ESTABLISHMENT OF RAINWATER HARVESTING FACILITIES IN SELECTED UPLAND FARMING COMMUNITIES IN ALBAY, PHILIPPINES:

Lessons and Experiences

ESTABLISHMENT OF RAINWATER HARVESTING FACILITIES IN SELECTED UPLAND FARMING COMMUNITIES IN ALBAY PROVINCE, PHILIPPINES:

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Preface

The upland farming communities in the Philippines are faced with a number of challenges --- low farm productivity, low farm income, low bargaining power in marketing their produce, and marginal conditions of the farms that they cultivate, among others. One of the major resource constraints in the upland farming communities is water to irrigate their cropped areas. Geographically, irrigation system is not feasible in the upland areas. Hence, farmers rely mainly on rainfall as their source of irrigation. Climate change has made their conditions even worse.

The **RAINWATER Project** was conceived by a team of collaborators from the University of the Philippines Los Baños-Institute of Agroforestry (UPLB-IAF) and Institute of Renewable Natural Resources (IRNR), and the Bicol University College of Agriculture and Forestry (BUCAF) to enhance the climate change adaptation strategies of the upland farming communities through the establishment of rainwater harvesting facilities. This capacity development project did not only address the development of the "physical structure" but more importantly it has also enhanced the "social infrastructure" particularly human capital development through training and active involvement in the project activities; bonding social capital formation by harnessing the collection action or "bayanihan system" of the community members; bridging social capital formation through the collaborative engagement of the local government units, farming communities and the state colleges and universities represented by UPLB and BUCAF.

The project collaborators have come up with this publication primarily to showcase the viability of small-scale rainwater harvesting ponds in the uplands; serve as a vehicle of disseminating the lessons and experiences that were generated from the project implementation; and building on these lessons and experiences, replicate the project in other upland farming communities in the Philippines.

May this publication inspire the local government units and other development workers to work collaboratively towards enhancing adaptive capacity of the upland farming communities in the Philippines.

Leila D. Landicho
Project Leader

Acknowledgement

The project collaborators acknowledge the upland farmers in Barangay Malama, Ligao City; Barangay Palanas, Guinobatan; and Barangay Balinad, Polangui for their enthusiasm and collective efforts in establishing rainwater harvesting ponds, soil and water conservation measures, and agroforestry in the selected sites and farms in their communities. The LGUs, particularly the Office of the Municipal Agriculturist in Polangui and Guinobatan, and the Office of the City Agriculturist in Ligao City, through their Agricultural Technicians as representatives, are likewise recognized for their untiring technical and logistics support that led to the smooth project implementation.

The Local Monitors from the three upland farming communities are highly acknowledged for serving as the link between the communities and the project collaborators and LGU Agricultural Technicians during the pandemic where travel restrictions were imposed. The institutions being represented by the project collaborators -- University of the Philippines Los Banos-College of Forestry and Natural Resources, particularly the Institute of Agroforestry and the Institute of Renewable Natural Resources; and, the Bicol University College of Agriculture and Forestry are also recognized for allowing the project collaborators render their services to the project on their official time, and for the logistics and technical assistance to the project implementation. Finally, the project collaborators would like to thank the Asia-Pacific Network for Global Change Research (APN) for the funding support to carry out this project.

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Introduction

The agriculture sector worldwide is dominated by smallholder farmers. Lowder et al (2014) reported that 85% of the 525 million farms worldwide are less than two hectares. Many of these smallholder farmers are poor, food insecure and have limited access to market and basic services (Rapsomanikis, 2015). Fortenbacher and Alave (2014) highlighted that the upland settlers are the poorest among the rural population because of low farm productivity, limited access to rural advisory services, alternative employment opportunities, and basic social services. Furthermore, most of the upland farmers cultivate in marginal lands, with generally steep slopes that are prone to soil erosion, and are rainfed or dependent on rainfall as source of irrigation (Landicho et al, 2015). Hence, they are also vulnerable to climate change impacts and other weather and natural disturbances.

In their research, Landicho, Nam Le Van and Ximenes (2018) emphasized that the low level of adaptive capacity for climate change adaptation among the upland farmers in Southeast Asia, particularly in the Philippines, Vietnam and Timor-Leste is brought about by the low level of farmers' knowledge and awareness about the climate change adaptation strategies, low level of assets, and weak leadership or governance in natural resources management. These results, according to these authors, suggest the need for capacity development programs particularly on the climate change adaptation strategies. Specifically, the upland farming communities in Albay Province have been experiencing climate change impacts such as unavailability of water during the dry season and long dry spell, stunted crop growth, low crop productivity and yield, and increase in farm inputs (Landicho, 2018).

The need for a source of water for crop irrigation was on the top-list of upland farmers in order for them to adapt to climate change impacts. Han (2006) argues the need for a new paradigm in the management of rainwater as weather becomes more severe and unpredictable due to climate change. The new paradigm involves the development of small scale detention ponds or rainwater storage facilities, insteaWd of large remote projects, with each small scale facility promoting multi-purpose rainwater management rather than single purpose watershed management (Contreras, et al, 2013).

Rainwater harvesting through small water impounding projects (SWIPs) addresses the unbalanced rainfall distribution by collecting and storing direct rainfall and surface runoff for future use (Contreras, et al 2013). SWIPs which serve as rainwater harvesting and storage structures consist of an earth embankment, spillway, outlet works and canal facilities. Aside from economic benefits, SWIPs have an important role in enhancing the multi-functionality of agriculture particularly in the uplands (Concepcion et al., 2006). Socio-economic benefits from SWIPs can be seen both at the farm and community levels (Monsalud et. al, 2002).

Given the potentials of rainwater harvesting ponds such as SWIPs, the project collaborators proposed for a one-year capacity development project aimed at enhancing the climate change adaptation strategies of upland farmers in Albay Province, Bicol Region through the establishment of rainwater harvesting ponds. Specifically, it aimed to: a) develop farmers' knowledge and skills in soil and water conservation, rainwater harvesting, and agroforestry; b) establish at least five (5) RWHFs in each landscape (cluster) in three upland farming communities in Albay Province, Bicol Region; c) develop a monitoring tool that will assess the RWH performance;

d) document the lessons and experiences in project implementation; and, e) develop a Manual for the Establishment of Rainwater Harvesting Facility in Upland Farming Communities in the Philippines.

The project was implemented in three upland farming communities, namely: Barangay Malama in Ligao City; Barangay Palanas in Guinobatan, and Barangay Balinad in Polangui (*Figure 1*).

The project was managed by the five research collaborators representing the UPLB-IAF and IRNR, and BUCAF. The local government units of Ligao City, Polangui and Guinobatan, Albay Province were also tapped as local partners, through their respective Offices of City/Municipal Agriculturists, and are represented by the concerned Agricultural Technicians. The key leader of each of the three upland farming communities, together with the Agricultural Technicians of the three LGUs comprise the Local Project Facilitating Team.

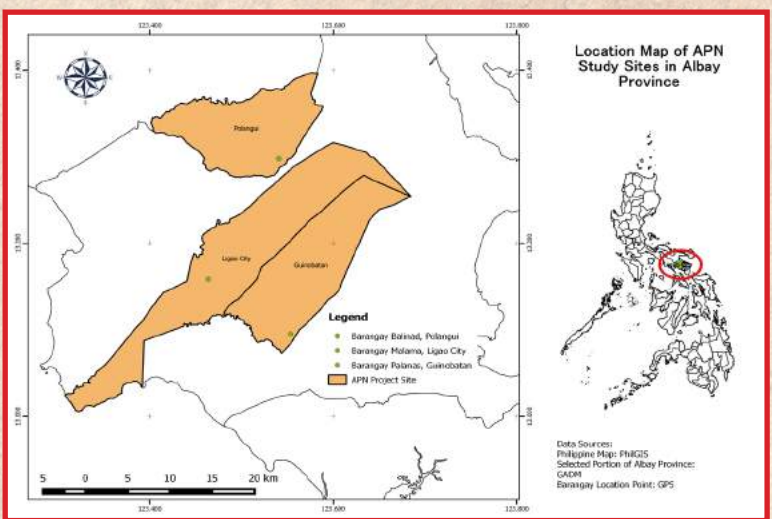

Figure 1. Project sites

THE RAINWATER PROJECT: PROCESSES UNDERTAKEN

Project Stakeholders' Orientation

The stakeholders' participation in project planning processes is essential in ensuring better project management (Usadolo and Caldwel, 2016) and efficient and sustainable project outcomes (MacArthur, 2015).

Figure 2. Courtesy call and presentation of project to the LGU-Polangui, Albay.

The project collaborators convened the representatives from the local government units and farming communities to provide them an overview about the project; discuss the methodologies and processes that would be undertaken in the one-year project implementation; discuss the project deliverables; plan for the succeeding project activities; and provide a venue for the formation of the Local Project Facilitating Team.

Figure 3. Project stakeholders' orientation and formation of the Local Project Facilitating Teams

The Project Stakeholders' Orientation was participated by the Agricultural Technologist/Technicians of the Municipal Agriculturist Office in Guinobatan and Polangui, Albay, and Office of the City Agriculturist in Ligao City; and, the key leaders from the three partner communities, namely: Barangay Malama in Ligao City; Barangay Palanas in Guinobatan; and, Barangay Balinad in Polangui.

The members of the Local Project Facilitating Team, on the other hand, re-echoed the agreements and concerns that have transpired during the stakeholders' orientation to their respective LGU Heads and farming communities.

Cross-farm visits

According to Millar, Photakoun, and Connet (2005) argued that cross-farm visits had the greatest impact on farmer awareness, farmer confidence, and problem solving. It was also the farmers' preferred approach for learning new technologies. The authors added that cross-farm visits offer opportunities for farmers to see the actual field situation, talk and discuss with their fellow farmers, and share experiences and lessons directly. Moreover, farmers tend to recall the strategies and methods much better with when they have seen them in the field. Through cross-farm visits, farmers find it much easier to apply the technologies to their own farms. Landicho et al (2009) also argued that the farmers learn from other farmers as they share similar symbols and experiences.

Fifteen (15) farmers each from the partner communities, and representatives from the local government units had a chance to learn about the agroforestry and soil and water conservation practices of one of the pilot sites of Conservation Farming Villages (CFV) Program, located in Barangay Oma-oma, Ligao City, Albay (*Figure 4*). Building from the lessons of previous capacity-building projects (Landicho et al 2009), the project collaborators believed that farmers learn from other farmers, as they share similar symbols and experiences.

Figure 4. Farmer-participants were taught on how to use the A-frame in establishing contour lines of steep farms

Figure 5. Alley cropping system showcases the use of Gliricidia sepium as contour hedgerows, while cash crops are planted along the alleys

Figure 6. Multi-storey agroforestry system

The selected farmer-trainers/ farmer-volunteers of the said CFV Program served as the resource persons. The farmers highlighted the importance of the Alley Cropping system that CFV farmer -adoptors in Barangay Oma-oma generally practice (*Figure 5*). Alley cropping system allows the steep farms to be cultivated by establishing contour lines and planting leguminous shrubs as contour hedgerows. The alleys are planted with cash crops, while the upper most portion of the farm is planted with woody perennials of various species.

Another agroforestry system that farmers adopt is the Multistorey System, which is composed of different layers or strata of woody perennials *(Figure 6)*. The farmer-participants were able to see and observe for themselves the two types of agroforestry systems in the CFV Site.

In addition, the farmer-participants were able to observe the rainwater harvesting facility that was established in another upland community in Barangay La Medalla, Polangui, Albay *(Figure 7*). This facility showcases the viability of rainwater harvesting facility, where a number of rice farmers are benefitting from rainwater collection, specifically during the dry season.

Figure 7. Rainwater harvesting facility in Barangay La Medalla, Polangui, Albay

Selection of sites for the establishment of RWHFs

The project collaborators and the Local Project Facilitating Team conducted a preliminary assessment of the potential sites where RWHFs would be established. The selection of sites for RWHFs was done based on the following considerations:

1

Number of farmers who would benefit from the facility.

Ideally, the farmer-cooperator but farmers in adjoining farms should benefit from the RWHF. Hence, the sites that were selected represent a particular cluster of farms/farmers.

2

Accessibility of the farm where the RWHF would be established.

This criterion was considered so that other farmers and/or development workers would be able to see and observe for themselves the workability and usefulness of the facility, and would later on adopt the technology. Furthermore, if RWHFs are accessible, then this would facilitate regular monitoring and maintenance of the facility.

3

Willingness of the farmer to serve as farmer-cooperator and share the resource to other farmers.

The establishment of RWHF, particularly the pond, would utilize a large portion of the farmer's farm, which could be allocated for other production purposes. The farmer would render additional time and effort in the establishment and maintenance of RWHF. Thus, farmer's willingness to allocate part of his farm, establish, and maintain RWHF was one of the major considerations. Furthermore, the farmer-cooperator should be willing to share the water collected from the pond to the adjoining farmers.

4

Land tenure and ownership of the land where the facility would be established.

The site where the ponds would be established should be owned by the farmer-cooperator. This is because the RWHFs are intended to support the agricultural production activities of the farmers over a longer time period, such that future generation of farmers would also benefit from the facility.

Based on the above criteria, a total of 11 sites were selected for the establishment of RWHF. *Table 1* shows that four sites were selected in Barangay Malama, Ligao City, five (5) in Barangay Balinad, Polangui; and two (2) in Barangay Palanas, Guinobatan. The number of sites differ in each partner community, depending on the size of the RHWF that would be established.

The size of the RHWF was computed based on the number of adjoining farms that would benefit from the pond, the kind of crops that are being cultivated by the farmers, and the budgetary allocation.

For instance, in Barangay Malama, where the estimated farm size ranges from 1.0-2.0 ha, and rice is the dominant crop, a dimension of 8m x 10m x 2m was proposed for an efficient rainwater collection of about 160m2, which can be used by 6-8 farmers in the cluster. In the case of Barangay Balinad, on the other hand, the estimated farm size is less than one hectare, which are planted mostly to vegetable crops, a dimension of 5m x 10m x 2m was proposed to catch rainwater of about 100m2, which can be used by 6-8 vegetable farmers. Meanwhile, in Barangay Palanas, where the estimated farm size ranges from 1.50-2.00 hectares, and are planted mainly to rice, a bigger pond was proposed having a dimension of 30m x10m x2m to collect rainwater of about 600m2, which can be used by 10-20 farmers.

Table 1. Distribution of sites for RWHF establishment in the three (3) partner communities.

Partner community	Cluster and farmer-cooperator	Dimension	Crops planted	Estimated farm size of farmer-cooperator and adjoining farms *(in ha)*
Barangay Malama, Ligao City	Mr. Alberto Pinoy (Lower elevation)	8mx10mx2m	Rice, vegetables	1.0 -2.0
	Ms. Alicia Canavarel (Mid-elevation)	8mx10mx2m	Rice, root crops, vegetables	1.0
	Mr. Claudio Imperial (High elevation)	8mx10mx2m	Rice, vegetables, root crops	1.0
	Ms. Delia Mendoza (High elevation)	8mx10mx2m	Rice, vegetables, root crops	1.0-2.00
Barangay Palanas, Guinobatan	Mr. Edgardo Martillan (High elevation)	30mx10mx2m	Rice, vegetables	1.50-2.00
	Mr. Eller Sabolboro (High elevation)	30mx10mx2m	Rice, vegetables	1.50-2.00
Barangay Balinad, Polangui	Mr. Rodolfo Bolilan (high elevation)	5mx7.5mx2m	Vegetables, corn	0.50
	Mr. Junel (high elevation)	5mx10mx2m	Vegetables, corn	<1.00
	Mr. Elmer Ciervo (high elevation)	5mx5mx2m	Vegetables	<1.00
	Mr. George Calingasion (mid elevation)	5mx10mx2m	Vegetables	<1.00
	Mr. Jomar Ciervo (mid elevation)	5mx10mx2m	Vegetables	<1.00

Soil texture analysis

Soil samples were collected from the 11 sites to determine the soil texture. Determining the texture and porosity would serve as basis in deciding whether to install plastics to prevent water dissipation and evapotranspiration, to ensure the RWHFs' efficient water collection and storage.

The farmer-cooperators were given an orientation on how to collect soil samples (*Figure 8*), as a way of building their technical capacity.

Figure 8. Collection of soil samples

Results indicate that soil samples in Barangay Malama and Barangay Palanas were both clayey.

On the other hand, based from the physical attributes and previous soil analysis done in Barangay Balinad, the farms have loamy and sandy soil, which suggests a lesser efficient water collection and storage. Thus, installation of plastics in the RWHFs was deemed appropriate.

Participatory planning for the establishment of RWHFs

Figure 9. Participatory planning for the establishment and maintenance of RWHFs in the three partner communities

The community members, particularly the farmer-cooperators and the "would-be" farmer-beneficiaries of the RWHFs were convened into a meeting (*Figure 9*) to:

a) discuss in detail the establishment of RWHFs;

b) present the sites that were selected for RWHF establishment;

c) decide on the logistics arrangements, including the farmers'arrangements on the establishment and maintenance of RWHF;

d) identify the tools and materials needed for the establishment; and

e) finalize schedule of actual establishment.

This activity was done to ensure that the farmers would develop their sense of ownership on the project, and thus, would serve as a vehicle to sustain the project initiatives.

The farmers, with the guidance of the project collaborators came up with the following decisions:

On the actual establishment:

- The community members, particularly the farmer-beneficiaries have all agreed on the sites that were selected for RWHF establishment.

- The community members agreed that they would establish the RWHFs through their collective action or "bayanihan" system. One RWHF would be established by a group all at a time to ensure completion of more effective and efficient outputs. On the other hand, the project collaborators would provide food allowance to the farmers all throughout the period of establishment.

- Required tools and materials for the establishment of RWHFs, including rental of carabaos and plows, would be provided by the project collaborators.

- The project collaborators, together with the local experts from the Regional Office of the Department of Agriculture, would provide technical assistance during the establishment of the ponds.

On the monitoring and maintenance:

- The project collaborators would devise a monitoring tool that would be used by the field staff for the periodic monitoring of technical and social aspects.

- The farmer-cooperators would take the lead in maintaining the ponds, while the other farmer-beneficiaries would also provide assistance whenever necessary.

- The farmer-cooperators and farmer-beneficiaries, with the assistance of the Local Multisectoral Team, would design a set of agreements as regards their respective responsibilities in the maintenance of the ponds.

On-site Technical Consultation on the Establishment of RWHFs

The project collaborators tapped the expertise of key persons involved in the establishment of RWHFs in Bicol Region. Two (2) engineers from the Regional Office of the Department of Agriculture in Bicol Region, provided their technical expertise in the appropriate design of RWHFs in the three partner communities (*Figure 10*).

Figure 10. Local experts providing technical advice and guidelines on the establishment of RWHF

The design of the ponds was based on the type of dominant crops and the farm size. These two factors determine the optimum volume of water for collection, storage and distribution in each cluster of farms. Hence, for Barangay Palanas with about 10-20 farmer-beneficiaries and with rice as the dominant crop, the type of RWH pond that is appropriate to the site is a "dam type" with a dimension of 30m x 10m x 2m for each cluster of farms. Similarly, "dam type'' type of RWH pond is designed for Barangay Malama having rice as the dominant crop as well. However, since the intended users of the resource is only 3-4 farmers, the ponds' dimension is 8m x 10m x 2m. In Barangay Balinad, on the other hand, the "embankment type" of pond was designed with a dimension of 5m x 10m x 2m.

A second round of technical consultation was made after a series of typhoons in Bicol Region in the latter part of 2020, when ponds in Barangay Balinad, Polangui were reportedly damaged, and when inefficient rainwater storage in Barangay Malama; and a partial damage of dike in Barangay Palanas were reported.

Establishment of RWHFs

The establishment of rainwater harvesting ponds took longer than planned. The actual establishment commenced in February 2020 and was projected to be completed by April 2020. However, due to a number of factors (i.e. typhoons, monsoon rains, COVID-19), the establishment of the pond was extended until the end of the project period in 2021. Using collective action or locally called as the "bayanihan system", the upland farmers were able to construct the 11 ponds: two (2) in Barangay Palanas; four (4) in Barangay Malama; and five (5) in Barangay Balinad.

Barangay Balinad, Polangui

In Barangay Balinad, Polangui, the establishment of the ponds was done by a maximum of 10 upland farmers. These were the farmers who expressed their willingness to participate in the establishment of four ponds in different clusters (*Figure 11*). The farmers did a manual construction of the ponds using the tools provided by the project such as hoe, shovel, and digging bars. In addition to the farm tools provided by the project collaborators, the farmers also utilized their existing tools. Because of their previous experience of rapid loss of water from the ponds, three of the RWH ponds were covered with UV plastics.

Figure 11. Establishment of RWHFs in Barangay Balinad, Polangui

These ponds were repaired after being damaged by the typhoons. More durable type of RWH ponds were established to ensure a more efficient and effective rainwater collection and storage, and to make the ponds more functional and sustainable, given the geographic conditions of Barangay Balinad.

Figure 11. Establishment of RWHFs in Barangay Balinad, Polangui

Figure 12 shows the reconstructed ponds with cement and boulders to efficiently hold rainwater; flushboard to control the rapid flow of water; distilling box to filter the soil and debris from the road and upper areas of the pond; and outlet or discharge canal for water distribution to adjoining farms.

Figure 12. Reconstructed ponds in in Barangay Balinad, Polangui

Barangay Malama, Ligao City

In Barangay Malama, where "dam type" ponds with bigger dimensions were established, the farmers used carabao and plows to facilitate soil excavation, and to make the soil more compact (*Figure 13*). A group of 12 farmers shared their efforts in constructing the ponds in four clusters using their "bayanihan system".

Figure 13. Establishment of RWHFs in the lower, mid and high elevation clusters in Barangay Malama, Ligao City

To secure the area, farmers in Barangay Malama fenced their ponds with cyclone wire, with *Gliricidia sepium* as live posts for climbing crops. At the same time, this would help restore soil fertility *(Figure 14*). In addition, available spaces around the ponds were planted with cover crops to stabilize the soil and serve as additional food and income source of the household. Since the completion in May 2020, the ponds have been collecting and storing rainwater. However, it was observed that three of the ponds had inefficient water storage. Hence, these ponds were repaired upon technical advice from the experts. One pond was installed with a plastic lining, while the outlets of two other ponds were repaired to ensure efficient flow and storage of rainwater.

Figure 14. The ponds in Barangay Malama have been collecting rainwater since May 2020. The ponds are also fenced with Gliricida sepium as live posts.

Barangay Palanas, Guinobatan

In Barangay Palanas, Guinobatan, two big "dam type" ponds measuring 30mx10mx2m were established that would cater to about 15-20 farmers each. These big ponds were established for a more realistic and efficient water collection and utilization, considering the farm sizes and the type of crops being cultivated by the farmers. Because of the relative bigger pond size and soil condition, the community members used carabao and plows to excavate the soil, and make the soil more compact. It took them three months to complete the first pond. Since the completion of the first pond in April 2020, it has collected rainwater during the first rain event in May 2020. The water was retained until present. The farmer-cooperator capitalized on the efficient water storage, hence, he integrated fishes in the pond to serve as additional food and income source. Meanwhile, the second pond which was completed in August 2020, through the collective efforts of the community members, has also become functional until present (*Figure 15*).

Figure 15. The RWHFsin Barangay Palanas have been collecting rainwater and has efficiently stored the water until present. The farmer-cooperator has incorporated fishes in the pond.

Periodic Monitoring of RWHFs

Monitoring of RWHFs is necessary to assess the status of the ponds based on their effectiveness in terms of addressing the problem on water scarcity in the selected cluster of farms; efficiency in terms of water collection and storage/retention; and, durability and stability in terms of withstanding the effects of erosion around the area, winds and heavy rains considering that the sites are typhoon-belt area. Furthermore, monitoring revolves around the execution of arrangements and agreements made during the planning stage, such as the arrangements among the beneficiaries and farmer-cooperators concerning the establishment of the ponds, distribution and use of water from the pond, as well as the monitoring and maintenance of the ponds. Likewise, issues, concerns and problems encountered all throughout the establishment and maintenance of the ponds and distribution and utilization of rainwater collected from the farm were also recorded in the project monitoring.

Indeed, periodic monitoring allowed the project collaborators and local partners to address the problems being encountered by the partner farming communities. These include among others the following:

- Repair of the ponds that were damaged by the typhoons;
- Repair of the ponds which were reportedly inefficient in water storage and collection;
- Integration of soil and water conservation measures to address soil erosion in sloping areas around the ponds;
- Installation of cyclone wires around the pond for safety of children and community members; and
- Revisiting farmers' arrangements in the maintenance of the ponds.

Because of the escalating cases of COVID-19 especially during the period of March-December 2020, the project collaborators tapped the local farmers, particularly the youth, and the agricultural technicians to conduct periodic monitoring of RWHFs. Tapping the locals provided a number of advantages. These include:

a) their proximity and accessibility to the project sites, particularly to the cluster of farms where ponds were established;

b) they serve as the link between the community and the local partners and project collaborators, particularly in channeling issues and concerns, and facilitating field activities, especially during the pandemic when travels and gatherings are highly restricted; and

c) this mechanism provided an opportunity to build and/or strengthen their capacity for project monitoring and follow-up and communications.

The periodic monitoring of the ponds is usually done every major rain event to measure the water collected and stored in the ponds. A monitoring tool, designed by the project collaborators, is found in *Appendix A*.

Integration of Soil and Water Conservation Measures and Agroforestry Systems

Sustaining the RWHFs is an utmost concern shared by the project collaborators, local partners and the farming communities. Hence, the need to integrate measures that would help conserve and manage the soil and water resources, while at the same time, capitalizing on the RWHF for crop diversification to ensure food security and provide additional income to the upland farmers. Thus, integration of appropriate soil and water conservation measures, and the development of agroforestry systems have become an important aspect of the RAINWATER Project.

Soil and water conservation measures are appropriate strategies to prevent soil erosion in the sloping areas, which are oftentimes, the sites that are cultivated by the smallholder farmers. Integrating SWC measures in upland farming would not only control soil erosion in the sloping areas and conserve soil nutrients that are needed by the crops, but more importantly would protect the ponds from being damaged by the soil and debris from the sloping areas around them.

Meanwhile, a number of studies have shown that agroforestry offers potentials in enhancing the socioeconomic productivity of the farmers because of the diverse crop components (Tolentino, et al 2010; Cunningham et al 2003; Landicho et al 2016), while at the same time addresses the ecological dimension (Baliton et al 2020; Baliton et al 2017; Palma and Carandang, 2014; Casas et al 2014). Agroforestry is a dynamic, ecologically-based natural resource management system that deliberately combines woody perennials with herbaceous crops and/or animals either in some form of spatial arrangements or temporal sequence on the same land, with the aim of diversifying and sustaining production for increased social, economic and environmental benefits (Leakey as cited in Feature Essay, 2007).

In Barangay Palanas, the upland farmers, through the technical assistance of the agricultural technician, have established an agroforestry system, integrating Mulberry (*Moros nigra*) as hedgerow species, and dragon fruit (*Hylocereus undatus*) as alley crops, in the alley/hedgerow cropping system (*Figure 16*). Mulberry, being a woody perennial, serves as the permanent crop, and are planted as contour hedgerows. On the other hand, the dragon fruit, which is a medium-term crops are planted along the alleys, together with annual vegetable crops. Besides their suitability to the site, mulberry and dragon fruit provides economic potentials, being high-value crops. Furthermore, mulberry wine is being produced in Bicol Region, and therefore, Barangay Palanas could be a potential supplier of raw materials to the processors. The vegetable crops would serve as food source of the upland farmers.

Figure 16. Establishment of contour hedgerows in Barangay Palanas, Guinobatan, with mulberry as hedgerow crop and dragon fruit as alley crop.

In Barangay Malama, the sloping farms around the ponds were developed into contour farms, where kakawate (*Gliricidia sepium*) serves as the hedgerow, and lemon (*Citrus limon*), cacao, (*Theobroma cacao*), turmeric (*Curcuma longa*) and vegetable crops serve as the alley crops. Lemon, cacao and turmeric are among the high-value crop species in Albay (*Figure 17*). Lemon is integrated in farms with open areas, as this species is light-demanding. On the other hand, cacao is integrated in farmers/areas under coconut. Vegetable crops are source of food of the household and other community members. *Gliricidia sepium* offers a number of potentials including soil fertility restoration, being a nitrogen-fixing tree species, a source of fuelwood, particularly the prunings; and, as a source of feeds for the livestock, particularly the leaves. The leaves could also be used as botanical pesticides.

Figure 17. Establishment of contour hedgerows in Barangay Malama, Ligao City, with kakawate as hedgerow crop and lemon and vegetle crops as alley crops.collecting rainwater and has efficiently stored the water until present.

In Barangay Balinad, the steep areas around the ponds will be developed into contour farms with *Gliricidia sepium* as the contour hedgerows (*Figure 18*). The farm is mostly planted with corn under coconut, and hence, another high-value crop, Cacao, will be integrated along the farm boundaries, to provide protection and production functions.

Figure 18. Integration of kakawate as hedgerows in corn areaator has incorporated fishes in the pond

CONTRIBUTIONS OF RWHFs IN AGRICULTURAL PRODUCTION OF THE THREE UPLAND FARMING COMMUNITIES

Water is one of the most significant resources in agricultural production. A farmer may have vast areas for agricultural production, but these areas may not be productive if water or irrigation is not available. In the same manner that a small-scale farmer may not attain farm production for his subsistence if water is not available to irrigate his crops.

The smallholder farmers in the three upland farming communities have been confronted with the problem on the lack of water to irrigate their crops, particularly during the dry season. As such, they leave their farms idle during this period. During the rainy season, however, these upland farming communities, are sites of heavy downpour being typhoon-belt areas. This opportunity to collect rainwater during the rainy season, was tapped, to ensure continuous water availability throughout the cropping season.

While the establishment of rainwater harvesting ponds is a tedious process, the farmers' perseverance to complete the projects paid off. From their personal accounts and observations, the farmers were able to experience the many contributions of rainwater harvesting ponds. In Barangay Palanas, for instance, the farmers used to cultivate rice in one cropping season-usually during the rainy season (May to September) to tap the availability of water for irrigation. With efficient collection and storage of two rainwater harvesting ponds, at least 20 farmers began cultivating rice during the dry season (November to March) in 2020. This enabled farmers to attain their rice production targets for one year for their home consumption and marketing, as well (*Box 1*).

Box 1.

"Dati ang mga magsasaka ditto sa Barangay Palanas ay isang beses lamang magtanim ng palay dahil sa kakulangan ng tubig. Pagkatapos magawa ng rainwater harvesting ponds, ngayon ay dalawang beses na silang magtanim ng palay sa loob ng isang taon"

Carolina Obnialla, Barangay Captain, Palanas, Guinobatan

In Barangay Malama, Ligao City, one farmer was able to expand his rice production area because of the availability of water that sustained production. Meanwhile, three farmer-cooperators integrated additional crops to maximize the availability and use of water for irrigation (*Box 2*).

Box 2.

"Ang kakulangan ng tubig ang isa sa mga matinding suliranin ng mga magsasaka sa Barangay Malama. Hindi kami gaanong umaani ng malaki sa palay dahil sa kawalan ng tubig. Ngayon, mas maganda ang ani naming ng palay at napalawak ang sakahan dahil sa rainwater harvesting ponds."

Alberto Pinoy, Farmer-Cooperator, Barangay Malama, Ligao City

Similarly, a farmer-cooperator and adjoining farms in Barangay Balinad, Polangui began cultivating the idle lands around the rainwater harvesting ponds. These lands were left idle because of lack of water for irrigation. However, because of the presence of rainwater harvesting ponds, the farmers were encouraged and motivated to expand their areas of cultivation (*Box 3*).

Box 3.

"Nagpapasalamat po kami dahil sa proyektong ito na nagsagawa ng rainwater harvesting ponds. Dahil po dito, hindi na naming kailangang maghintay ng ulan o kumuha ng tubig mula sa malayong pagkukuhanan"

Rodolfo Bulolan, Farmer-Cooperator, Barangay Balinad, Polangui

SIGNIFICANT LESSONS DISTILLED FROM PROJECT IMPLEMENTATION

1

Support of the local government units at various levels helps facilitate the smooth project implementation in the three project sites.

The active involvement of the Office of the Municipal/City Agriculturist, through their focal persons/Agricultural Technicians in the three partner communities, helped mobilize the farmers in all stages of project implementation, and closely monitored the status of project implementation.

2

Regular communication of the project collaborators via electronic mail and other forms of social media is a key to sustain the project implementation despite the travel restrictions and face-to-face interactions brought about by the pandemic. The diverse means of communications ensured that the project implementation is on-track and issues and problems arising from the project implementation are immediately being addressed.

3

Mobilizing the Local Multisectoral Team, through the leadership of the agricultural technicians representing the Office of the Municipal/City Agriculturists in the three local government units. Constant communication and close coordination are being done as regards the field activities, and these are being relayed to the key leaders of the partner communities.

4

Tapping the locals as the Local or On-Site Monitors is both capacity development and a project facilitating opportunity. These on-site monitors served as the link between the farmers and the collaborators, since the agricultural technicians, whose municipalities were also on lockdown, were restricted to do fieldworks. The local/on-site monitors organized the field activities, coordinated with the collaborators for logistics and technical concerns, and monitored the progress of RWHF establishment. These local/on-site monitors were also tapped to conduct periodic monitoring using the monitoring tool that was developed by the project collaborators. Engaging youth in field monitoring did not only facilitate project implementation, but also provided an opportunity to enhance their capacities in project coordination and monitoring, and enhancing their communication skills as well. In Barangay Balinad, the local/on-Site monitor was the President of the 4H-Youth Club, while the Barangay Secretary was tapped as the local monitor in Barangay Malama. In Barangay Palanas, the President of Sangguniang Kabataan (Youth Organization) was also engaged as the local monitor.

Establishment of rainwater harvesting facilities is site-specific.

There is no standard size type, and even processes in establishing rainwater harvesting facilities in upland farming communities. The size and type of rainwater harvesting ponds depends on the existing local conditions, particularly the size of the farms being cultivated by the farmers, the type of crops being cultivated, the geographical conditions of the community and farms therein, the number of farmer-beneficiaries that would use the resource; and, the willingness and commitment of the community members to engage in the establishment and maintenance of the facility. In the case of Barangay Palanas, Guinobatan, where the dominant crop is rice – a water-demanding crop; and, where a number of adjoining farms were considered as among the farmer-beneficiaries, the size of the pond that was constructed was about three times the size of the ponds in the two other project sites. This way water collection, storage and distribution would be more effective and efficient. Hence, only two ponds were constructed given the budgetary requirements.

5

The spirit of collective action or "bayanihan system" is essential in a more efficient establishment of the rainwater harvesting facilities.

As in other community-based development projects, the cooperation and spirit of "working together" played a key role towards the completion of the RWHF establishment. This element is essential particularly for development projects which are in the "pilot stage" and have limited funding support.

6

Resource sharing is an important ingredient in any community development project, and serves as a mechanism to develop a sense of project ownership among the stakeholders.

Unlike the traditional projects where everything is given out by the project implementors and funding agencies, and local organizations and farming communities are merely considered as "beneficiaries", this capacity development project showed the relevance of counterparting from the local government units and the three partner communities. For instance, the LGUs provided vegetable seeds for the establishment of agroforestry systems/models, and engaged the agricultural technicians in the project without additional compensation. The farming communities, on the other hand, provided labor in the establishment of RWHFs and agroforestry systems, as their counterpart. Sharing of resources and efforts enables the local stakeholders to value the project, develop a sense of project ownership, and paves the way for the sustainability of the project initiatives.

7

8

Capacity development is a two-way, interacting process, which enables the project partners to "learn together".

As a learning process, capacity development is seen as an interaction between the project collaborators and the local communities. The local communities are not seen as merely recipients of support, but more importantly as active partners in project implementation. The creative ideas, suggestions and decisions of the local communities were respected, considered and accommodated by the project collaborators, even to the extent of modifying and adjusting the project targets. The project collaborators also learned from real field experiences of the farmers and the technicians. As such, capacity development is not only "learning from one another", but also "learning together".

9

Addressing the expressed/felt-need of the communities guarantee their commitment and engagement in the project activities.

Since agriculture is their main livelihood, the three farming communities were in dire need for water source that will provide irrigation to sustain their agricultural production even during the dry season. This need was expressed in 2018 when a study was conducted in the three farming communities (Landicho, 2018). Since the project's inception, the farmers and the local leaders extended their support and active engagement in the project activities. Despite the pandemic and natural disasters brought about by typhoons in 2020, the farmers persisted to complete the establishment of RWHFs.

10

Openness to embrace the opportunity of being a partner to the project on establishment of RWHF among the three communities.

This was evidently facilitated by the observed trust and belief of the farmers to the agricultural technicians. An indication of an existing functional, strong working relationship among them, in view of the sustained visibility of the LGUs was through farming and livelihood assistance programs delivered at various events.

11

Sustainability and functionality of the installed RWH structures given the test of time in view of structural deterioration, inactive participation of some farmer-beneficiaries in the continued maintenance and monitoring, including climate change and uncontrolled watershed threats, among others remain a challenge that demand attention from the LGUs and farmer-beneficiaries themselves.

These are all realities in the upland farming environment and for which their capacity have initially been developed.

Market-driven selection of crops and perennial species for both hedgerows and alleys, combined with their known soil, climatic requirements, availability and observed growth and production performance in the different project areas are clearly employed.

While the productivity of selected perennial crops has yet to be achieved after several years, there is consciousness for such considerations among partner farmer-beneficiaries, about the economic potentials of these perennial crops.

12

Rainwater harvesting and utilization at times where most abundant and needed respectively, facilitates the long term development and adoption of agroforestry technology that is appropriate for the three upland farming communities in Albay Province.

In Barangay Palanas, for instance, the farmers used to cultivate rice in one cropping season only. However, with efficient collection and storage of rainwater harvesting ponds, they started cultivating rice for two cropping seasons. In Barangay Balinad, on the other hand, the farmers did not cultivate the sloping areas surrounding their coconut farms because of the lack of water. However, with the establishment of rainwater harvesting ponds, these farmers started cultivating these idle lands with agricultural crops.

13

Documentation of lessons and experiences in this RWHF project, particularly those of personal accounts by the farmers themselves promote dissemination towards adoption of the practice/technology.

Some of the farmers openly express their appreciation of the immediate as well as the potential impacts these RWHF and agroforestry could bring to their overall farm and livelihood conditions, bringing about both the economic and ecological improvements.

14

RWHFs, as demonstrated in this project seems to be so modest and practical, yet immensely significant and useful for the upland farming communities in the three project sites.

Given additional resources, this could be replicated in other LGUs in Albay and other provinces of Bicol Region of similar farming and environmental conditions.

15

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ESTABLISHMENT OF RAINWATER HARVESTING FACILITIES IN SELECTED UPLAND FARMING COMMUNITIES IN ALBAY PROVINCE, BICOL REGION, PHILIPPINES

MONITORING SHEET

A. BASIC INFORMATION

PROJECT SITE (Barangay, Municipality)	NAME OF FARMER-COOPERATOR	SIZE OF THE RWHF			NUMBER OF FARMERS BENEFITING FROM THE RWHF	SIZE OF FARMS CULTIVATED BY THE FARMER-COOPERATOR AND FARMER BENEFICIARIES	TYPES OF CROPS BEING CULTIVATED
		L (m)	W (m)	H (m)			

B. MGA KASUNDUAN SA PAGGAMIT/DISTRIBUSYON NG TUBIG MULA SA RWHF

Anu-ano ang mga naging kasunduan ng mga magsasaka sa mga sumusunod?	Mga Kasunduan
a) Sharing o ang paghahati-hati at distribusyon ng tubig mula sa RWHF hanggang sa mga ibang nakikinabang na magsasaka (farmer-beneficiaries)?	
b) Maintenance o ang pagpapanatili ng RWHF	
• Regular na pagche-check o pagsuri ng mga pipes o daluyan ng tubig	
• Regular na pagtatanggal ng mga damo o nga peste sa paligid ng RWHF	
• Regular na pagche-chek ng kabuuang pisikal na kondisyon ng RWHF	

C. MGA SULIRANIN/PROBLEMA/ISYU SA PAGSASAGAWA AT PAGPAPANATILI NG RWHF

Anu-ano ang mga naging suliranin, problema o isyu sa mga sumusunod	Mga Suliranin/Problema/Isyu	Mga Solusyong Isinagawa Upang Matugunan ang Suliranin
a) Pagsasagawa ng RWHF		
b) Pagpapanatili o maintenance ng RWHF		
c) Distribusyon ng tubig mula sa RWHF patungo sa mga sakahan		
d) Iba pang mga suliranin (tukuyin)		

D. EFFECTIVENESS AND EFFICIENCY OF RWHF

1) Pagkolekta at pag-imbak ng tubig (isulat sa likod kung kulang ang ispasyo)

Pangalan ng Farmer-Cooperator	Petsa ng umulan sa lugar (Month/Date)	Taas o metro ng tubig na nakolekta	Ilang araw/linggo tumagal o naimbak ang tubig pagkatapos ng ulan
1.			
2.			
3.			
4.			
5.			

2. Pakinabang sa tubig-ulan na nakolekta

Pangalan ng Farmer-Cooperator	Mga pakinabang mula sa tubig-imbakan (RWHF)	Ilang magsasaka na kalapit ang nakinabang mula sa tubig-imbakan	Mga pananim na pinaggagamitan ng tubig mula sa RWHF	May mga ibang pananim ba o isda na nailagay sa paligid o loob ng RWHF? Anu-ano ang mga ito?
1.				
2.				
3.				
4.				
5.				

3) Tibay at tatag ng mga RWHF

	Farmer Cooperator 1	Farmer Cooperator 2	Farmer Coopertor 3	Farmer Cooperator 4	Farmer Cooperator 5
Maymga naisagawa na bang repair o pagsasaayos ng mga RWHF pagkatapos itong magawa? Kung oo, anu-ano ang mga ito?					
Nakakaimbak ba ng tubig ang RWHF nang matagalan? Gaano katagal naiimbak ang tubig dito?					

4) May mga suhestiyon o rekomendasyon po ba kayo upang mas maging kapaki-pakinabang ang RWHF? Kung meron, anu-ano ang mga ito?

Pangalan ng Farmer-Cooperator	Mga Suhestiyon/Rekomendasyon
1.	
2.	
3.	

Pangalan ng Farmer-Cooperator	Mga Suhestiyon/Rekomendasyon
4.	
5.	

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