



## AGROECOLOGY CASE STUDY

### SUPPORTING SUSTAINABLE LIVELIHOODS AND RECLAIMING DEGRADED LAND BY ENHANCING AGROFORESTRY IN SOUTHERN SHAN STATE

#### 1. SYNOPSIS

Smallholder farmers particularly in climate vulnerable developing countries such as Myanmar face challenges related to food security and climate change. Research has increasingly pointed toward agro-ecology as a movement with the science and approach suitable to building the resilience of smallholder farmers. Since 2014, the Myanmar Institute for Integrated Development (MIID) has been working in ethnic Taungyoe villages in southern Shan State, Myanmar. The focus has been to build climate change resilience in part by promoting and implementing agro-ecology initiatives. This case study examines the impact of MIID's agro-ecology approaches particularly focusing on agro-forestry, sustainable alternative livelihoods and organic home gardens that aim to support sustainable food systems and climate resilient landscape transitions. The work of MIID referred to in the study is largely funded by the European Union through the International Centre for Integrated Mountain Development (ICIMOD) and USAID through Winrock International, with additional support from The Field Alliance and the Alliance for Agro-ecology in Southeast Asia (ALiSEA). The work has been implemented in six villages covering 394 households.

The three-year project titled Rural Livelihoods and Climate Change Adaptation In the Himalaya (Himalica) has consisted of integrated and holistic approaches, including best practices in participatory assessments to ensure meaningful community engagement and evidence based initiatives. The study first outlines the overall project area context and the identified key challenges and community strengths. The response of MIID is explained in-depth and analyzed against key agro-ecological measures. Notable initiatives highlighted in this study include home garden demonstration plots with mixed cropping of nutritious vegetables including cabbage, cauliflowers and mustard, drip irrigation utilizing available products (bamboo) and community agro-forestry for alternative livelihoods and addressing the impacts of deforestation. This document is intended as an information and sharing tool to support future programming initiatives and planning by government stakeholders, practitioners and communities working in similar contexts.

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## 2. PROJECT AREA CONTEXT

**Location and topography:** The project area consists of a six village cluster that straddles two hilly townships in southern Shan State, Inlay Lake region. The villages are Zeyar from Bawnin Village Tract, Kalaw Township, and Pantin, Thayetpin, Kyaung Nar, Kyaung Taung and Enpak of Let Maung Gwe Village Tract, Nyaungshwe Township. The villages are situated close to the towns of Heho and Nyaungshwe, both are seven kilometers from Let Maung Gwe. The village altitudes are between 1,200-1,450 meters above sea level. Hills dominate the topography with moderate to extreme sloping that consists of scattered permanent vegetation. Forest trees are scarce with natural forest only remaining in small areas near the monasteries and other religious sites.

**Climate:** The climate in southern Shan State is subtropical to temperate. Precipitation in southern Shan State rarely occurs during the dry season from November to March limiting cultivation options. The wet season commences in April or May, peaking in August and ending by November. However, the project area can face periods of drought and/or excessive periods of rainfall during the wet season. The mean number of rainy days is 119 annually, which is less than that of Yangon. MIID's commissioned Land and Resource Assessment Report<sup>1</sup> completed in 2014 found that recent decades show rainfall decline is occurring in southern Shan State. Farmers in the project area rely predominately on rain-fed agriculture, and cultivation starts from May. If soil maintains its moisture some short span varieties such as pigeon pea or bean can provide two harvests.

**Soil conditions:** The soil in the project area is generally low-activity clay that is red, brown or yellow in color. There are several limiting factors affecting agricultural production of the soil type that predominates the area. The soil is shallow with stone and rock presence. It also has limited water holding capacity, poor internal drainage, slow soil permeability, low fertility, low cation-exchange capacity and presence of toxic ions and absence of minor nutritional elements.<sup>2</sup>

**Socio-economic status:** Written records do not exist but village elders estimate that the Taungyoe ethnic group settled in this area of Shan State approximately 100 years ago. The total population of the six project villages is 1,623 adults of whom 843 are females and 780 males, equating to 394 households. The main livelihood is a mixture of subsistence and commercial farming on sloping land. Customary land use practices remain common, namely shifting cultivation (also known as "slash and burn" or "swidden agriculture"). Farmers divide land and utilize plots for one or two harvest periods before rotating to another plot that allows the land to fallow and rejuvenate. However, over time the ideal eight year rotations have reduced to three to five years, placing a strain on the sustainability aspect of this method, which has been recognized as a type of agro-forestry. 70 per cent of households are considered smallholders with an overall access to less than two hectares of marginal and sub-marginal land per year.

**Crop production:** The main crops cultivated in the project area consist of cereals (upland rice, wheat and maize), oil seeds (groundnut and niger-seed), pulses (pigeon pea and rice bean), spices (ginger and turmeric) and vegetables (butterfly bean, cucumber, cauliflower, chilies, tomato and mustard). Crop production is for household food security and some cash crops are produced for the market such as hybrid maize, wheat and ginger.<sup>3</sup>

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1 Myanmar Institute for Integrated Development (MIID). 2014. *Land Resource Assessment Report: Himalica Pilot Project Myanmar*. Yangon: Myanmar Institute for Integrated Development (MIID).

2 Ibid.

3 Myanmar Institute for Integrated Development (MIID). 2014. *Land Resource Assessment Report: Himalica Pilot Project Myanmar*. Yangon: Myanmar Institute for Integrated Development (MIID).

**Challenges:** Villagers living in the project area face numerous challenges including a lack of formal recognition of land tenure, poor quality housing, limited access to markets and infrastructure as well as deforestation and soil degradation. Coping strategies are limited by increasing climatic extremes, which exacerbate the existing weather conditions most notably water scarcity issues during the dry season and reduced fallow periods.

### 3. RESEARCH METHODOLOGY

The main tenets of agro-ecology, focusing particularly on the agro-forestry component, provide a guide for developing a theoretical framework of analysis for this case study which can be broken down into three major themes: ecological diversity, food security and dynamic change.

1. **Ecological diversity:** Has there been an increase in diversity of crop species, function and methods present in home garden and agro-forestry areas? Are species propagated using methods for quality and reliability?
2. **Food security:** Do home gardens contribute to subsistence food, income or alternative livelihoods? Has diversified and nutritious food sources increased in amount or accessibility? Has income increased?
3. **Dynamic change:** Have the production and activity levels in the gardens changed? What methods have been adopted and why? Are the methods economically viable, environmentally sound, gender sensitive and risk adverse? Has there been government engagement for long-term support and sustainability?

The research method included primary and secondary data using a mix of quantitative and qualitative methods. Primary data was collected through key informant interviews (KIIs) with project staff and beneficiaries from Let Maung Gwe Village Tract. Existing data was obtained from donor annual reports and research



Clockwise from top left: Project bamboo craft training for women; A farmer shows off his ginger; Bamboo grows ubiquitously in the project area; Hillside cultivation in Nyaungshwe Township

commissioned by MIID including a Baseline Survey, Participatory Rural Appraisal, Land Resource Assessment Report and Value Chain and Gender Analysis of Agricultural Small Holders in Southern Shan State.

#### 4. RESPONSE: APPROACH AND IMPACT

In many upland regions crop species and genetic diversity has evolved and flourished due to cultural traditions and practices. However, pressures to modernize and other land use changes have impacted on communities, increasing dependence on unsustainable external inputs. Thereby approaches should support to revive local knowledge and improve livelihood systems to be more sustainable, food secure and resilient to dynamic change. To understand the local knowledge and context, MIID assessed existing home gardens and agro-forestry systems through best practice participatory and community engagement tools. More specifically, the project partner ICIMOD conducted a baseline survey and MIID carried out a land and natural resource assessment, value chain and gender analysis, participatory rural appraisals, rapid water assessment, hydro-geological assessment and community sensitization meetings. As a result, a flexible and integrated approach was developed. This case study focuses on activities aimed at improving the agro-biodiversity of home gardens and enhancing agro-forestry practices in the project area. Informed by evidence based participatory research and drawing upon existing practices, knowledge sharing and promoting agro-ecology methods, MIID has worked toward building climate resilient communities in the project area.

##### 4.1 Home garden demonstration plots

Essential to food security, each household in the project area has small home garden plots containing vegetables and fruit trees largely for household consumption. Managed primarily by women, crops commonly cultivated consist of cabbage, cauliflower and kidney beans. Other crops include butterfly beans, tomatoes, pumpkin, mustard, green chili and ginger. A variety of trees are dispersed throughout household areas including perennial orchard trees, bamboo and banana trees, in some cases mango, avocado, papaya and jackfruit trees are also found in village household areas. Considering the existing practice and potential for increased productivity and diversification in home gardens in Let Maung Gwe, MIID constructed a plan to improve home gardens through enhancing agro-forestry and organic farming. The Land and Natural Resource Assessment in 2014 found several areas for improvement of the condition of home gardens in Let Maung Gwe:<sup>4</sup>

- Chemical fertilizer and buffalo manure are common for increasing production and there is unsafe excessive use of chemical pesticides
- Small plant nurseries are linked to home gardens, however many hybrid seeds are purchased from the local market
- Bamboo and banana trees are mostly left to self-propagate, whereas other fruit trees are grown from seedlings or through grafting
- Seedlings for perennial trees such as avocado, mango and tea are purchased from the market or have been provided by the Forest Department and UNDP
- Home gardens are rain-fed relying on seasonal rains from April to November. In the dry season they are largely inactive.

**Response:** The MIID Agronomist engaged with mostly female farmers to set up home garden demonstration plots in each village, of about 0.25 acre in size, commencing in July 2016. The following techniques were demonstrated in the plots and shared in the Farmer Field Schools (FFS) and other trainings: Organic

<sup>4</sup> Myanmar Institute for Integrated Development, 2014. *Land Resource Assessment Report: Himalica Pilot Project Myanmar*. Yangon: Myanmar Institute for Integrated Development.

fertilizer, compost creation methods, additional nutritious vegetables, seedbed preparation and nurseries for fruit trees. To increase access to water sources during the dry season wastewater harvesting techniques were promoted for herbs and spices. Bamboo pitcher irrigation systems were demonstrated for monsoon crops and winter crops in each village.

Though the first home garden demonstration plot was held relatively late in the project cycle (July 2016), participants have already seen the advantages and the Agronomist reported that many participants have expressed interest in replicating the models. According to data from MIID's impact assessment, 20 percent of households have adopted the method of wastewater collection for home garden irrigation, over half of which find it useful. Composting knowledge has increased and an estimated 57 percent of households currently know how to make basic compost and 49 percent have knowledge of composting with effective microorganisms. A further 41 percent have found this method useful. 89 percent of households have knowledge of mixed cropping and 86 percent found this technique helpful. However, the respondents indicated that they adopted this practice mostly for ginger plots – less so for home garden purposes.

In Kyaung Nar Village a home garden was observed to be utilizing several methods such as mixed cropping (tomato, cabbage, cauliflower, bean, cucumber, pigeon pea and corn), and agro-forestry (avocado, mango, jack fruit and bamboo). The household mentioned that they sometimes purchase vegetables during the dry season and they grow plants mostly in the rainy season. In their opinion, composting was the most valuable method adopted that was taught through the project. A female respondent mentioned that her husband attended the FFS and shared with her the safe usage of chemicals and composting methods. She noted that they had received improved yields as a result. However, she learned little about mixed cropping and introducing pest resistant crops. This was evident when observing her home garden which consisted primarily of cabbage. Holes were easily observed in the cabbage patches nearby the home indicating the presence of pests. On the other hand two male participants interviewed in Thayetpin village indicated that mixed cropping and the introduction of new nutritious vegetable crops had increased food diversity and production.

**Tomatoes and bamboo pitcher irrigation:** for those FFS participants interested in irrigation methods, bamboo pitcher irrigation was demonstrated as a method for farmers aimed at improving crop yields and introducing a method that reduces water usage. The bamboo irrigation method allows for slow release water in direct proximity to the plants' roots. This method was adopted only in an estimated five percent of cases. The most common bamboo available in the area is generally of low quality and cracks, requiring replacement. Despite this, the majority of respondents that have adopted the bamboo pitcher irrigation reported it being a useful method. Two farmers from Theyetpin stated they earn between 6-8 lakhs a year from the combination of pitcher irrigation and the other new methods practiced, noticing an increase in the number of fruit that ripened and became richer in color. This increase was largely attributed to pitcher irrigation combined with organic composting. The farmers overcame the issue of cracking by learning how to properly cultivate the large and higher quality bamboo species through MIID support.

#### **4.2 Increased bamboo cultivation, quality and production levels**

Bamboo is of multipurpose use in Let Maung Gwe for food, housing, furniture and other basic items. It contributes to soil and water conservation and the reduction of hard wood consumption. Bamboo is accessible to villagers as it can be found in both forest areas and home yards. At least one third of total households have maintained bamboo areas for generations with the household average consumption estimated at 120 culms of bamboo per year. There are 102 species of

bamboo in Myanmar, 18 of which have been identified to have commercial value. In addition, the villages are near Inlay Lake, one of Myanmar's most popular tourist destinations and a potential market for bamboo products. Bamboo thereby was assessed as a viable value chain product to improve sustainable livelihoods.<sup>5</sup> The value chain assessment found several factors important to consider for scaling up bamboo cultivation and diversification for livelihoods:

- Lack of bamboo varieties resistant to pest and diseases
- An estimated 50 percent of culms are affected by pests and diseases
- The pit size was found to be inadequate, farmers rarely utilized fertilizer
- Lack of knowledge for best cultivation practices and bamboo management
- Buds were often damaged during extraction and transportation.

**Recommendation:** MIID sought support from the Forest Department and bamboo experts for input, training, and promotion and demonstration of new varieties resistant to pest and disease, cultivation techniques, and maintenance of bamboo plantations. Specific recommendations included enhancing the technical know-how for processing bamboo with a market-oriented approach, whilst improving sustainable resource management of bamboo to reinforce the important ecological contributions this plant provides to the wider ecosystem. Bamboo propagation training involved demonstration and discussion of four methods of propagation to the villagers:

1. **Vegetative propagation:** Branch cutting (including wrapping method): Between 10-20 seedlings through this method
2. **Vegetative propagation (stem cutting):** Approximately 5-10 seedlings can be obtained through this method
3. **Seed-based propagation:** Bamboo flowers perish after 20-60 years; therefore annual seed availability is limited. It was demonstrated to the farmers how seeds could be gathered quickly and affordably before seeds are interfered with by other rodents or insect pests. Five seedlings were distributed and utilized for the demonstration planting in the villages
4. **Rhizome transplanting (also called off-set planting):** This method can be difficult as the right bamboo stem must be extracted from the cluster of bamboo and must be done carefully not to disturb the rhizome buds during removal.

Participants learned that separation and planting should occur before the rainy season when the nutrient reserves are at their peak, which provides the best chance for the new roots to establish. If rhizomes are collected late and planted during the rainy season the bamboo is likely to fail.

**Bamboo nursery:** Nurseries were established in each village in May 2015 to demonstrate propagation methods and introduce new pest resistant varieties. Ten new bamboo species were distributed to all 394 households in the project villages. Participants engaged with the bamboo consultant Professor U San Win to learn land preparation for establishing a bamboo nursery, horizontal bamboo propagation, hormones for root development, duration of cutting for germination stage, and transplanting seedlings to field. According to MIID evaluation reports participants found the layering methods of bamboo propagation most useful. Nurseries were also useful to participants for germination testing, systematic application of pesticides, new vegetable cultivation practices, compost making using effective micro-organisms (EM), new variety of orange (thin peel), pollination of papaya, and growing methods of gourd and vermi-liquid as foliar fertilizer. This learning provided the groundwork for also promoting specialist quality handicraft products.

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5 Lwin, U Ko, and Victoria Garcia. 2015. 'Value Chain Analysis Of Agricultural Small Holders In Southern Shan State'. Yangon: Myanmar Institute for Integrated Development.



Clockwise from top left: Training participant shows her completed bamboo products; Farmers harvesting their ginger; Farmers weight their ginger for collective selling on project provided scales; Agroecology participants trial integrated pest management strategies

### 4.3 Bamboo handicraft capacity building

Bamboo crafting was limited to crafting of basic items such as baskets and mats prior to the project beginning and subsequent training on handicraft production. While farmers had worked with bamboo in the past, products were generally of a relatively low quality and value and as such they were interested in holding social enterprise trainings and learning new techniques. A MIID commissioned Value Chain Assessment concluded that trainings should focus systematically on improved product designs, marketing and establishing bamboo producer groups to promote collective sales, transportation, information sharing and market linkages. Staff from MIID then researched the bamboo market across Myanmar, and found that the creative handicraft market was not very mature, with most bamboo products sold featuring basic designs. However, there were a few bamboo craftspeople making waves in the market and one talented Inthar minority entrepreneur from Inlay Lake, Kyaw Zeyar, was hired by MIID to upgrade the crafting skills of project area farmers.

Commencing in January 2016, the first series of trainings were attended by 30 participants (16 male and 14 female). Products included flowerpots, cups, trays, toys, teapots, ashtrays, phone holders and water jugs. The second training advanced the program, engaging 53 participants in total (32 male, 21 female) across the six villages. A follow-up training was conducted in August 2016 on product quality, covering aspects such as finishing, polishing, varnishing and treatment to prevent fungus and to preserve the products. MIID staff have since continued to provide direct support to participants for market linkages, packaging and transportation. A formal market training was held in February 2017. With co-funding from Winrock International, MIID hired Thirimay Women Development Co-operative who delivered training to 64 participants (32 males and 32 females).



The marketing training was held in two sessions, with three villages attending each session. Two trainers facilitated the training with support from the MIID Project Officer and field team. The Livelihood Development Groups created with the support of MIID included the bamboo handicrafts makers and provided the space to transfer knowledge and solve problems on issues related to their livelihoods, including methods to improve the quality of the bamboo products. In 2017 further training was provided on finishing products using hydrogen peroxide. Training that focused on women craft makers was sponsored by MIID and led by the Small and Medium Scale Enterprise Department from the Ministry of Agriculture. Since the start of the training, 33 bamboo handicraft makers have been engaged in this activity. Handicrafts produced include kettles, cups, trays, bowls, tealeaf bowls, water bottles, food carriers, vases, beer mugs, stationary container boxes, tissue boxes and clocks.

**Income:** In August 2016, bamboo craftsmen and women began selling their bamboo product, with facilitation by MIID. Business promotion began by MIID staff and, as sales continued and the business and crafting skills of farmers improved, craft makers began to handle the business side more directly. Project staff have supported linkages to a range of customers including individuals, restaurant owners, and at market stalls. The total cash amount derived from reported bamboo crafts since selling began is 13,843,100 MMK (10,158 USD, calculated at the end of September 2017), in addition to sales unreported to MIID. 155 orders have been recorded from multiple locations across Myanmar including Yangon, Mandalay, Nyaungshwe, Taunggyi, Shwe Nyaung, Pyin Oo Lwin, Naypyidaw, Bogalay, Shwe Bo, Sittwe, Minpya, and Bagan. Thus far, orders indicate that cups, stationary container boxes and trays are the most popular products. There are more than 30 active handicraft sellers from across the six villages, though this has increased as craft makers have involved their families. Women-focused trainings have brought success for several participants.

**Trade fairs:** Farmers have showcased their products and met potential traders at Trade fairs in Bagan, Nyaungshwe, Yangon, Mandalay, Pyin Oo Lwin and Taunggyi. At the August 2016 Fruit, Flowers and Vegetable Trade Fair in Taunggyi, villagers attended with MIID support staff and received significant interest as a result. The handicraft makers gained media coverage from The Farmer News Journal, The Global New Light of Myanmar, and Skynet media group.

**Social media:** In August 2016 bamboo handicrafts made by the villagers were promoted via social media which sparked significant interest, indicated through the large number of reposts and a measured spike in sales. A Facebook post describing the craft makers and their story was reposted 25,000 times. Within two days of creating the Facebook page, MIID staff facilitating business development with the sellers received an estimated 150 calls.

**Skills transfer:** Before the trainings, the farmers did not believe they could become competitive bamboo craft makers. It was thus important to show them the end market and how they too could have market power. Exposure trips to Magwe and Yangon enhanced farmers' knowledge of bamboo cultivation, production and marketing. The Yangon visit included 19 participants (11 male, 8 female) who attended a major market in Yangon to experience the wide variety of bamboo and other handicrafts on display. The group visited author and bamboo enthusiast U Tin Maung Soe's bamboo farm for a practical session and discussion about the history of bamboo, the various propagation methods, bamboo varieties, nurseries and management for operating a bamboo farm. In Bagan participants visited a lacquerware workshop and were exposed to the process of producing quality handicrafts and the overall market strengths and challenges. On return, farmers shared their experiences during FFS sessions. An additional 216 participants were exposed to the learning via demonstrations led by participants who attended.



## WOMEN'S BAMBOO HANDICRAFTS

Women-focused bamboo handicraft training was held in Let Maung Gwe Village Tract, Nyaungshwe Township from the 16th–31 May, 2017. Over 35 young women and government officials attended the opening of the training organised by MIID. U Thet Naing Oo, the Deputy Director of Small and Medium Enterprises Department, Shan State Government, welcomed the female attendees and encouraged their full participation to improve incomes and wellbeing. Participant Daw Khine Htwe, aged 24 from Kyaung Taung village, said she was "very interested to create the bamboo crafts and make some money especially after seeing the benefits from those who participated in previous bamboo trainings with MIID". Project staff are continuing to support these women bamboo makers after the 15-day training to produce competitive items by training them on business skills and assisting in marketing, packaging and transporting the goods. The training was tailored to the livelihood needs of the women in the villages based on community consultation and lessons from previous bamboo training.

Crafting the high value bamboo products taught during the two weeks requires delicate carving skills to make ornate weavings and patterns. Carving thin strings and weaving, participants learnt how to make items such as photo frames, clocks, lampshades, tissue boxes, and coasters. The women are started off with crafting tools and materials to make their first batches of products. The crafting training is the first step, with business guidance and through working together they will achieve a new source of income during their limited spare time without leaving their villages.

### 4.4 Mobilizing support for agro-forestry

Research commissioned by MIID found that villagers in Let Maung Gwe have relied on communal forest areas for livelihoods for several decades as a source for gathering medicines, food items and earning an income by selling firewood and charcoal. To maintain and protect certain forest areas with cultural and religious significance is important to the communities in the MIID project area. For example, bamboo trees are considered precious and bamboo shoots are managed sustainably for future use. Some villagers continue to undertake practices to preserve threatened species which in the past grew in forest areas including medicinal plants, fruit and nut trees, and elephant foot yam. Nevertheless, since 1997–98, public and natural forest areas have been depleted due to clearing for cultivation, uncontrolled forest fires, illegal resin tapping, logging and encroachment. The response by the Ministry of Natural Resources Environment Conservation (MoNREC, formerly the Ministry of Environmental Conservation and Forestry) was to section and protect small forest areas and grant community forestry certificates. Allocated plots sized at 20–60 acres per village were provided 30-year community forestry leases in 2006. To complement, MoNREC provided seedlings and disseminated technical advice to the communities for maintaining community forest areas. Areas were planted with jackfruit, mango and avocado trees. These initiatives show government commitment and support for community forestry initiatives and access to land tenure. However, forest areas have continued to diminish and MIID research suggests that strengthening community agro-forestry was required to address serious land and forest degradation and to restore vibrant landscapes for improved sustainable livelihoods.

**Response:** MIID responded by supporting communities to improve land conditions through introducing and demonstrating several context relevant agro-forestry methods. The agro-forestry initiatives aimed to facilitate uptake and long term planting and management of fruit and timber, in partnership with the local Forest

Department. The MIID team and villagers developed long term participatory land management strategies to restore degraded lands and forest areas. Activities included reforestation, watershed protection, nursery training and addressing erosion of sheet, rill and gully areas. In 2017 work was done to redraw the existing community forest areas to include a larger population of farmers and their land. A key to MIID's forest work has been ongoing close engagement with the community and the Forest Departments of Nyaungshwe and Kalaw Townships and local NGO Forest Resource Environment Development and Conservation Association (FREDA).

**Tree planting:** Demonstrations of good community agro-forestry plots were initiated by planting a variety of tree species and establishing contour lines for watershed management in four of the project villages. Appropriate trees were selected through a combination of participatory and specialist assessment methods including community identified local ecosystem varieties, value chain analysis and recommendations from the government. A mass meeting held to generate regulations for collective forest management including designating tasks and responsibilities for planting, maintenance, and allocating participants to attend resource management trainings. In 2016 the Forest Department provided 700 eucalyptus seedlings and 500 avocado seedlings. These were supplemented with seedlings from private businessmen from Naypyidaw and Shan State, and MIID distributed 3,600 bamboo seedlings to all six villages. In addition, fruit seedlings like mango and avocado were distributed, supported by demonstrations and discussions on agro-forestry with farmers during regular monthly FFS sessions. A total of 15,140 seedlings were provided across the six villages in 2016 and a further 10,000 in 2017.

**Skills transfer:** The work of MIID complemented these initiatives by working with ICIMOD, Yezin Forestry University, FREDA and the Forest Department to conduct detailed trainings on suitable agro-forestry practices including enhancing shifting cultivation, soil protection, watershed protection, home garden tree planting for shading, introducing new planting methods, maintenance of seedlings and pruning. Participants also learnt how to make budget plans for maintaining wood supplies, including planning five years ahead in order to estimate the amount of trees required to be planted (e.g. 100 trees per household). Planting was initiated to enhance the forestation of the area and improve the forestry skills of the farmers.

### **INTEGRATED DEVELOPMENT: THE IMPORTANCE OF COMMUNITY – GOVERNMENT LINKAGES**

Fostering the relationship MIID has with MoNREC has been critical to the success of this work. MIID and MoNREC have signed a Memorandum of Understanding (MOU) to work together and there is ongoing communication to keep MoNREC informed of key events and project progress where appropriate. Furthermore, MIID has engaged well with key township departments. For example, MIID invited government stakeholders of the Forest Department and Department of Agriculture from Kalaw, Nyaungshwe and Taunggyi Townships to participate in "Improved Options for Integrated Mountain Development" a program organized by ICIMOD and MIID. When visiting the site, government officials engaged with project activities such as micro planning facilitation, trainings on climate resilience and a soil, land and water management campaign held in Kyaung Taung and Zeeyar villages. These engagements led to the Forest Department supporting aspects of the micro plans, such as planting wind break trees, supporting labor costs for hill contouring, and providing encouragement and feedback to villagers and project officers.

## 5. CONCLUSIONS

Agro-forestry has been present in Myanmar uplands for decades. In the form of home gardens, multipurpose trees and shrubs in farmlands, boundary planting, orchards and tree gardens, plantations, shaded tree crops, fallow areas and crop areas with trees, agro-forestry has influenced ecological processes and characteristics that are vital to biodiversity for the dispersal of flora and fauna, water and nutrient flows, microclimate, disease and pest control. Sustainable landscapes and livelihoods require biodiversity in agricultural systems. However, several drivers of land use change were found to have significant impacts on the villages in the project area generating a need for improved extension services that support and enhance the maintenance of agro-forestry. With the support of donor funding and government engagement, MIID has responded with well-informed interventions to improve agro-forestry systems combining local knowledge and science, contributing to an increase in access to diversified income sources, food and improved conservation practices.

**Food security:** Home garden interventions have contributed to existing subsistence household food consumption in a variety of ways. Composting methods have been adopted by a significant number of households contributing to safer food products and increased production and activity levels in the garden, thus enhancing food security at the household level. Complementary to this was the technique of mixed cropping. Though not adopted by all households, many participants recognized the benefits and several have commenced mixed cropping in home gardens which has increased access for some to more diversified food sources for home consumption.

**Income and livelihood:** A small number of households have initiated bamboo irrigation methods, which have led to notable changes in the quality of tomato products and increased access to income and food products in the dry season. Although this method was challenging for many households to adopt due to the cracking of bamboo and the overall adjustment to a new method. The holistic bamboo initiative of handicrafts training, market support, propagation methods and provision of seedlings has been particularly successful for a number of farmers who have seen significant boosts in income. Production has increased households spending on basic needs such as food, shelter and investment in materials.

**Community forestry:** The holistic methods conducted by MIID to address soil erosion and deforestation has contributed to building an agro-forestry transition in the project area. Significantly, MIID have engaged positively with local forestry departments supporting important community linkages for sustainability well after the project ends. With support from the government and a local forest association, communities have accessed a large number of seedlings and plants, and taken part in trainings on maintenance of community forests, learning conservation and land preparation techniques for improving soil conditions. A large number of fruit and forest plant seeds were mobilized which, with continued support from the government combined with enhanced community practices gained from MIID and FREDA trainings and demonstration plots, should lead to improved livelihoods and conservation benefits.



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