETABLES AND LEGUMES WITH CROP TRIALS FOR NEW INTRODUCED CROPS

Introduction of new cultivated species and improved varieties of crop is a technology aimed at enhancing plant productivity, quality, health and nutritional value and/or building crop resilience to diseases, pest organisms and environmental stresses. Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns from value-added crops with complementary marketing opportunities.

Major driving forces for crop diversification include: (a) increasing income on small farm holdings, (b) mitigating effects of increasing climate variability, (c) balancing food demand, (d) improving fodder for livestock animals, (e) conservation of natural resources, (f) minimizing environmental pollution, (g) reducing dependence on off-farm inputs, depending on crop rotation, (h) decreasing insect pests, diseases and weed problems, and (i) increasing community food security.

Though rice is a staple diet for the Chin community, they also consume maize and corn. Nowadays, the farmers from Sakta village are growing less upland rice because of labor scarcity, lower yields and heavy work load with lower returns (compared with other cash crops such as elephant foot yam, potato). The community is still interested in cultivating maize (corn) for human food consumption and for feeding livestock.

Different crop types such as corn, taro, potato and several leguminous crops were introduced and tested (crop performance trials) by farmers. Under farmer's management and control, Ekery and Yezin-1 maize varieties, introduced from Aungban Upland Research Station (DAR) performed well. They were rated high because of taste and short duration (compared with local varieties).

When open-pollinated corn varieties (OPV) are used, farmers are able to save seeds for the next growing season. However, because of its OPV character (cross pollination), seed purity and a decline in quality can be an issue. To address this problem, a frequent renewal of seed stock say, every three years, with new germplasm from the research station is important. Farmers should have received training on seeds production practices on corn.

VARIETY NAME	2018	2019	2020
Ekery	10	42	42
Yezin-1	10	42	42

Farmers are still growing corn/maize varieties introduced from Aung ban research station. The farmers observed that introduce variety has better aroma, more flavorsome and is of short duration compare to local one(thus escaping the risks of season droughts). The cob sizes are smaller and shorter than that of the local variety. However, the varieties are popular and already spreading farmer to farmer. The farmers are excited about these varieties requesting for seed quantities. As often is the case what farmers are access to production assets such as seeds.

Root and tuber crops such as potato, taro, sweet potato and elephant foot yam are considered as semi-commercial crops of the community. By supporting planting materials of roots and tuber crops and other nutritionally-rich vegetable seeds, income generation opportunities are fostered.

ROOT AND TUBER CROPS IN SAKTA CSV	2019	2020
Number of planting materials	150	620
Number of households	9	11

The project secured and transported new varieties of white potato from Aungban. The performance of the **Carolus potato** variety (yield, size and disease resistance) was better than the traditional variety. Farmers are saving these planting materials for sharing locally. Thus, a local seed system for potato is emerging. Carolus has become popular because of its better germination, more yields, larger tubers size and longer duration than other varieties; also more tolerance to drought and heavy rainfall conditions. Due these findings, the farmers in the village have a high and rising interest in expanding the cultivation of the Carolus variety. As result of this experience, even the interest in the local variety and its conservation has grown. After supporting potato seeds by KMSS Hakha and IIRR, the farmers in Sakta village can produce enough quantities for their own village. Nowadays, the farmers in Sakta village do not need to purchase potato seeds from other border villages.

ITEM	DESCRIPTION
LOCAL VARIETY	
1. Supported quantity	120 vises
2. Harvested quantity	520 vises
3. Shared quantity	30 vises to 10 HHs
4. Sold quantity	300 vises with 1500 MMK
5. Stored quantity for next cultivation	150 vises
6. Labor cost	-
7. Total income	450000 MMK
8. Net profit	450000 MMK

Among the CSA ideas and options that KMSS and IIRR introduced throughout the project, potato (both Carolus and local varieties) cultivation, root and tuber cultivation, fruit trees, fish multiplication center, pig farming, permanent farm and school garden will sustain in the future.

CAROLUS VARIETY (2 YEARS)	
Supported quantity (2019)	1 vis
Harvested quantity (2019)	13 vises
Harvested quantity (2020)	127
Implementing (2021)	127 vises (growing)

Agroforestry-based Integration of fruit tree in farms (avocado, mango, banana, jackfruit, oranges)

Climate variability and poor crop diversity are major challenges in Sakta CSV. Diversification with several types of fruit trees was considered a pathway for reducing risks to climate change. Agroforestry-based diversification allows farmers to gradually adapt to a changing environment, relying on the inclusion of economically valuable diversified set of trees. The sequential inclusion of trees into the annual shifting cultivation systems proved to be a very popular risk aversion strategy.

	2018	2019	2020
Total number of fruits trees	1027	1518	790
Number of households	68	49	40

The integration of perennials with seasonal vegetables crops within homestead have also been demonstrated. Locally adapted fruit trees seedlings such as avocado, plum, stink bean, pear, lime and lemon, etc. are now grown in these diverse, mixed crop and multi-story system.

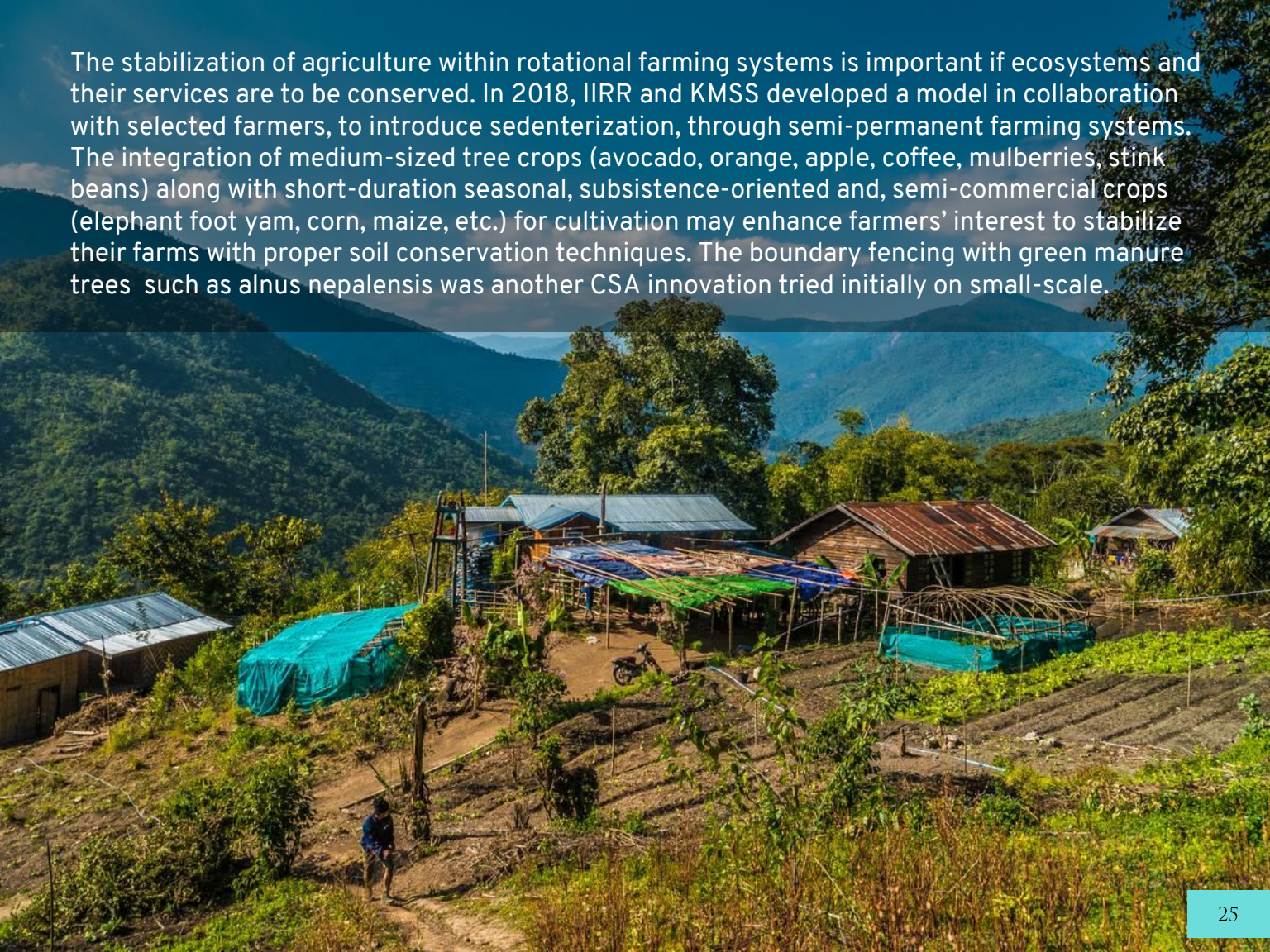
Of the introduced CSA options, the Sakta CSV community took special care were very keen to care of the trees that they received. Fruit tree seedlings such as (avocado, lemon, orange, grape, etc.) were received by about 50% of village households, thus creating a future economic/ business hub in this village. The species adaptability was tested by exploring a wider range of fruit trees (inter-species diversity). Lime, grapes and stink beans are found that in the farms close to the lower valleys, but avocado, orange, and plums are growing very well at the high elevation sites. Grape and lemon had high mortality rates. It is not known if this is a varietal issue (need to try other varieties). Cultivars do matter (intra-species diversity), so it would be prudent to not give up on grapes and lemons yet.

Agro-ecologies matter a lot when proposing commodity interventions. While the overall survival rate of fruit trees which the project supported was high, avocado, plum, cherimoya, and pears were found to be more adapted to the climate and soils of Sakta (B) village. Lime, orange, and grapes appear more adapted to Sakta (A). Farmers will soon start to see results: One farmer indicated that his plum, cherimoya, and grapes will set fruit within the next year. The beneficiaries are very optimistic about the idea of growing fruit trees on their farms. Ultimately, this will also reduce the reliance on shifting farms.

Planting of multipurpose leguminous trees on farms and along boundaries (Alnus spp, Cassia spp, Gliricidia spp)

As a result of the impact of several factors such as intense rainfall, strong wind, landslides, and mono-cropping practices, soil erosion leading to low fertility and soil degradation is a common problem in all agroecological zones of Myanmar. Chin state, because of its current reliance on short cycle shifting cultivation methods undertaken on steep slopes (than 45°) has the most serious ecosystem degradation problem. Shifting cultivation has become a more serious problem as the fallow period cycles are too short (i.e. not long enough to allow for trees to grow back). This kind of land use system promotes deforestation and forest degradation, thus contributing to carbon emission and biodiversity loss. With labor shortages, there are now ways to restore fertility and reduce emission. Trees on boundaries are one such method.

The stabilization of agriculture within rotational farming systems is important if ecosystems and their services are to be conserved. In 2018, IIRR and KMSS developed a model in collaboration with selected farmers, to introduce sedenterization, through semi-permanent farming systems. The integration of medium-sized tree crops (avocado, orange, apple, coffee, mulberries, stink beans) along with short-duration seasonal, subsistence-oriented and, semi-commercial crops (elephant foot yam, corn, maize, etc.) for cultivation may enhance farmers' interest to stabilize their farms with proper soil conservation techniques. The boundary fencing with green manure trees such as alnus nepalensis was another CSA innovation tried initially on small-scale.



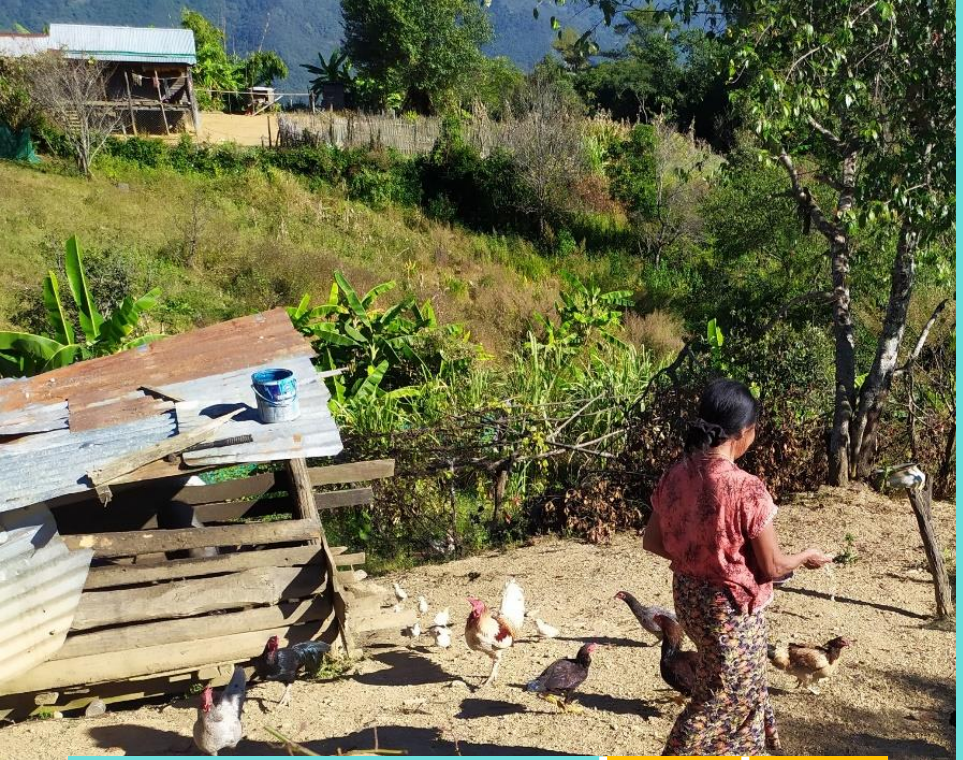
Alnus nepalensis is a plant of the warm temperate to subtropical zone. It can also be grown at higher elevations in tropical areas with high rainfall. The trees develop an extensive lateral root system. They fix atmospheric nitrogen and are known to be fast growing. They give stability to slopes that otherwise tend to slip and erode. They are effectively used to reforest abandoned and deforested mountains and valleys areas because they can grow in degraded habitats with low fertility soils. *Alnus nepalensis* and Gliricidia sepium was introduced to stabilize soils on slopes and as a source or organic matter and green manure.

Agroforestry-based farming system is a way to sequester carbon, to enhance the diversification of products which also contribute to a family's nutrition and income. The integration of perennial fruit trees in small orchards, homestead and in their seasonal cropping lands can help farmers to transition to semi-permanent farming systems. All of these elements also promote increased carbon sequestration.

HOMESTEAD PRODUCTION OF VEGETABLES, FRUITS AND CASH CROPS

A home garden is primarily intended for ensuring a continuous supply of fresh vegetables for family use. Vegetables in a home garden has advantages including (a) supply fresh fruits and vegetables high in nutritive value, (b) supply fruits and vegetables free from toxic chemicals, (c) help to save expenses on the purchase of vegetables, and (d) vegetables harvested from home garden taste better than those purchased from market.

The consumption of vegetables and beans in this village is comparatively low as to the other CSVs. The project introduced more diverse types of vegetable including cabbage, radish, carrot, mustard, kale, garlic, lettuce, spinach, yard long bean and garden pea. Households are interested to grow home gardens except during the long winter and dry season (November to March). Home gardening is the best option among the CSA options that the project supported, because there already is an interest and tradition in gardening. However, there is a very big challenge of accessing quality seeds. The high price of quality seeds, poor availability and lack of knowledge on seeds production methods remains a concern. Local seed systems are a high priority for Chin and other mountainous areas (which otherwise have the right conditions – elevation – for seed production).



NATIVE CHICKEN DISTRIBUTION	2019	2020
Number of fowls	50	00
Number of households	10	40
Chicken multiplication center	1	-

SMALL LIVESTOCK PRODUCTION IN HOMESTEADS

Small-scale livestock is a promising pathway out of poverty for rural farmers in developing countries. Livestock keepers are generally better off than those who depend entirely on crop agriculture. The livestock sector contributes to the major livelihoods of the landless and marginal farmers of the rural community. Small livestock production is considered an important climate-smart agriculture option helping households better deal with crop failure on their farms.

In small-scale livestock production, the project prioritized women's group especially from the landless, poor and marginal social groups. The poor valued what they received because it was a way to also build their asset base. The table below provides an example to demonstrate that this small production, led by women, can support not only home consumption but can partially contribute to household income as well.

ITEM	DESCRIPTION
Supported quantity	5 hens (60,000 MMK)
Vaccination	Not applicable
# of production	42 numbers
# of consumption	1 number per month (in average)
# of sold	34 number with 10,000 MMK (average)
Feeding cost	None (only used farm and home garden products)
TOTAL INCOME	**340,000 MMK**

Native pigs in rural areas are adapted well to local conditions and can be raised with locally available foods. Moreover, they are a very important source of protein and serve as assets, also used to trade/barter with other commodities. Among the introduced CSA options, this is probably not totally new as the community have experience in managing their pigs. The major challenge was in breeding of local stocks and poor accessibility to good quality native pig breeds and the need for initial capital for buying the piglets. The project supported the acquisition of good quality native breeds, then set up a revolving scheme (in close discussion with community) for the sustainable access to continuous inputs.

PIGLET DISTRIBUTION IN SAKTA VILLAGE	2018	2019	2020
Number of piglets	20	-	50
Number of households	20		50
Breeding center	-	2	-

AQUACULTURE IN HOMESTEADS AND FARMS

Small-scale fishery makes an important contribution to nutrition, food security, sustainable livelihood and poverty alleviation especially in developing countries. The consumption of fish is the source of energy and high-quality animal protein and also a key source of other nutrients such as minerals, trace elements, fat-soluble vitamins and essential fatty acids.

Due to the well distributed rains in Chin State and the natural topography, there are many ponds around Sakta village and in the valleys of the mountains. Some ponds, which are connected with streams or creeks, tend to hold water throughout the year and others are seasonal ponds (rainy season) which completely dry up or have less water during dry season. One of the indigenous species of fish which common in the region is Rohu (called Golden Carp). There is interest in growing Rohu because it is culturally valued as food. However, fingerling availability has been a constraint. To address fingerling availability and to promote small-scale fisheries in the village, fish multiplication ponds were supported by the project. Annual support in the form of fingerling helped more farmers, especially the poor, to undertake short-cycle seasonal fish rearing.

A fish multiplication center was initially established with 2000 fingerlings while other households were also provided small quantities of fingerlings for their seasonal fish ponds. The fish multiplication center is doing very well, as result of the increasing demand for fish fingerlings in the CSV. The participating farmer increased the number of ponds from two to five to meet the local demand for fingerlings.

Those engaged in seasonal fish ponds are usually poor and can only afford rice bran as feed for fish. This kind of feed does not contain sufficient protein which is most important for fingerling growth. The project provided farmer learning session on fish raising, on feed, and water management and other important practices. Making fish farming inclusive is an important agenda for the project.

The table below shows the data of achievements that farmer got from fish propagation center

ITEM	DESCRIPTION
1. Distributed Quantity	5,000 numbers of fingerlings
2. Type of fingerling	Shew Wa (Golden carp species)
3. Number of ponds	6 ponds
4. Harvest quantity	11,700 numbers of fingerlings
EXPENSE	**AMOUNT**
1. Feed cost	1,200,000 MMK
INCOME	AMOUNT
1. Fish (100 numbers sold)	500,000 MMK
2. Fingerling (11,500 numbers sold)	3,450,000 MMK (300 MMK per number in average)
TOTAL INCOME	**3,950,000 MMK**
NET PROFIT	**2,750,000 MMK**

COMMUNITY-BASED ANIMAL PROPAGATION CENTERS (PIG, CHICKEN, DUCK AND FISH)

Decentralized propagation centers for small livestock help facilitate the access and out scaling of CSA at local levels. Such systems are of special relevance to the economic empowerment of women in the CSVs.

A Native chicken multiplication center was established in partnership with a farmer in Sakta village in order to support wider, continuous, and easy access to native chicken breeds. Growing chickens in the homestead provides additional household income. Good quality native chicken breeds were identified and maintained to support local farmers with starting stocks.

School Garden in Sakta CSV

SCHOOL GARDENS (VEGETABLES, FODDER, FRUIT TREES)

A school garden is a powerful environmental education tool. Through gardening, students have an opportunity to engage in agricultural practices on a small scale, learning about the responsibilities and impacts of land cultivation.

In general, the school gardening in Myanmar is a challenging endeavor not just for this project but most of the projects of many NGOs and development agencies. Unlike in other countries, Myanmar has no policy nor government program on school gardening. There is also no school feeding program in Myanmar to create demand and a purpose for the school gardens.

Despite of these limitations, the project continued to promote school gardens in the CSVs by devising different ways and support to gradually build interest among administrators, teachers, students and parents alike.

Because of the COVID-19 crisis, the schools are closed, therefore posing challenges to manage and care for school garden (all the teachers and students who take care of their garden are unable to meet in the school).

IMPROVING WATER STORAGE FACILITIES

To support continuous water supply for the purpose of agriculture and domestic use and to reduce the risks of water shortage during dry and drought period, irrigation materials such as tanks and water pipes were supported for emergency storage for the village community and school.

Outcomes from the Work During 2018 to 2021

As a result of the promotion of CSA options, the household survey data have indicated increases in the the percentage of households growing corn, fruits and other crops — such as potatoes. There is also an increase in the percentage of households raising chicken and pigs.

CROPS AND ANIMALS GROWN	SAKTA (N=112)	
	2018	2020
CROPS		
Corn	22.32	42.86
Elephant foot yam	28.57	49.11
Fruits	16.96	25.00
Rice	30.36	16.96
Sesame	0.00	0.89
Vegetables	80.36	60.71
Other crops	12.50	19.64
ANIMALS		
Chicken/Poultry	55.36	73.21
Cow/Ox/Buffalo	42.86	13.39
Goat	0.00	1.79
Pig	34.82	60.71
Other animals (horse, mythun, fish, rabbit)	10.71	2.68

IIRR used the access and utilization of land as an indicator of increased productivity, as more farmers have diversified their production, they would need more land to cultivate. In Sakta village, we have seen that there is significant increase in percent of households having access to land in 2020. The surveys also indicated significant reduction in the households owning less than one acre of land and a significant increase of households farming more than two acres of land.

PARAMETERS	SAKTA		
	2018 (%)	2020 (%)	MCNEMAR'S (P-VALUE) [A]
LAND OWNERSHIP			
Yes	80.56	95.54	0.001**
No	19.44	4.46	
LAND SIZE [B]			
Less than or equal to 1 acre	52.87	37.38	0.018*
1.1 acre to 2 acres	34.48	30.84	0.871
2.1 acres or more	12.64	31.78	0.000**

[a] McNemar's test was conducted to determine if there is a significant difference on the proportion (increase or decrease) over time. [b] Only households who owned land were included in the analysis. * statistically significant at 5%, ** is statistically significant at 1%.

Climate-smart agriculture must build resilience to risks associated with climate change, while also improving people's lives and livelihoods. Unlike, say a decade ago, the nexus between environmental degradation, poverty and climate change is much better understood today. The role of farms in expanding natural carbon sinks, protecting habitats and biodiversity and the protection of ecosystem services is rarely challenged. Following the UN Food System Summit and the COP 26 meeting in Glasgow, there is not a doubt about the need to accelerate adaptative action at multiples scales. The work of IIRR and KMSS in Chin State, Myanmar has demonstrated that positive outcomes can be demonstrated in a short time frame. Transformation at the level of farms and landscapes is indeed an incremental approach and is best achieved and sustained if people and communities are put at the center of adaptive actions.

Outcome stories/Testimonies

Improving native chicken practices for livelihood and consumption

Daw Ngun Har, 67, lives in Sakta village and she has one daughter. She has a homestead garden where she grows vegetables for their own consumption and she also raises chickens using cultural practices. With such practice, however, the growth of her chickens are slow and most of them die from infectious diseases. In 2020, Daw Ngaun Har participated in the CSV Project to improve her chicken raising techniques. The CSV project promotes climate smart practices to improve rural livelihoods and provide villagers with local access to nutritious food to improve their health. Daw Ngaun Har underwent training and received five chickens after building a chicken coop using locally available materials. Because she could not afford to buy ready-made feeds, she fed the chickens with crops from her garden like corn and vegetables. She kept the chickens in the coop for three days and lets them out in the garden for two days.

This shows that native chicken market is good in Sakta and that she can earn a good profit from selling native chicken. Daw Ngaun Har noted that chicken raising does not require high labor cost, so she is happy to continue raising native chicken in her village.

Production cost of Daw Ngaun Har's poultry raising

ITEM	DESCRIPTION
Supported quantity	5 hens (60,000 MMK each)
Vaccination	Not applicable
Number of production	42 members
Number of consumption	1 per month
Number of chickens sold	34 (10,000 MMK average)
Feeding cost	None (used home garden crops)
TOTAL INCOME	**MMK 340,000 (USD 261.54)**
NET PROFIT	**MMK 340,000 (USD 261.54)**

Outcome stories/Testimonies

Establishing a fish multiplication center for fish farmers

Van Thawng Ling is a 30-year-old farmer who lives in the village with his wife Daw Zung Lang and their two children. His livelihood mainly relied on vegetable crop growing, small livestock raising, and fish farming for home consumption. His fish ponds are located outside of the village. Because of limited access to water, he could only dig two ponds and produce fishes for home consumption.

In 2018, after Van Thawng Ling became part of the CSV Project, he attended learning sessions on efficient and sustainable fish farming. Encouraged and bearing the responsibility of supplying his village with fingerlings, he applied his learnings in his fish farm. He systematically expanded his ponds from two to six ponds until he was finally able to establish a fish propagation center in 2019.

By 2020, Van Thawng Ling was able to produce 11,700 fishes. He distributed 500 fingerlings that cost an average of MMK 5,000 and harvested 11,500 small fingerlings that cost an average of MMK 300 (USD 0.23). Overall, he earned a gross income of MMK 3,950,000 (USD 3,038.46). The farmers from border villages such as Dongva, Buanlung, Zathal Villages purchased fingerlings from Sakta's fish multiplication center.

Breakdown of Van Thawng Ling's expenses and income from the fish multiplication center

ITEM	DESCRIPTION
Distributed quantity	5,000 fingerlings
Type of fingerlings	Shew Wa
Number of ponds	6 ponds
Harvest quantity	11,700 numbers of fingerlings
EXPENSE	**AMOUNT**
Feed cost	MMK 1,200,000 (USD 923.08)
INCOME	**AMOUNT**
Fish (100 sold)	500,000 MMK (USD 384.62)
Fingerlings (11,500 sold)	3,450,000 MMK (300 MMK each) (USD 2,653.85)
TOTAL INCOME	**3,950,000 MMK (USD 3,038.46)**
NET PROFIT	**2,750,000 MMK (USD 2,115.38)**

Ecological restoration is the "practice of renewing and restoring degraded, damaged or destroyed ecosystems and habitats in the environment by active, human interventions and action. (Wikipedia)

Nature based solutions "are actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively while simultaneously providing human well-being and biodiversity benefits. (IUCN)

Lists of Publications for Chin CSVs

1. **Village Profile (Saktha CSV):** http://hdl.handle.net/10625/57257
2. **Primer on the Concept of Climate Smart Villages** (2018) in Myanmar language (http://hdl.handle.net/10625/57253)
3. **Primers on Adaptation Options per CSV** (2018) both in English and Myanmar language. The English version in these links: Saktha CSV: http://hdl.handle.net/10625/59378
4. **Primers on Insights from the Implementation of the Myanmar CSVs** (2020). English versions in these links: Saktha CSV: https://cgspace.cgiar.org/handle/10568/110701
5. **Nutrition Education Modules** aimed for community facilitators intending to facilitate nutrition education within agriculture development programs.

   English Version: (http://hdl.handle.net/10625/59401)
6. **Brochure on Promoting Nutrition in CSA** is designed to community readers. Concepts are presented in very simple language with a lot of visuals.

   English version: https://hdl.handle.net/10568/109055

   Chin Dialect: https://doi.org/10.5281/zenodo.5703878
7. **Climate Smart Agriculture Options for Myanmar Small-Holder Farmers: Education and Training Posters for Villages.** These are 10 posters, 9 are for specific technologies and practices on adaptation and then 1 poster on women empowerment in the CSVs.

   English Version (https://hdl.handle.net/10568/109054)

   Chin Dialect: https://doi.org/10.5281/zenodo.5703862
8. **Primer on Nutrition Co-Benefits of Climate-Smart Agriculture in Myanmar**: https://hdl.handle.net/10568/107814
9. **Nurturing Resilience in Smallholder Farming Systems: Emerging Insights from a Climate-Smart Village in Southern Shan State, Myanmar:** https://hdl.handle.net/10568/108682

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