Climate Smart Farmers' Field School as Extension Modality for Climate Change Adaptation in Rice Farming: Bicol, Philippines

A Success Story

Asia-Pacific Association of Agricultural Research Institutions

4th Floor FAO Annex Building, 202/1, Larn Luang Road,
Klong Mahanak Sub District, Pomprab Sattrupai District,
Bangkok 10110, Thailand

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Dr. Cely S. Binoya

Executive Director, Asia Pacific Association of Educators in Agriculture and Environment

Former Professor and Dean of the Graduate School

Central Bicol State University of Agriculture Philippines

Asia-Pacific Association of Agricultural Research Institutions

4th Floor FAO Annex Building, 202/1, Larn Luang Road

Klong Mahanak Sub District, Pomprab Sattrupai District

Bangkok 10110, Thailand

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For copies and further information, please write to:

The Executive Secretary
Asia-Pacific Association of Agricultural Research Institutions (APAARI)
4th Floor, FAO Annex Building
202/1, Larn Luang Road, Klong Mahanak Sub-District
Pomprab Sattrupai District, Bangkok 10110, Thailand
Tel : (+662) 282 2918
Fax : (+662) 282 2919
E-mail: apaari@apaari.org
Website : www.apaari.org

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Contents

Foreword

Farmer Field Schools, a participatory knowledge sharing approach is known for building capacity of farmers for efficient, sustainable and inclusive food production systems. It draws and builds inspiration from practical experiences of farmers and gathers crescendo as the learning event progresses and as farmers discuss and experiment on new agricultural management techniques.

The success story shows imprints of Dr. Cely S. Binoya's rich academic and professional life in extension education, climate science, disaster risk management including Earthquakes.

The Climate Smart Farmers Field School (CFS) enhanced the capacities of 629 farmers in Climate Change adaptation skills in rice production in 14 farming barangays in 3 municipalities in BICOL Philippines by increasing their knowledge and skills on climate change adaptation strategies, demonstrating hands-on climate risk resilient agricultural technologies and setting up of small scale irrigation systems.

The CFS adopted an implementation framework covering 4 stages: the preparatory stage, familiarization stage, skills enhancement and innovation/application stage.

The CFS equally had an aspect of gender mainstreaming where at the end of the capacity and knowledge sharing programme there were changes in gender roles with women participating more in decision making activities related to farming that would require family investments. According to Binoya's narration, female participation in decision making increased in six aspects of farm operations: water management, fertilizer management, pest and weed management and in post-harvest handling and packaging of harvested palay for the market.

The CFS was not only farmer geared, it equally targeted policy Climate -Agriculture -Modeling and Decision Support Tool (CAMDT); a computer desktop tool designed to guide decision-makers on adopting appropriate crop and water management practices that can improve crop yields in a climatic condition.

The CFS equally introduced Good Governance Processes to Farmer Organizations as farmers associations were guided in drawing up written constitutions, by-laws and rules to avoid internal conflicts and make the responsibilities of officers and members clear. Besides perenniality and sustainability of the knowledge is also gained.

The CFS was not a stop gap measure, the project implementers ensured that the initiatives undertaken by the project are sustained after project termination. Hence, the following sustainability mechanisms was adopted: the local government units passed an Ordinance that institutionalized CFS and equally it financial support. The three local government units that were host to the CFS, created a local law that ensured implementation of CFS as Agricultural Technicians of the LGUs were assigned to carry out the CFS in other barangays not covered by the project.

Dr. Binoya's CFS now has to be scaled up to a research and extension modality through which the Department of Agriculture (D. A) and the Municipal Agriculture Offices (MAOs) can effectively educate farmers on CC and CCA to ensure that they can adapt to climate change and cushion its impacts on their farm productivity.

I would like to laud the efforts of the Knowledge Management Coordinator of APAARI, Fai Collins in meticulously improving and editing this publication. It is our expectation that APAARI members, stakeholders and other readers will find this important publication both informative and useful.

Ravi Khetarpal
Executive Secretary
APAARI

Climate Smart Farmers' Field School as Extension Modality for Climate Change Adaptation in Rice Farming: Bicol, Philippines

Cely S. Binoya[1], Elena B. De Los Santos[2], Antonio P. Payonga[3], Rodel P. Tornilla[4], Annalyn O. Agua[5], Sarah D. Sambajon[6], Kim Jonah P. Bolivar[7], Edlynne Kaith P. Ravago[8], and Agnes C. Rola[9]

[1]Asia Pacific Association of Educators in Agriculture and Environment (APEAEN), Philippines, celybinoya2@gmail.com
[2]Department of Agriculture, Regional Field Office 5, ebdsa2012@yahoo.com
[3]Bicol University Graduate School, appayonga@yahoo.com
[4]Department of Agriculture, Regional Field Office 5, rodel_tornilla@yahoo.com
[5]Central Bicol State University of Agriculture (CBSUA), Philippines, olanoannalyn@gmail.com
[6]Bicol University College of Agriculture, Philippines, sambajon.sd@gmail.com
[7]Department of Agriculture, Regional Field Office 5, kimjonahbolivar@gmail.com
[8]Department of Agriculture, Regional Field Office 5, ekaithravago@gmail.com
[9]University of the Philippines at Los Banos, College of Public Affairs and Development, Philippines, acrola@up.edu.ph

ABSTRACT

Extreme hydro-climatic conditions, such as droughts, flood and typhoons can adversely affect or even completely interrupt agriculture systems and other agri-water related services. Drought can result in irrigation water scarcity that may lead to poor yield, while direct losses are experienced by farmers during typhoon and flood season. Climate change is expected to increase incidence of these natural hazards putting food security at risk. With heavy reliance on indigenous knowledge by farmers, they are usually unable to cope with the impacts of extreme events, necessitating science-based interventions to deliberately introduce climate change adaptation practices to the farmers. This was the basis of the USAID funded Bicol Agri-Water Project on Climate-Smart Farmers' Field School (CFS) that aimed at disseminating science-based climate information to farmers.

The CFS ran for two years covering two wet and two dry seasons in three project sites in Bicol, Philippines. A Total of 616 farmers graduated out of 629 participants from 14 barangays (villages); 271 of whom are males and 345 females. Weekly learning by hands-on sessions were conducted to introduce climate change adaptation strategies. The sessions covered wide ranging topics such as the use of multi-trait rice varieties suitable to drought, flood and saline-prone areas, the sloping agricultural land technology for the upland areas of Polangui, integrated farming system, organic fertilizer production and vermi-composting (as source of organic fertilizer) , water management technology (alternate wetting and drying) as an irrigation strategy, and the installation of small scale irrigation systems to enable farmers to farm even with the occurrence of drought of dry spell.

Results showed that the CFS increased the knowledge of farmers on CC, CCA and on the technologies introduced; yield increased; and income also increased with an ROI of 49% in the wet season and 55% for the dry season. There were also changes in gender roles with women participating more in decision making activities related to farming that would require family investments. The sustainability mechanisms include the passage of local ordinances to institutionalize the CFS, organizing farmers and training them on sustainable livelihood options.

Key words : Climate Change Adaptation, Climate Smart Field School, Extension Modality, Rice Farming, Bicol, Philippines

Acronyms and Abbreviations

ATs	Agricultural Technicians
AWS	Automatic Weather Station
AWD	Alternate Wetting and Drying
BAWP	Bicol Agri-Water Project
BSWM	Bureau of Soils and Water Management
BU	Bicol University
BUCAF	Bicol University College of Agriculture and Forestry
CAMDT	Climate Agriculture Modelling and Decision Tool
CBSUA	Central Bicol State University of Agriculture
CC	Climate Change
CCA	Climate Change Adaptation
CDP	Climate Data Pricessor
CFS	Climate Field School / Climate Smart Farmers Field School
CLEA	Climate Forecast and Extension Advisory
CPRA	Climatized Participatory Resource Appraisal
CRM	Climate Risk Management
DA	Department of Agriculture
DA ATI	Department of Agriculture, Agricultural Training Institute
DA-RFO 5	Department of Agriculture-Regional Field Office 5
DENR	Department of Environment and Natural Resources
DOLE	Department of Labor and Employment
DOST	Department of Science and Technology
DRR	Disaster Risk Reduction
DRRM	Disaster Risk Reduction and Management
ENSO	El Nino Southern Oscillation
FA	Farmers' Association
FAO	Food and Agriculture Organization

FFS	Farmer Field School
GPOs	Good Practice Options
IFS	Integrated Farming System
IK	Indigenous Knowledge
IMO	Indigenous Microorganisms
IPM	Integrated Pest Management
IRI-CU	International Research Institute for Climate and Society – Columbia University
LGU	Local Government Unit
MA	Municipal Agriculturist
MAO	Municipal Agriculture Office
MAS	Municipal Agriculture Services
MOCSFA	Monte Calvario Smart Farmers Association
NIA	National Irrigation Administration
NGO	Non-Government Organizations
NSIC	National Seed Industry Council
PA	Project Assistant
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PSB	Philippine Seed Board
RAELine	Rainfed Advanced Elite Line
ROI	Return on Invenstment
SALT	Sloping Agriculture Land Technology
SFR	Small Farm Reservoir
SSIS	Small Scale Irrigation System
STW	Shallow Tube Well
SUC	State Universities and Colleges
TOT	Training of Trainers
TWG	Technical Working Group
UP	University of the Philippines
UPLB	University of the Philippines at Los Baños
UPLBFI	University of the Philippines at Los Baños Foundation, Inc.
USAID	United States Agency for International Development

1 Introduction

Climate change (CC) is a global phenomenon that poses a threat to food security. Extreme events, like droughts, floods and typhoons brought about by the changing climate adversely affect agriculture, including services from the water resources systems. Drought can result in irrigation water scarcity leading to poor yield, while farmers suffer from direct losses during typhoon and flood season. CC increases the incidence of these natural hazards putting food security at risk (Rola, et.al. 2017).

This phenomenon has serious implications in the agriculture sector in adapting to changing climate, particularly in modifying cultural practices and the use of appropriate technologies to mitigate and/ or cushion the impacts of climate change. Climate change adaptation (CCA) can significantly reduce many potentially dangerous impacts and reduce the risk of key vulnerability factors (*Schneider, S.H,* et.al. 2010).

As defined in wikipedia, CCA is a response to global warming and CC, that seeks to reduce the vulnerability of social and biological systems to relatively sudden change to offset the effects of global warming. Adaptation is especially important in developing countries like the Philippines, since these countries are predicted to bear the brunt of the effects of global warming (Cole, 2008). Reily and Schimmelpfennig (1999) also reported that adaptation at the farm level, through changes in crops, cultivars, and production practices, is a necessary adaptation mechanism.

However, adaptation among farmers does not take place overnight. Farmers with their belief system and indigenous knowledge (IK), do not easily change their age-old farming systems because these practices may have proven useful to them, regardless of results. This reality has challenged the extension system to develop extension modalities, approaches and strategies in introducing the needed technologies to the farmers to solve their production problems. The Farmer Field School (FFS) is one of the approaches that was tried in extension in the late 80s

The FFS is a group-based learning process that has been used by a number of governments, NGOs and international agencies to promote integrated pest management (IPM). According to Wikipedia, the first FFS was designed and managed by the United Nations (UN) Food and Agriculture Organization (FAO) in Indonesia in 1989. The study of Godtland, et.al, (2004) found that farmers who participated in the FFS program have significantly more knowledge about IPM practices than those in the non-participant comparison group. They have also found suggestive evidence that improved knowledge about IPM practices has the potential to significantly improve productivity in potato production. The FFS was not only effective in technology transfer but it was also effective in promoting social transformation as reported by Khisa, et. al. (2014). They found that through the FFS, specific technical skills, organizational skills and practice, analytical skills and practice, and basic group assets, such as the trust and confidence required for joint activities were provided to farmers. On the effect of FFS to the farmers and the farming community, an FAO study conducted in Ghana in 2008 on four different approaches in extension, reported that FFS model proved very effective at strengthening farmers capacity and in empowering rural people. The FFS program showed positive impact on production and income among women, low-literacy, and medium land size farmers.

Participation in FFS improved overall agricultural income and crop productivity. Davis, et.al. (2012) corroborated the report saying that the FFS is a useful approach to increase production and income of small-scale farmers in East Africa. Gwary, et.al. (2015) also found empirical evidences that show how the approach reached the small holder farmers in sharing knowledge and skills which had positive effect in transforming farmers and increasing the quality of their produce (yields) and income. Furthermore, several studies have shown that knowledge and skills obtained by the FFS participants are lasting and sustainable (Rola et al. 2002). The positive effect of the training is still measurable several years after the training took place, with trained farmers performing better than their untrained neighbors (FFS Bangladesh, 2011). A meta-analysis of 25 impact studies commissioned by FAO (van den Berg 2004) concluded that in the majority of studies, there were substantial reductions in pesticide use and in a number of cases, of increased yield due to training. Furthermore the 'empowerment' impacts of the training resulted in widespread and lasting developmental impacts, such as continued learning, and increased social and political skills that enable improved agro-ecosystem management.

2 The Challenges

In recent years, the climate change phenomenon that brings negative impact on the agriculture sector became a challenge to the Philippine Extension System and the local government units (LGUs) that handle the delivery of agricultural services to the Filipino farmers after devolution in 1991. Despite having IK in farming, farmers are unable to cope with CC due to many vulnerability factors, like their low knowledge on climate forecast, hence the need for a science-based strategy to address CC.

To initially address the problem, Golez (2012) reported that the LGU of Dumangas, Iloilo, Philippines, with most of its area devoted to agriculture and fisheries, started Climate Field School (CFS) in 2007. The CFS adapted the FFS method, by integrating climate information and adaptation modules. It replicated the CFS model of Indramayu, Indonesia. The report showed that "aside from being able to help the farmers increase farm production, the CFS program enhanced the farmers' adaptive capacity, while addressing poverty and reducing vulnerability and their causes. CFS also enabled them to monitor the changing weather and adjust their farming practices, hence, they were able to maintain good quality agricultural products despite the continuous threats due to climate change". The Dumangas experience also noted that "through the CFS program, farmer participants have become more knowledgeable and well equipped in their farming practices. Moreover, the farmers are now able to identify available management options in order to lessen climate-related risks. They are now able to understand the process of forecast interpretation, translation, and communication for agricultural applications. In the same manner farmers in Indonesia, have had impressive rice yields despite El Niño-induced drought as a result of CFS organized by the Indonesian Agency for Meteorology, Climatology and Geophysics. This is because, the CFS served as venue to discuss how to apply weather and climate information during the planting and growing season, how to use simple tools like rain gauges, and temperature and humidity readings. Following the success of the CFS in Dumangas, it was also tried in Irosin, Sorsogon Philippines, giving favourable results.

Currently, the Philippines' Department of Agriculture (DA) is faced with the challenge of enhancing the regular FFS program towards Climate- Smart Farmers Field School (CFS). As mentioned earlier, through the CFS, locally-tailored climate information is incorporated into the FFS curriculum to enhance farmers' capacity in planning and decision making to improve disaster preparedness and to minimize losses or reduce the impacts of climate-related hazards in their farming activities. According to Oxfam, (2015), the CFS is working directly with local farmers by providing information and training in climate-smart farming practices and ensuring that farmers have access to reliable climate and weather information on which to base planting decisions.

The Bicol Region is also in need of a CFS since the area is also highly vulnerable due to climate change. Billion pesos worth of damages to agriculture has been recorded since Typhoon Reming, international code name "Durian" with 320kph wind struck Bicol in 2006 and Super Typhoon Nina known as Nock-ten hit Bicol in 2016. Between this period, many extreme events took place in the Bicol region, including floods, dry spell, and volcanic eruptions that caused severe damage to agriculture, lives and properties. Farmers could hardly cope with the impacts of these extreme events, necessitating a science-based intervention to effectively manage their farming practices.

3 Initiatives

According to FAO (2016), the CFS and FFS programs fall under the domain of extension services and technology transfer. It represents a significant step forward in agricultural education and extension by increasing the resilience of small-scale farmers. The traditional top-down technology transfer systems have a role in some aspects of agriculture development, but the human capacity building required for the creation of independent commercial farmers and farmer organizations needs new approaches.

The project titled "Water Security under Climate Risks: A Philippine Climate Change Adaptation Strategy for the Agriculture Sector" was implemented by the University of the Philippines Los Baños Foundation, Inc. (UPLBFI) in collaboration with the International Research Institute for Climate and Society-Columbia University (IRI-CU), Department of Agriculture-Regional Field Office (DA-RFO) 5, the Central Bicol State University of Agriculture (CBSUA), Bicol University (BU) and the Local Government Units (LGUs) of Albay and Camarines Sur, and other regional partners. Dubbed the Bicol Agri-Water Project (BAWP), the development initiative ran for five years (2012-2017) with funding from the United States Agency for International Development (USAID). One of the activities of the BAWP was the conduct of the CFS.

The BAWP innovated on the CFS and adopted the Climate Smart Farmer Field School (CFS) as an extension modality for building capacity of farmers in selected barangays in Bicol, Philippines from 2013 – 2014 covering two wet and two dry seasons. It provided farmers the opportunity and the ways to learn by doing. It involved a series of lecture sessions and hands-on exercises in the field for one whole cropping cycle for a period of two years (Ravago, et.al, 2017).

This paper describes the CFS and its development framework as formulated in the BAWP project. It also describes the interventions introduced during the CFS; the knowledge gained by farmer- graduates; the changes in gender roles after the CFS attendance; the yield and income performance of the CFS farmers; and the sustainability measures implemented by the project.

The Project Site

The project focused on two watersheds (sub-basin) (Fig.1), (1) the Buhi-Barit Watershed Reservation and Quinale A Watershed in Polangui. The study towns are Nabua and Buhi in Camarines Sur; and Polangui in Albay. Buhi-Barit Watershed Reservation is located in the municipalities of Buhi, Sangay and Iriga City in the province of Camarines

Fig. 1. *The map of the Philippines and the map of Bicol showing the project sites within the Bicol River Basin area (https://www.bing.com.images)*

Sur covering an area of 18,379.8 hectares covering the municipality of Buhi extending to Mount Asog and Mount Malinao including parts of the municipalities of Sangay in Camarines Sur and the City of Iriga. 92) the Quinale A watershed cut across the municipalities of Polangui, Oas, Ligao City and Tabaco City in the province of Albay, covering an area of 53,565 hectares. These areas have mainly rice-based agri-ecosystem.

Shown below are the maps of the Philippines and the project sites.

A total of 629 farmers from 14 barangays participated in the CFS: 5 barangays in Buhi with 224 farmers, 4 barangays in Nabua with 185 farmers and 5 barangays in Polangui involving 220 farmers. These numbers represent the participants in the CFS for two years covering two wet and two dry seasons in the three project sites.

The farmers were selected after a benchmark survey of farmers in selected barangays using a list provided by the Municipal Agriculture Office.

The BAWP Climate Smart Farmers' Field School

The CFS targeted to enhance capacities of farmers to adapt to climate variability and change by:

- increasing knowledge and skills of farmers on climate change adaptation strategies;

- demonstration of climate risk resilient agricultural technologies; and
- establishment of small scale irrigation systems.

The teaching-learning process involved a series of lecture sessions and hands-on exercises in the field for the whole cropping cycle. The CFS was designed to provide farmers with agricultural technologies and locally tailored climate information to enhance their capacities in planning and decision making to improve farming practices (Ravago, et.al, 2017).

The CFS was conducted in 14 farming barangays in three municipalities, namely Barangay Sta. Cruz, Monte Calvario, Dela Fe, Sagrada and Iraya in Buhi; San Vicente, San Esteban, San Antonio Ogbon, and San Roque Madawon, in Nabua, Camarines Sur; and Balangibang, Pintor, La Medalla, Kinuartelan and Gamot in Polangui, Albay. The CFS (Fig. 2) served as venue to impart agriculture technologies and water management practices such as small-scale irrigation systems (small water impoundment, shallow tube well technology for groundwater extraction) and other water saving technologies in rice to improve farmers and local communities' resiliency to hazards brought about by climate change.

Fig. 2. *CFS classrooms are make-shift structures, church and other village level spaces.*

The BAWP CFS Implementation Framework

The CFS adopted an implementation framework covering 4 stages: the preparatory stage, familiarization stage, skills enhancement stage and the innovation/application stage (Fig. 3).

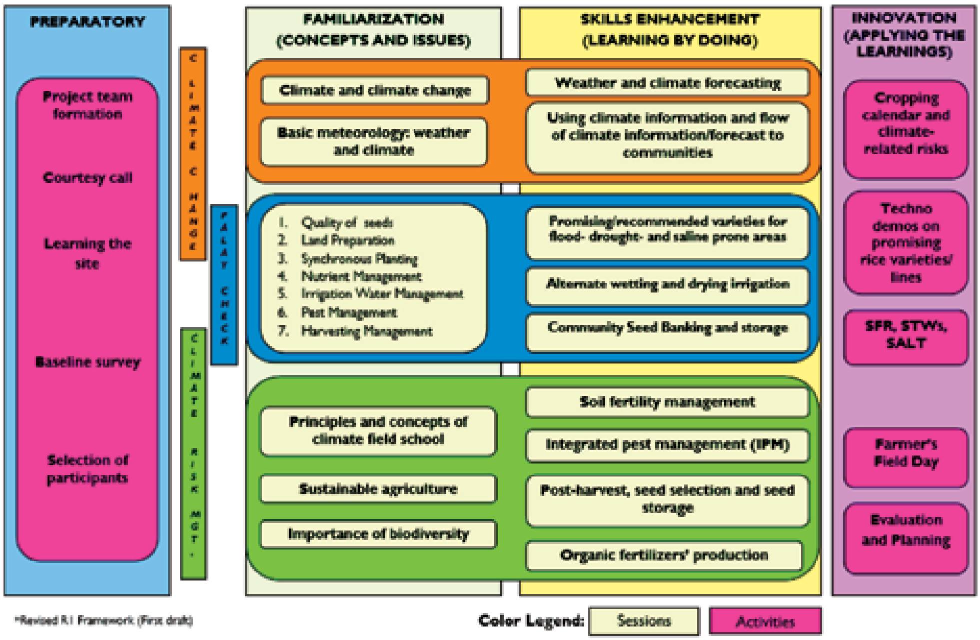


Fig. 3. *Framework followed in implementing the Climate-Smart Farmers Field School (Ravago et al., 2017)*

Preparatory Stage

The preparatory stage included project team formation, courtesy call to the Local Chief Executives and the Municipal Agriculturists, project site assessment and analysis using the Climatized Participatory Resource Appraisal, carrying out of Baseline Survey to identify potential farmer-participants and finally, the selection of participants to the CFS.

Formation of the Project Team

This was made at two levels; project level team and LGU counterpart team. The LGU team was composed of Agricultural Technicians tasked to perform community coordination. They were also trained on the use of the CFS modules and to facilitate the field school.

Courtesy Call to the Local Chief Executive and the Municipal Agriculturist

This was a necessary step in the project development cycle. This was carried out to establish rapport, carry out project orientation/ briefing and agree on forthcoming activities relative to project implementation.

Project Site Assessment and Analysis

The Climatized Participatory Resource Appraisal (CPRA) of Camarines Sur and Albay was conducted on October 17-19, 2012. It's was to gather relevant information on current levels of production and livelihood profiles in the target communities; assess their current climate-related risks and hazards; identify local/indigenous coping capacities and adaptation strategies as well as physical and environmental constraints experienced; determine the different local institutions assisting the target communities in climate change adaptation and disaster risk management; and identify and prioritize adaptation/technology options for specific climate-related hazards/risks.

Baseline Survey

A baseline survey was conducted to analyze the present farming conditions and farming system of the rice farmers in the locality and to come up with recommendations on how to improve these, and to determine the possibility of adopting climate risk management techniques and approaches. It was also deemed necessary in assessing changes in farmers' cultural practices after the CFS.

Selection of Participants

Based on the results of the baseline survey, the farmer participants to the CFS were selected. The main consideration was the willingness of the farmers to attend and actively participate in a season-long CFS activities,

Familiarization Stage

The familiarization stage covered introduction of theories and concepts on climate change (CC) and climate risk management (CRM), side by side with relevant contents in the Palay Check of the FFS. Topics discussed under CC included: Climate and Climate Change and Basic Meteorology. Under the CRM, topics were Principles and Concepts of the CFS, Sustainable Agriculture, and Importance of Biodiversity. Seven topics under the Palay Check were studied at this stage : 1) quality of seeds, 2) land preparation, 3) synchronous planting, 4) nutrient management, 5) irrigation water management, 6) pest management, and 7) harvesting management (see Figure 3).

Skills Enhancement Stage

At this stage, topics were discussed with farmers' practicum. CC topics that were demonstrated and practiced by farmers included weather and climate forecast and using climate information and flow of climate information or forecast to the communities. CRM topics included: soil fertility management, integrated pest management, post-harvest seed selection and storage, and organic fertilizer production (vermi-composting). Three Palay Check topics were also discussed and demonstrated under this stage. There were promising / recommended rice varieties for flood, drought and saline prone areas, alternative wetting and drying irrigation system, and community seed banking and storage.

Innovation/ Technology Application Stage

At this stage, farmers were already engaged in techno demos of promising rice cultivars, use of cropping cum hazard calendar, installation of small scale irrigation system, demonstration of the Sloping Agricultural Land Technology in the uplands, conduct of Farmers' Field day and Evaluation and Planning for the next cropping season. It is worthy to note that the innovation / application stage is also integrated to the familiarization and skills enhancement stage as applicable.

4 Major Outputs

Actual Conduct of the CFS

Four season-long CFS was conducted, two for wet and two for dry seasons. The CFS adapted a module on climate science, water resource and climate risk management applied to rice farming, which was tested in Iloilo and Sorsogon. An alternative water management technology was also introduced. The adaptation package centered on watershed improvement as core included activities to conserve ecosystem services, and practices for specific crops and other forestry products, as well as improved gender relations. The CFS also used the existing Palay Check Farmers Field School's learning module of the DA, and integrated other relevant concepts on the effects of climate change in agriculture, CCA in agriculture, disaster risk reduction and management (DRRM), water management technologies and other essential topics, to come up with innovative and practical CFS learning module. A total of 616 farmers graduated from the CSFFS out of 629 initial participants, made up of 217 males and 345 females, registering a success rate of 98%.

Training of Trainers

The DA-RFO5 managed the CFS through Agricultural Technicians (ATs) assigned in the target barangays. Though the ATs were already acquainted with the FFS methods, they were further trained through the "Training of Trainers in Climate-Smart Farmers Field School (TOT- CFS)" to enhance their knowledge on climate, climate change scenarios, and possible effects to agriculture. In the TOT for CFS, resource persons were invited from relevant agencies like the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), National Irrigation Administration (NIA), the Department of Environment and Natural Resources (DENR), Bureau of Soils and Water Management (BSWM), the University fo the Philippines at Los Banos (UPLB), the Central Bicol State University of Agriculture (CBSUA), the Bicol University – College of Agriculture and Fisheries (BUCAF) and International Research Institute for Climate and Society-Columbia University (IRI-CU).

Conduct of Weekly CFS Learning Sessions

The retooled ATs served as the CFS facilitators and resource persons during the entire duration of the season-long CFS. Resource persons were invited from the above agencies on special topics and in the conduct of key hands-on, on-farm activity (*e.g.*, establishment of contours in the uplands). Regular weather forecast and/or warning on extreme events were discussed with the farmers and were inputted in making adjustments in their cropping plans, if necessary.

Lakbay-aral (Field Trips)

Part of the learning activities of the CFS participants was exposing them to suitable farming technologies that they would adopt to promote the practice of sustainable agriculture. There were also lectures from farm managers / owners on the technologies they adopt and how they operate their farms. Per request by the farmer-participants, the farmers that were visited include the Pecuaria Development Cooperative, Inc. in Bula, Camarines Sur, which is dubbed as the Home of Organic Farming in Bicol; the Penafrancia Sugar Mill where they observe vermi-composting and sugar milling for the upland farmers of Polangui; the Carmel Farms in Pili, a 5-hectare organic training farm; and the Organic Agriculture Development Project in CBSUA.

Provision of Inputs and other Logistical Support

During the conduct of CFS, the DA RFO5 provided training and field supplies for the CFS sessions and techno demos in both lowland and upland areas. These were rice seeds (NSIC Rc 238 and 274), different kinds of fertilizers including organic, complete (14-14-14), Muriate of Potash (0-0-60), and Urea (46-0-0); soil test kit, minus one element test kit, assorted vegestable seeds, and laminated sacks. Garden tools like wheel barrow, knapsack sprayer, water sprinkler, hoe, shovel and rake were also provided. Fuel was also provided for transportation, food and other training expenses, as well as water and electricity. The CFS participants, on the other hand, provided local food for snacks during their trainings.

Monitoring and Evaluation

The partners in the academe monitored and evaluated the conduct of the CFS and the changes in adaptation behaviour of the farmers who attended the CFS. Farmers were trained to monitor their performance through farm record keeping.

A monitoring and evaluation system was integrated in the CFS curriculum to have a timely assessment and to make improvements in the activities, processes and tools as well as determine the outputs and outcomes of the CFS, and its effectiveness after a season of implementation. The monitoring process during the conduct of the CFS includes the following:

Leveling of Expectations

This was conducted on the first session of the CFS to find out the participants' expectations on the activity; to identify expectations that do not match with the CFS framework and to determine their areas of interest.

Weekly Assessment

This was done after every session to evaluate the activities of the day. Farmer participants gave feedback (positive/negative) on the sessions conducted and recommendations were made. Planning of activities and list of inputs needed for the next sessions were made and farmer participants were reminded of their duties/ responsibilities.

Farm record keeping and Planning

Farmers were trained to do farm recork keeping to keep track of all farm expenses and income, ensure smooth flow of farm activities and in making future decisions to increase productivity, efficiency and income in the use of available resources. Planning was necessary to maximize utilization of limited resources.

Farm Self-assessment Session

This was scheduled on the latter part of the CFS to help the farmer participants evaluate themselves in terms of changes in the field results, such as yield. The adoption level of recommended practices was checked and viable or appropriate techniques were identified during this session.

Self-evaluation Session

This was done to determine the level of empowerment and weaknesses of the farmer participants. This session prepared them to be more aware of what they have gained from participating in the CFS.

Planning Ways Forward

In the last session of the CFS, the participants were assisted to see the need for, and appreciate the process of planning for the promotion of the groups' continuing activities towards the next CFS cycle.

On the part of the project implementers, on-going CFS in the different study sites were monitored on a weekly basis. Schedules were properly arranged to enable the Project Assistants (PAs) from the DA RFO 5, CBSUA and BUCAF to monitor their respective areas within a week time.

Monitoring Activities after CFS Implementation

A critical activity for the project was the periodic monitoring of the farmers' activities to effectively assess the impact of the CFS not only to the participants, but also to those who were not part of the CFS. The monitoring was done through the following:

Conduct of Regular Farmers' Meetings and Trainings

Farmers' meeting is a once a month assembly of CFS graduates and other interested farmers in the study site. It was a continuing activity which usually lasted for 3-4 hours. The AT facilitated this meeting but in her/his absence, the PA of BAWP or the President of the farmers' association took over. During the meeting, updates on farming technologies, rain data collection, weather and climate advisories vis a vis their cropping cum hazard calendar, discussion of the Seasonal Climate Forecast and Extension Advisory (CLEA), crop insurance coverage, irrigation and planting schedules, topics requested by the farmers and other topics/information for dissemination deemed necessary by the AT/PA were discussed. Farmers' meeting also served as venue for organizational development, providing updates on their application for registration of their farmers' organization to the Department of Labor and Employment (DOLE) and formulation of guidelines for the association's project implementation. Several factors such as small number of attendees and farmers who opposed the idea to register the association formally, (thereby limiting its access to government projects and interventions) affected the conduct of the meetings.

Farm Record Keeping

Farm record keeping is an activity learned from the CFS which enabled participants to have detailed records of the daily operations, income and expenses from their farms. Record keeping provides valuable information on farm activities that are successfully implemented and the reasons why some are not; and whether a farmer gains or loses money. As part of monitoring the technology adoption of farmers, the PAs collected the farmers' farm records every end of the planting season to determine the status of their farming activities.

Results of Technological Interventions Introduced Through the CFS

Technology demonstration is one of the key elements of the CFS. It is one of the farmer-led extension approaches used in a Farmer Participatory Research (FPR) and Extension process. The FPR was a deliberate effort among agricultural professionals to combine farmers' indigenous traditional knowledge with the more widely recognized expertise of the agricultural research community where farmers are actively involved in setting the research agenda, implementing trials and analyzing findings and results (Farrington and Martin, 1988). As such, nine demonstration farms were established adjacent to the learning sites, hand-in-hand with the conduct of the CFS. These served as practical and experiential learning stations, where farmer-participants, on a weekly basis observed and learned the different growth stages of rice, as well as the performance of rice varieties and various component- technologies during the entire duration of the field school. The observations and subsequent sharing of ideas and experiences among farmer-participants served as an integral part in the improvement of knowledge, attitude and skills in rice production. The following are the technology demonstration projects established through the CFS:

Use of Multi-trait Rice Varieties

In the techno-demo sites, new rice varieties were planted to determine which ones were highly adaptable in each site. Promising rice lines in the process of purification (no commercial name yet) were evaluated for several seasons before the National Seed Industry Council (NSIC), formerly Philippine Seed Board (PSB), will certify and release them as fit for commercial purposes.

In Nabua, Camarines Sur, four rice lines were evaluated (Fig. 4), the PSB RC 18 Sub-1, Green Super Rice 8 (GSR 8), Rainfed Advanced Elite Line (RAELine) 10 and V4. Based on the grain yield, GSR 8 was the fittest variety in the municipality.

Fig. 4. *Climate Field School farmer-students establishing the techno-demo farm at San Esteban, Nabua, Camarines Sur*

For other locations with different microclimate, the other varieties were deemed more fit. For instance, in Buhi, Camarines Sur where nine lines were evaluated, results revealed that the most promising varieties were RAELine 10, PSB RC 18 Sub-1 and GSR 2. However, this may not be conclusive because some seeds did not germinate due to the long dry spell and the late onset of the rainy season experienced in the municipality, particularly during the start of the planting season.

In Balangibang, Polangui, Albay, out of the seven lines that were evaluated, GSR 8, GSR 1 and PSB RC 18 Sub-1 were found to be promising.

Based on the yield results of field trials during 2014-2015 dry season, the Palay Check variety NSIC RC 222 (the farmers' preferred variety) generally out-performed the other tested lines in all the municipalities. Though in some sites like Buhi, GSR 2 stood out, in Nabua, GSR 8 performed well. Based on repeat tests, in terms of potential yield, GSR 8 was promising in Balangibang, Polangui, Albay while RAELine 10 consistently exhibited promising results in Buhi and Nabua. These results served as basis in the formulation of location-specific recommendations on promising rice varieties that are highly adaptable in a particular site.

Small Scale Irrigation System (SSIS)

The Shallow Tube Wells

The SSIS is composed of Shallow Tube Wells (STW) and Small Farm Reservoir (SFR). The STW is a tube vertically set into the ground to lift water from shallow aquifer. It can serve contiguous areas owned by individuals or group of farmers. The pumping unit consists of a centrifugal pump powered by diesel engine or electric motor.

The STWs were established in barangays San Esteban and San Roque Madawon in Nabua (Figure 5) and Brgy. Iraya in Buhi, Camarines Sur. These are barangays very prone to drought; where water delivery is inadequate to support farm requirements.

Fig. 5. *STW in barangay San Roque, Madawon, Nabua, Cmarines Sur*

The Small Farm Reservoir

The SFR is a small water impounding dam structure that collects rainfall and runoff. The SFRs were established in the upland Barangays of La Medalla and Kinuartelan in Polangui, Albay where the source of water can be tapped and where rice and other crops can be produced. The Farmers' Association (FA) in the area was tasked to maintain the SFR by planting grasses around the reservoir to minimize soil erosion, planting of fruit and timber trees and establishing the fence around the SFR, to protect the area from stray animals and intruders. Water level measuring gauges were installed in the two SFRs (Fig. 6) to be able to monitor and report the volume of water being impounded and released by the reservoir. Monitoring of measuring gauges was conducted by members of the FA in the area. With the availability of data, the farmers could schedule the release of water from the SFR. The installation and calibration of the water level measuring gauge was supervised by an expert from DA RFO 5.

Fig. 6. *SFR established in Polangui, Albay*

Based on the data collected from monitoring the performance of the SFR in the area, the rainwater collected can supplement the irrigation water for rice production of about 3.8 ha, serving four farmer-beneficiaries. Since rice is the main crop in the area, the SFR served as a supplemental irrigation system that increased the yields of the farmers.

The Sloping Agricultural Land Technology (SALT)

BAWP also established two SALT model farms (Fig. 7) at Barangay Kinuartelan, and Gamot, Polangui, Albay. SALT is a form of alley farming in which field and perennial crops are grown in bands of 4-5m wide between contoured rows of leguminous trees and shrubs.

The SALT model farms intended to showcase conservation and land management technologies appropriate for cultivated upland sloping agricultural areas as well as approaches for sustainable land and crop productivity. Technologies such as contour farming, alley cropping, and integrated farming system were applied in the model farms. The prevailing results confirmed positive economic and environmental benefits of SALT.

Fig. 7. *SALT model farm at Barangay Kinuartelan, Polangui, Albay planted with legumes such as peanuts and other crops like corn and sweet potato*

Integrated Farming System (IFS)

The IFS was introduced to change the farming techniques of participants. Through the IFS, upland farmers in the study sites are able to practice multi-cropping for maximum production and optimal ulitization of their resources. (see Box 1)

Alternate-Wetting and Drying (AWD) Technology

The importance of water and recommended water management practices in lowland areas and the AWD method were also introduced to the participants of the CFS. To produce maximum yield, the Philippine Rice Self-Sufficiency Program or the food staple sufficiency program recommended that farmers should maintain appropriate water depth to attain optimum growth of palay. However, it was stressed that rice farming requires a lot of water supply compared to other crops like corn and usually farmers are carrying out wasteful practices. The discussion also focused on saving irrigation water during land preparation, crop establishment and crop growing period; low cost AWD so that farmers can decide when to irrigate; and

Box 1. A Farmer- Adaptor of Integrated Farming System

Farmer adopts Integrated Farming System from CSFFS

As a CSFFS graduate, Milagros Sarto, practiced integrated farming system. With 11 children to feed, clothe and educate, she explores every possibility to earn a living. By applying the knowledge and skills she learned from the field school, she now provides her family's basic needs by planting vegetables such as string beans, eggplant and cassava along the rice field levee. According to her, "Every piece of land must be used wisely and efficiently".

Ms. Sarto monitors her family's rice farm (upper left) and weeds the levee planted with string beans, eggplant and cassava (bottom left and right).

to bridge the gap between research and extension. This technology can help save water by 33%.

Dynamic Cropping Calendar

A dynamic cropping calendar is a combination of hazard and cropping calendar. It includes information of crops being planted by farmers in a cropping season and the various climate-related hazards that are affecting the area in the same cropping season that can make them vulnerable to climate change impacts. It is dynamic because farmers prepare it based on forecast they get from PAGASA and the DA through the Climate Forecast and Extension Advisory (CLEA). Through the dynamic cropping calendar, corresponding actions in response to the challenges are made by the farmers.

In creating a hazard calendar, one must know the rainfall data, weather hazards that affect the area, their characteristics, forecast interpretation, dates of occurrence, and adverse effects to human lives. It is necessary to integrate hazard calendar to a cropping calendar to determine appropriate timing of farming practices/technology application, which are important mitigating measures to address farm level impacts of climate change.

As shown in the sample hazard and cropping calendar of Buhi, Camarines Sur (Fig. 8), the hazard calendar was the basis for crafting the farmers' cropping calendar. The latter is an offshoot of the CFS. Using the data generated from the integrated hazard-cropping calendar, a local specific dynamic cropping calendar can be established which are used by the ATs to analyze and interpret existing agro-climatic conditions and provide recommendations to farmers. The use of a dynamic cropping calendar is a climate risk management technique which can improve water security and enhance climate resilience in agriculture at the farm level.

Climate Forecast Using CAMDT and CLEA

One of BAWP's state-of-the-art and user-friendly decision support tools that was developed by its partner, the IRI-CU with the two watersheds as pilot areas,

HAZARD AND CROPPING CALENDAR

Buhi, Camarines Sur

Barangay	Month											
	January	February	March	April	May	June	July	August	September	October	November	December
Hazard Calendar												
Sagrada	Dry spell						Heavy rains/Flooding					
Dela Fe	Dry spell						Heavy rains/Flooding					
Monte Calvario							Heavy rains/Flooding/landslide					
Sta. Cruz	flooding						Heavy rains/Flooding					
Iraya	flooding						Heavy rains/Flooding					
Cropping Calendar												
Sagrada	Rice + vegetable + corn+water melon+root crops				fallow period	Rice + Gabi				fallow period	Rice+water melon + vegetable	
Dela Fe	Rice + vegetable + corn+water melon+ root crops				fallow period	Rice + Gabi				fallow period	Rice+water melon + vegetable	
Monte Calvario	Rice + vegetable+perenial crop establishment+ rootcrops				fallow period	Rice + corn (upland-rainfed)+ Duck (lowland)				fallow period	Rice + vegetable	
Sta. Cruz	Rice + vegetable+root crops+ fishing				fishing	Rice (upper part) + gabi + fishing + ducks				fishing + duck	Rice + vegetables + fishing	
Iraya	Rice + corn + vegetable+root crops+ fishing				fishing	Rice (upper part)+ gabi + fishing + ducks				fishing + duck	Rice + vegetables + fishing	

***Fig. 8.** Example of a dynamic cropping calendar which combines the Hazard and Cropping Calendars*

was the Climate -Agriculture -Modeling and Decision Support Tool (CAMDT). It is a computer desktop tool designed to guide decision-makers on adopting appropriate crop and water management practices that can improve crop yields given a climatic condition. Further improvement was made to CAMDT, and its updated version was introduced to participants of the "Intensive Technical Workshop on CAMDT," (Fig. 9) through these hands-on exercises: Exercise 1 covered the changing of variables to be inputted in CAMDT with activity 1 - the effects of fertilizer application to the crops if the amount of fertilizers for a particular planting window was changed; and activity 2 - identifying the optimal planting dates with the planting dates that varied with early, middle and late dates for a particular month. In exercise 2, the participants used their own data based on the existing condition in the field. Outputs of the CAMDT Exercises are then inputted to the CLEA.

The Climate Forecast and Advisory (CLEA) is a one page back to back briefer which contains the six months climate information from PAGASA; historical rainfall data from the rain gauge stations collected by the BAWP's Rainfall Data Collectors (RDCs); El Niño Southern Oscillation (ENSO) Forecast from the IRI-CU; Tropical Cyclone Forecast; CAMDT scenario on early, mid and late application of fertilizer to rice; and the Extension Advisory on Good Practice Options (GPOs) for planting and harvesting, crops or varieties to plant and crop and water management practices suitable to the climate outlook provided by PAGASA. The GPOs for rice and other

Fig. 9. *Technical Workshop on Models and Tools for Water, Agriculture and Knowledge Sharing, February 2014.*

crops are recommended by the respective Municipal Agricultural Officers (MAOs) of the project sites and the DARFO 5. Copies of the CLEA were distributed to ATs and farmers during farmers' meetings and during the Provincial level farmers' summit. It was used as a tool to have an in-depth discussion and presentation of the seasonal climate advisories which in a way could help farmers decide on how to deal with pressing climate-related problems in their farms.

The process of data generation to produce a CLEA involved: 1) testing and evaluating CAMDT through several cases; 2) collaborating with academe partners to run the CAMDT to generate crop yield outlook given a seasonal climate forecast from PAGASA; 3) preparing the CLEA with CAMDT results as input and DA's input on what to do with their standing rice crop at any growth stage considering the climate forecast for the season. There are also advisories presented in terms of good practice options (GPOs) on what to do with other crops, livestock/ poultry and for fishing within the cropping season (Fig. 10).

The lead roles in creating and disseminating the CLEA (after BAWP) are with the municipal study sites and partner academe. The academe runs and analyzes the results from the CAMDT, including the potential and attainable yields and send them to the LGU MAS for the preparation of the CLEA. The project takes cognizance of these roles. On this basis, a "Training Workshop on the Preparation of CLEA Integrating CAMDT" was conducted to: 1) share and discuss the integration of CAMDT into CLEA; 2) discuss the preparation and publication of CLEA; and 3) elicit feedback on how CLEA can be improved, disseminated and sustained.

SEASONAL CLIMATE FORECAST AND EXTENSION ADVISORY (CLEA)

Fig. 10. *The Climate Forecast and Extension Advisory*

Installation of Automatic Weather Station (AWS). Rain Gauges, Rainfall Data Collection and Reporting

Another sustainability mechanism is the installation of AWS in the project sites and rain gauges to collect rainfall data. Selected farmers were trained on rainfall data collection and reporting to Rainfall Data Processors of BAWP. Cellular phones with load were provided to the Rainfall Data Collectors (RDCs). The CDPs consolidated the data by entering these in a computer data base for processing. The monthly return of rainfall observation was then sent to the Climate Data Analyst (CDA) for consolidation and analysis. The data was also sent to PAGASA for generation of the Climate Outlook and preliminary data for the decision support tools, and back to the study site for local farm advisory and local weather forecast.

5 Impact

Results of Knowledge Tests in the CFS

To assess knowledge gained by farmers from the CFS, pre- and post-tests were conducted among the participants. Participants from four barangays were asked 20 questions.

Table 1 below shows the pre-and post- tests results in the three CFS sites in Bicol, the percentage increase and the result of the test of significant difference in test scores (Ravago et al. 2017).

Table 1. Comparison of pre-test and post -test scores of CFS graduates in the three CFS sites in Bicol, (2013-2014).

Barangays	No. of Pax	Mean Pre-test Score	Mean Post -Test Score	% Increase	P-value
			Municipality of Nabua		
San Esteban	29	29.08	70.00	40.92	0.012**
San Antonio Ogbon	27	35.22	79.07	43.85	0.014**
San Roque Madawon	28	44.19	70.18	25.99	0.107
San Vicente Ogbon	40	39.86	74.50	34.64	0.072*
Total / Mean	**124**	**37.08**	**73.44**	**36.36**	
			Municipality of Buhi		
Dela Fe	41	80.92	81.81	0.89	0.589
Monte Calvario	30	80.00	81.05	1.05	0.931
Sagrada	20	72.04	78.29	6.25	0.006**
Iraya	26	74.29	76.15	1.44	0.490
Sta. Cruz	33	76.71	77.06	0.35	0.781
Total / Mean	**150**	**72.79**	**78.87**	**6.08**	
			Municipality of Polangui		
Balangibang	21	36.43	76.90	40.47	0.091*
Gamot	23	32.14	79.26	47.12	0.029**
Kinuartelan	28	32.59	80.19	47.60	0.024**
La Medalla	27	31.97	82.03	50.06	0.028**
Pintor	33	26.52	81.74	55.22	0.033**
Total / Mean	**132**	**31.93**	**80.02**	**48.09**	

**Significant at 10% level*
*** Significant at 5% level*

Comparative analysis of test scores of CFS participants in the three municipalities indicates that Buhi, Camarines Sur farmers had the highest level of knowledge of 72.79% on CC and CCA before the CFS. This could be due to the fact that the farmers in Buhi had been recipients of DRRM activities of the DA-FAO projects since 2009. A score of 31.93%, which is the lowest was observed among the farmers of Polangui, Albay.

Pre-test scores show that from among the barangays engaged in the CFS, barangay Pintor in Polangui registered the lowest score of 26.52%, while the highest score (80.92 % was obtained in Barangay Dela Fe of Buhi . For the post-test, the highest score of 82.03% was obtained in La Medalla, Polangui, followed by Barangay Pintor with 81.74%; consequently, the percentage increase in knowledge gained (55.22%) was observed in Barangay Pintor . The increase in post-test scores of all barangays in Polangui, Albay are significant at 5% and 10% levels. The barangays of Buhi showed small percentage increase in scores since their pre-test scores were already high, however, the increase in post-test score of 6.25% in barangay Sagrada was found to be significantly different from the pre-test score at 10% level. For Nabua, Barangay San Antonio had the highest post-test score of 79.07%. The increase of 43.85% is significantly different to the pre-test score at 5% level. Significant differences in pre- and post-test scores were also observed in barangays San Esteban and San Vicente, Ogbon in Nabua.

In the pre-test, participants in Nabua obtained the lowest scores in questions about factors which would not aid in mitigating the negative impacts of climate change and the quantity of water needed (cc) in the tilling stage. Highest score was noted on questions about the color of the tag for Foundation seeds. Participants of Buhi had the highest correct responses in questions about examples of grasses; examples of Nitrogen; and advantages of synchronous planting. Farmers from all barangays had lowest correct scores in the question about the top ingredient in making indigenous microorganisms (IMO). The next lowest correct scores were obtained for questions on what insect causes tungro; usefulness of farm record keeping; and the top or major cause of damage to Philippine biodiversity. For Polangui, the participants had the most knowledge about the kinds of organic fertilizer as well as the recommended depth of water from tillering until 1-2 weeks before harvesting. They had the least knowledge on the meaning of SALT and how to plant following the SALT.

In the post-test phase, farmers in Nabua showed highest percentages of correct responses in questions about factors which would not aid in mitigating the negative impacts of climate change; the term that refers to a climate condition which results in frequent and strong winds in the Philippines and cause flooding, flashflood, and landslide; the meaning of MOET; typhoons with strong winds above 118 kph; and where weather forecasts can be obtained. Lowest scores were registered in questions about the palay disease that is caused by a fungus; and what Key Check 8 is.

Farmers in Buhi had highest percentage of correct responses in questions about the meaning of AESA, example of grasses, and kinds of organic fertilizer. The next highest percentage of correct responses were on questions about the meaning of climate change; recommended type of seeds to farmers; meaning of PAGASA; and the part of the rice field where there should be no weeds/grasses. The lowest scores were on the use of the leaf color chart or LCC; insect causing tungro; and the use of AWD technology followed by the instrument used to determine wind direction; common rice diseases; and recommended depth of water from tillering up to 1-2 weeks before harvesting.

For Polangui, participants got most correct responses on the identification of grasses and identification of insect pests. The least correct responses were in questions about the use of Alternate Wetting and Drying (AWD) technology; the moisture content of palay that is ready for harvesting; and the kinds of organic fertilizer.

All the barangays that participated in the CFS benefited from the CFS as shown in the increase in the knowledge gained by the farmer-participants based on the pre- and post-test results.

Changes in Gender Roles of CFS Participants

Table 2 presents the changes in gender participation in decision making process in farming practices in the municipality of Nabua, Camarines Sur. As shown in Table 2, women's participation in decision making increased in six aspects of farm operations: water management, fertilizer management, pest and weed management and in post-harvest handling and packaging of harvested palay for the market. It showed that if decision entails household expenditure, then wives would participate in decision making. This was also true for activities that would involve getting income from the farm's harvest, where women are also involved. It was also noted that joint decision making in all aspects of farm operation increased due to the CFS. Highest percentage increase in joint decision making was on pest management (80%), followed by fertilizer and weed management (73%).

There are several possible reasons noted for the aforesaid change in gender participation: 1) majority of the CFS graduates were females; their exposure to CFS curriculum has raised their morale, thereby gaining confidence in sharing their ideas/opinions on matters pertaining to farm practices; 2) majority of the participants during farmers meetings were females (one of the roles of women is to represent their husbands during meetings, while the men are busy attending to farm activities) 3) preliminary results of farm practices monitoring showed that female farmers or wives of farmers have been involved in farming activities particularly in purchasing

Table 2. Percent change in gender participation in decision making in farming practices, Nabua, Camarines Sur

Farm Practice	Before CFC (%)			After CFS (%)			Nature of Change		
	Male	Female	Joint	Male	Female	Joint	Male	Female	Joint
Land clearing and preparation	37	10	53	27	10	63	-	0	+
Crop Establishment	37	10	53	27	10	63	-	0	+
Seeding Management	37	10	53	26	10	63	-	0	+
Water Management	40	7	53	30	10	60	-	+	+
Fertilizer Management	37	10	53	13	13	73	-	+	+
Pest Management	30	10	60	7	13	80	-	+	+
Weed Management	36	10	53	13	13	73	-	+	+
Harvesting	33	7	60	23	7	70	-	0	+
Post –harvest Handling	33	7	60	27	10	63	-	+	+
Packaging of harvested palay	33	7	60	27	10	63	-	+	+

Legend: (+) + increase (-) = decrease (0) = no change

farm inputs, preparing food for farm workers, farm monitoring and harvesting, and selling harvested palay to the rice mill; income from farming were remitted to the wife; and wives have been involved in decision making for farming activities.

Results of Cost and Returns Analysis of Rice Production by Season

Farm record keeping enables the farmer to monitor his farming activities and expenses for the cropping season. It is particularly important for future analysis of production methods, cropping history and decision making. As part of the monitoring process, these records were analyzed to come up with tables and figures that show the comparative cost analysis of irrigated rice farming during the wet and dry season cropping, yield distribution, and comparative cost and return analysis of irrigated rice farming during the wet and dry season cropping.

For LGU Polangui, the average cost incurred in each major activity in rice production is shown in Table 3. Considering the mean cost incurred per activity, harvesting had the highest average cost per hectare both for dry and wet seasons. The lowest mean cost was incurred for irrigation in both seasons. This was due to the presence of the small farm reservoir in the area that was constructed through the project.

Table 4 shows an increase in average yield per hectare from the wet to dry season cropping. It was noted that the yield and gross income of farmers was

Table 3. Comparative cost analysis of irrigated rice farming during the wet and dry season cropping in Polangui Albay, CY 2015-2016.

Cultural Practices	Average Cost Incurred by CFS Graduates (PhP)			
	Wet Season (June – October, 2015)		Dry Season (Nov 2015 – Apr 2016)	
	PhP	Percentage	PhP	Percentage
Seed selection and seedling management	3,611.11	11.8 %	3,806.21	11.9 %
Land Preparation	4,777.43	15.6 %	4,817.21	15.1 %
Planting/Transplanting	3,950.19	12.9 %	4,025.95	12.6 %
Fertilizer and Application	6,241.64	20.4 %	6,321.51	19.8 %
Irrigation	605.91	2.0 %	632.96	2.0 %
Pesticide and Application	2,845.65	9.3 %	2,658.27	8.3 %
Harvesting	8,706.57	28.1 %	9,653.99	30.2 %
TOTAL	**30,738.51**	**100 %**	**31,916.09**	**100 %**

higher during the dry seasons (Nov. 2015 – April 2016) than during the wet season (June-October, 2015) with 5,045.56 kg/ha valued at PhP70,298.23 and 4,435.87 kg/ha valued at PhP59,945.00, respectively. This has corresponding increase in ROI of 55% for the dry season compared to 49% for the wet season.

Farm records also show that production cost per kilo of palay was higher during the wet season than the dry season with PhP6.9/kg and PhP6.3/kg, respectively. It can be noted that the farmers' Return of Investment (ROI) during the dry season was higher (55%) than during the wet season (49%) planting. The higher ROI during the dry season could be attributed to the good weather condition at harvest time.

Table 4. Comparative cost and return analysis per hectare of irrigated rice farming during wet and dry seasons in Polangui, Albay.

Yield and Income of CFS Graduates	Average Cost and Returns/ Ha	
	Wet Season (June – October, 2015)	Dry Season (Nov 2015 – Apr 2016)
Yield (kg/ha)	4,435.87	5,045.56
Price/kg (PhP)	13.5	13.9
Gross Returns (PhP) (yield × price)	59,945.23	70,298.23
Total Cost/ha (PhP)	30,738.51	31,916.09
Production Cost/kg	6.9	6.3
Net Returns/ha (PhP)	29,206.72	38,382.14
Return on Investment (ROI)	49%	55%

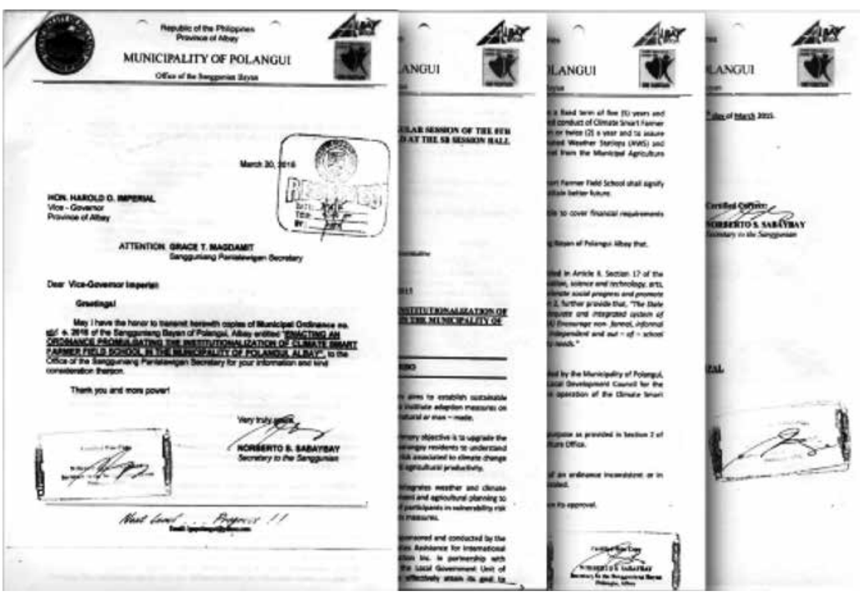
6 Lessons Learnt

Based on BAWP's experience, it was important for project implementers to ensure that the initiatives undertaken by the project through the CFS are sustained after project termination. Hence, the following sustainability mechanisms was adopted.

Passing of Municipal Ordinances to Institutionalize the CFS and the CLEA

To ensure continued implementation of the CFS, the LGUs passed an Ordinance through its Sanguniang Bayan, that institutionalized CFS and the provision financial support, thereof. All three LGUs succeeded in creating this local law, hence, after two years of CFS implementation by the BAWP, the LGUs, through its Municipal Agriculture Service continued to implement the CFS. Agricultural Technicians of the LGUs were assigned to carry out the CFS in other barangays not covered by the project (Fig. 11).

Another local ordinance for the continued implementation and use of the CLEA was passed, through its Sanguniang Bayan. All three LGUs succeeded in creating this law. The passing of the ordinance to adopt the CLEA and provide financial support in its reproduction and distribution was on the 5th year of the project; just before its end.


Republic of the Philippines
Province of Albay
MUNICIPALITY OF POLANGUI

HON. HAROLD O. IMPERIAL
Vice - Governor
Province of Albay

Dear Vice-Governor Imperial

Greetings!

Thank you and more power!

NORBERTO S. SABAYSAY
Secretary to the Sanggunian

Fig. 11. Municipal Ordinance passed in the LGU of Polangui, Albay to institutionalize the CFS

Since the passing of the ordinance would mean additional duties and responsibilities to the major key players at the LGU level and among project partners, it was deemed necessary to set up the implementing rules and regulations. The following agreement was reached by partners.

Roles of Partners in the CFS:

PAGASA

PAGASA shall provide the following services:

- Daily farm weather forecast and advisories for agriculture
- Tropical cyclone warning and advisories
- 10-day regional agri-weather forecast and advisory
- Seasonal forecast and advisories for agriculture
- Extreme climatic forecast and advisories for agriculture (El Niño/La Niña)
- Reception and safe keeping of local climate/weather data for future local weather forecasting capacities.

Office of the Municipal Agriculturist (MA) and the Farmers

- Reports local weather data to PAGASA/receives and disseminates weather forecast advisories from PAGASA
- Provides the necessary farming advice and crop plan adjustments for farmers
- Ensures that forecast and advisories are disseminated to communities and farmers on time
- Delivers the necessary supplemental support service to ensure farm/crop success and sustained livelihoods of farmers
- From the local climate data generated by the Automated Weather Station (AWS), the office of the MAS can establish weather baselines vis-à-vis impacts and eventually develop specific protocols for Disaster Risk Reduction (DRR) in agriculture

Farmers

- Practice recommended adjustments and learning applied from the season-long CFS
- Actively seek farming and weather advisories
- Report weather anomalies and farm trends/challenges for immediate actions

- Share climate information and corresponding farming advisory to other farmers even those who have not attended the CFS

Retooling of the Agricultural Technicians

The Agricultural Technicians also need to perform additional roles in running the CFS. They should equally be retooled to enable them to have working knowledge on climate change science, climate change adaptation and other essential knowledge system necessary to implement the CFS. As such, the ATs were trained through the TOT on CFS. The TOT aimed to enhance their knowledge on climate, climate change scenarios and possible effects to agriculture. This intervention ensured that the Agriculture Technologists are able to adapt to their changing roles vis a vis the implementation and institutionalization for the CFS.

The retooled ATs served as the facilitators and resource persons during the entire duration of the season-long CFS. Resource persons from partner agencies/institutions were invited on special topics and when key hands-on/on-farm activities need to be conducted. The roles of the ATs go beyond facilitating the CFS, to facilitating farmers' meetings for the purpose of monitoring changes in farm practices of farmer graduates.

Module Development

To ensure that instructional materials are available for use by the ATs, especially in upscaling the CFS at the national level, it was deemed necessary to develop and produce CFS learning modules.

Based on BAWP's experience in the conduct of the CFS for two years, the project was able to come up with two volumes of Climate-Smart Farmers' Field School- A Facilitators' Manual, one for Lowland Irrigated Agro-Ecological Zone and the other one is for the Upland Agro-Ecological Zone. The said manuals (Fig. 12) are intended to guide the LGUs especially the Agriculture Technologists who are planning to conduct a CFS in their respective communities (Ravago, et.al., 2017). These modules (Figure 18) are now available in the Bicol Region, and copies of the modules were already passed on to the National Director of the Agricultural Training Institute for nationwide reproduction and dissemination.

Organizing the Farmers

Farmers are difficult to handle and manage if they are not organized. Sustaining their interest to participate and engage in projects after the CFS is also very challenging. Hence, the strategy adopted by the project was to organize the farmers after the CFS implementation.

Farmers were inspired to organize themselves with the assistance of the project staff and ATs. Farmers were made to understand that they have the right to form

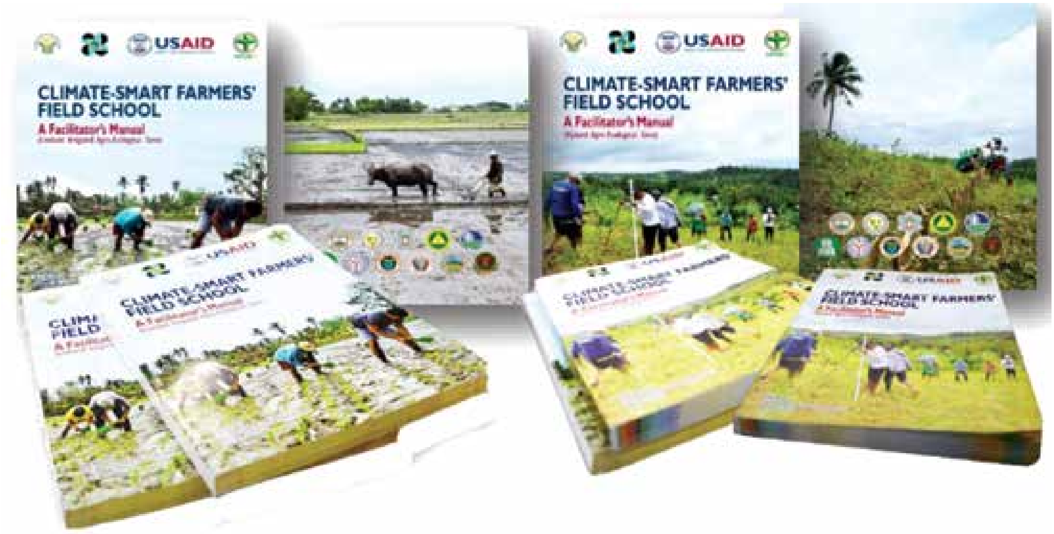


Fig. 12. *The Climate-Smart Farmers' Field School Facilitator Manuals for Lowland Irrigated Agro-Ecological Zone and Upland Agro-Ecological Zone (Source: Ravago, et al., 2017)*

themselves into an organization. Some advantages presented to them include being represented in the board of government agencies'; but more importantly, registered farmers' associations can avail of the different services of the Department of Agriculture like farm inputs and equipment. They were also informed that they can also access some projects from other government agencies and non-government organizations (NGOs); many of which cater for groups; not individual farmers. They were also informed that farmers' association can also be a venue for members to share information and learn from each other. It was also observed from the organized groups that through meetings, trainings and collaboration, new ideas spread faster (Agua, et.al. 2017).\

Sustainable Practices of Farmers' Organizations

The sustainability of farmer organizations is a great challenge. As such, the Project initially focused on developing the group's capabilities and then trained them on livelihood options centered on marketable products.

Introducing Good Governance Processes to Farmer Organizations

Governance is about exercising authority within a framework defined and protected by law with the goal of providing common public goods and services (Subash Dasgupta and Indrajit Roy, 2011). The project implementers believe that the farmers' association has to govern itself. To do so, they were guided in drawing up a written constitution, by-laws and rules to avoid internal conflicts and make the responsibilities of officers and members clear. A written constitution is also necessary to register the group with proper authorities. To facilitate this, the Department of

Box 2. Aspects of good governance introduced and practiced by the farmers' association

Based on Common Reporting Standard and MEAS (2015), the aspects of good governance include:

- **Regular, independent elections :** Group members periodically choose officers to lead the group.
- **Term limits :** These restrict the duration a person may serve in the same office.
- **Transparency :** All information is open and freely available to all. For example, group meetings are open to all members, financial records may be reviewed by any member, and rules and decisions are open to discussion. When activities or decisions are transparent, it is more difficult for individuals to take advantage for their own interest.
- **A constitution :** The group should have a constitution that sets out its goals, functions and basic rules.
- **By-laws :** The group may also decide on by-laws (internal rules) to say how it does particular things.
- **Record keeping :** Good records help the group monitor its progress, review discussions and agreements, keep track of expenses and earnings and prepare financial reports.
- **Good communication :** Good communication among group members helps them to participate in group activities and decision making.

Labor and Employment (DOLE) has a generic template of written constitution and by-laws that was given to the farmers' association upon registration. A farmers' association has adopted the constitution and by-laws of the association and the adoption was put on record.

To institutionalize the good governance process in managing farmers' associations, the BAWP conducted a Leadership and Capacity Building Training for Farmer-Leaders and Agricultural Technicians. This training aimed to develop/enhance the skills, traits and capabilities of the participants. They were also able to identify qualities and characteristics of a good leader and the responsibilities of officers. The participants were taught how to prepare their organizations' vision, mission, goal and objectives (VMGO), minutes of meeting, resolutions and action plans.

As a result of the training, all the ten registered associations have practiced the above elements in running their day-to-day affairs. They have constitutions and

Box 3. Impact of BAWP Leadership Training on Farm Practices

Mr. Jejomar Aguilar, MOCSFA President and Brgy. Councilor of Monte Calvario, Buhi, Camarines Sur was one of the participants to the Leadership Training conducted by BAWP and DA. Subsequently, he authored and successfully passed Barangay Ordinance No. 010 series of 2017 for the practice of synchronous rice transplanting at their barangay using the Climate Forecast and Extension Advisory (CLEA) as guide in determining the schedule of rice planting.

by-laws, and specific terms of office for the elected officials. They now have VMGO statements and action plans, prepared by themselves. Each association conducts regular meetings where members discuss their projects and plans and share good practices in farming. The associations also maintain logbooks including financial transactions and minutes of meetings which are open to members. They have become proficient in making resolutions which are submitted to the LGU, the DA and other agencies to secure support services they need. The practices now obtained are consistent with prescribed governance mechanism for farmers association found in the CRS and MEAS, 2015.

Factors Affecting Sustainable Farmer Organizations

The sustainability of farmer organizations is a great challenge. As such, the BAWP arranged and conducted several activities towards this end. The Project initially focused on developing the group's capabilities and then trained them on livelihood options which centered on marketable products. the following fundamental factors or features led to sustainability of farmer organizations.

Good leadership and commitment of members

It was observed that the commitment of leaders and members to the VMGO of the organization was instrumental in sustaining the activities of their association. The leader must be a role model to the members especially in adopting technologies learned from the Climate Field School (CFS). He/she must be committed in performing the roles and responsibilities as president and should involve members in developing, implementing and monitoring the plans/projects of the association. Members' adherence to the by-laws of the association, cooperation in implementing group projects, and attendance to training-workshops, introducing good practice options in farming and alternative livelihood activities, all contributed to the sustainability of their association.

Fig. 13. *Members of the Dela Fe United Farmers Association and Integrated Sagrada Farmers Association attending Training on Mushroom Production.*

Transparency and accountability of leaders and members of the farmers associations

Within the association they have to practice transparency and accountability by maintaining their accounts which are open and accessible to the members. The leaders also have to report to the members all transactions entered into by the association during their regular monthly meetings. It was observed that these practices developed the trust and confidence among members and keep the organization stable.

The association as an avenue to access services (e.g., farm inputs and equipment) from the DA and others

Another distinguishing mark that makes for a sustainable organization is the perception of members on the organization's ability to draw forth necessary service and support from government and non-government institutions. As noticed from the associations registered with the DOLE, farm inputs and equipment from the DA regional office

became more accessible. An example is MOCSFA which succeeded in availing pre- and post-harvest facilities like hand tractor with trailer, thresher and solar dryer;

Fig. 14. *The Monte Calvario Smart Farmers Association (MOCSFA) receiving a hand tractor with trailer and vermicomposting facilities from the Department of Agriculture Regional Field Office 5.*

vermicomposting and mushroom production facilities; and farm inputs like seeds and fertilizers. In contrast, assisted barangays that did not succeed in organizing a farmers' association failed in obtaining such services. Hence, upon seeing the benefits that organized groups were receiving from DA and other partner agencies; they eventually organized themselves too.

Production and market linkages

A good demand for a farmer organization's produce or products before starting production is a key to its success. Though farmers have been trained to link their products to markets, these were mostly limited to local markets. As such, during the BAWP Farmers' Summit, Farmers Organizations were given space to advertise their produce. This in effect gave timely market information and linked farmers with traders catering to national and regional markets.

The BAWP Farmers' Summit was conducted on July 14, 2017 at Macagang Business Center in Nabua, Camarines Sur. It was attended by 426 project beneficiaries and graduates of the Climate Field School and 56 representatives from project partner agencies, institutions and universities.

The event featured exhibitions of the One Town One Product of the three-project partner LGUs. It provided market matching and promoted local products. It

Fig. 15. *(left to right) Mushroom products from Buhi, vegetables products from Nabua and sugarcane products from Polangui showcased during the Farmers' Summit.*

also showcased good agri-practices and climate resilient strategies of the respective LGUs.

Savings and credit schemes

These have been identified as one of the factors that strengthen farmer organizations. However, the credit scheme should be studied further since it can also be a negative factor in terms of the sustainability of farmer's organization. Some association members failed to pay their loans from the association. The downside of this was that the non-paying farmers stopped attending the activities of the association.

Role of Local Government and National Agencies' Partners in Sustaining Farmer Organizations

The local government and the national agencies' partners like the DA and academe play a great role in sustaining farmer organizations. The LGU has been promoting a savings culture, which is seen as the seed for autonomy of farmer organizations and a means to overcome the chronic lack of funds and inputs for small-scale farmers. Savings not only help finance production, but also strengthen bonding and harmony among members, as they try to protect one another's savings. As a result, most of the farmers associations have improved farmers' access to capital by combining the traditional merry-go-round system with savings and credit schemes. The "merry go round system" practiced by members is termed "paluwagan", though with addition of savings and credit scheme. The farmers have their "paluwagan" and a portion of it goes to their savings of the association. Part of the members' monthly contributions in this system is paid out to members as dividends, while the other portion goes into a savings scheme.

Another remarkable role of the local government and partners was illustrated in the change of planting behavior in certain areas. Because La Medalla is prone to drought, the BAWP with the DA provided a Small Farm Reservoir (SFR) for the barangay. The SFR became famous as the association members were able to plant even during the dry season and grow fruit trees and vegetables in an otherwise harsh environment. As this organized farmers' association is recognized by the LGU, it was also given a seat in a committee involved in local government planning and budgeting. Hence, farmers' voices are heard in terms of prioritizing projects and in appropriating funds. Clearly, this mechanism espoused by LGU encourages a more participatory planning process.

On the other hand, the academe partners have a mandate to carry out extension activities. They have been involved in making farmers' associations competent in technology promotion and adaptation particularly with the use of the CAMDT and CLEA as decision support tools for climate change adaptation in farming. National agencies like the DA are sources of services like post-harvest facilities for the registered farmers' associations in the BAWP site. To make the system more robust, a monitoring mechanism may be established to monitor implementation of policies of the famers' association.

From the above experience, it was learnt that strengthening farmer organizations' governance is affected by several factors. One is the presence of partner organizations assisting farmers in the organizational development process. In BAWP's experience, providing assistance in organizing and registering the associations with DOLE has started the organizational strengthening process. Trainings on leadership and capability enhancement of both leaders and ATs help set the directions of their associations especially in formulating their VMGO and action plans. Partnerships with agencies that facilitated access to resources have also proven to ignite farmer organizations' desire to sustain their operations. Above all, the commitment, transparency and accountability of leaders and members of the farmers' associations are keys to effective governance. Farmer leaders must be role models of good governance and must enhance participatory and consultative decision making process to erase doubts among members in all transactions entered into by the association, and to encourage mutual accountability between and among members and leaders.

7 Supporting Narrations and Images

Narratives of Trainers on shared experiences

Changes in the tasks of the ATs with the institutionalization of the CFS need to be well understood by technicians involved in the project. To better understand the change in roles mentioned above, it is useful to know from the ATs themselves on how they carried out their tasks.

Mr. Jonel Llagas, AT/Training Coordinator/Facilitator of CFS in Balangibang, Polangui, Albay said:

"I was able to use my knowledge gained from the training activities conducted by PAGASA in assisting to update the CFS modules; the knowledge and skills learned from the TOT for CFS Implementation was used in facilitating the field school in barangay Balangibang, Polangui, and in teaching my farmer clients in the field how to do the weather hazards mapping and prepare the cropping calendar. This know-how enabled the farmers to adjust their schedule of planting rice, so when typhoon Nina occurred, it was still in the seedling stage, thus the risks brought about by this super typhoon was minimized." He added that, "I put more emphasis on helping the farmers organize themselves and have their organization registered with the Department of Labor and Employment (DOLE). On my part, it is easier to disseminate information on weather conditions, water availability, inputs available for distribution such as seeds, and other useful information such as changes in schedule of meetings. Even after the CFS, they still continue to practice what they have learned and I can easily monitor them. On the part of the farmers, information-sharing which is an important factor to enhance technology adoption can be easily facilitated and they have realized that one of the benefits of a registered organization is its access to government projects/programs geared towards introducing improved agriculture and water management practices. I am continuously receiving weekly forecast from PAGASA which I use as the weatherman in the LGU (Polangui) Municipal Agriculture Services (MAS) weekly radio program at the Radio Progreso, 90.5 FM. I am also one of the contributors to the CLEA . My anticipatory approach in managing my activities as an AT, is an immense help to farmers and other stakeholders for they too, become anticipatory in managing their farming practices and other livelihood activities, thus minimizing losses or reducing the impacts of climate-related hazards."

Mrs. Maria Salome Laynesa, AT/Facilitator of CFS in San Esteban, Nabua, Camarines Sur, had this to say :

"Now that I am more equipped with the knowledge on climate change and its impact to food security, I become more computer literate in terms of preparing my reports; compiling my records of recommendations and information on climate- related and other hazards; preparing cropping calendar; and doing research on climate change. This way I can easily go back to my files and prepare recommendations or measures that need to be taken to mitigate the harmful effects of climate-related risks at the field level. She added that, "I strongly support farmers efforts to be organized, and to have their organization registered with the DOLE, not only for material benefits but, it would be easier to let them understand that managing risks proactively is not only my task, it's theirs, too. If they are organized it is likely that a farmer-member will be teaching a fellow farmer through information-sharing the importance of religiously following recommendations to address the impacts of climate change."

Mrs. Sylvia San Luis Oaferina, AT/Facilitator of CFS in Monte Calvario, Buhi, Camarines Sur considered BAWP as an innovation. She expressed her view of change in roles in the context of her BAWP experience this way:

"To facilitate farmers' learning process of improved agriculture, climate risk management and water management practices and technologies were among the challenges confronting an AT like me, who has been a witness to farmers indifferences when it comes to learning. But I was wrong, the farmer-participants were enthusiastic, and eager to learn. I was only expecting 30 of them, but more came. Wives were sent as their representatives when they couldn't attend the sessions. They enjoyed doing exercises on cropping cum hazard calendar, typhoon tracking, cost and return analysis and more. They were motivated to organize themselves. On my part, I felt much more confident about myself and my abilities to carry on, up to the second season even after the CFS. I know my BAWP experience was one of several factors that caused my becoming an awardee in the DA's Agricultural Extension Worker Category in 2015. What is more important, I come to know more farmers from other barangays and Monte Calvario, because of the CFS, has adopted me as its AT."

Mrs. Elsa Cabrera, AT/Facilitator of CFS in De La Fe, Buhi, Camarines Sur, shared her idea of change in roles in the context of her BAWP experience:

"It was a pleasure facilitating the CFS. I have been used to the FFS curriculum, and anything new in terms of information and knowledge integrated to

the curriculum is interesting and always a challenge. The same feeling was shown by the farmer-participants as they tackled the 24 sessions for almost six months. Even after the CFS, during farmers' meetings their interest is still there, that's why we continuously conduct training activities, assist them in the process of technology adoption and discuss with them the CLEA. This way, I am not only helping the farmers address the impacts of climate change, I'm also helping myself by adapting a proactive approach in my roles as an AT and in managing climate risks. Everybody knows the difficulty of experiencing losses and damages after a strong typhoon, flood or draught, if we can do something about these, then let's do it."

8 Case Stories of Successful Farmer – Beneficiaries in Technology Adoption

CASE STUDY #1: Climate Field School: Opportunities for livelihood improvement

Mr. Jejomar Aguilar, CFS graduate of Barangay Monte Calvario, Buhi, Camarines Sur.

Mr. Jejomar Aguilar, 41 years of age, married, and a graduate of BS Marine Transportation did not only gain additional knowledge from his participation in the Climate Field School – Bicol Agri-Water Project (CFS-BAWP) in 2013 but also gained the necessary attitude and skills needed to improve the implementation of an integrated farming system in his farm in barangay Monte Calvario, Buhi, Camarines Sur. He is not new to the different varieties of rice (certified, registered, hybrid, inbred) as he has been using these in his half a hectare irrigated and one hectare rainfed rice farm for two cropping seasons. Applying what he learned from his CFS classes he started using the wet season hybrid, certified/ registered varieties of high yielding GSR lines (GSR 5, 8) and those with better eating quality like the SL 8, Bigante and BH 82 and during the dry season he uses hybrid varieties of the same qualities.

He also uses organic fertilizer and pesticide in rice production. In his 4 parcels rainfed area, 1 parcel is used for organic farming and 3 parcels are on trial for organic farming. During the wet season with the high incidence of pest, he uses inorganic pesticide. With these new practices, he has noticed an increase in yield; 10 cavans were added to the 120-130 cavans from his 1.5 hectares during the wet season, while during the dry season, 15-20 cavans were added to his 150-160 cavans harvest.

Apart from rice production, Mr. Aguilar is into piggery. He has 9 breeders and 10 to 30 heads fattening. He has a 2.5-hectare coconut and vegetables and another 1.5 hectare abaca fruit and non-fruit bearing trees.

Two technologies, which according to Mr. Aguilar are very significant are mushroom production and vermi-composting. He and his wife started mushroom production using rice straw in 2014 (1st season) with 200 pieces of fruiting bags. After four months, they were able to harvest 80 kilograms, (50kgs sold at Php200/kg; 30kgs consumed). The second season in February 2015, with 300 pieces of fruiting bags, they harvested 100 kilograms (50% sold at same price; 50% consumed). The third season in July 2015 and with 600 pieces of fruiting bags their total harvest was 250 kgs (50% sold at same price; 50% consumed). March 2016 which was the fourth season, with 400 pieces of fruiting bags gave a total harvest was 150 kilograms (50% sold at same price; 50% consumed). The fifth season started in October 2016 and is still ongoing with 700 pieces of fruiting bags they had an initial harvest of 30 kilograms.

Mushroom production a reliable source of additional income to his family and is now part of his family's nutritional diet.

Mrs. Judith S. Aguilar helps her husband in their mushroom production

They also started their vermi-composting in January 2016 with one bed and one kilogram vermin worm. To date, with three participating farmers, they have four beds with around 10 kilograms of vermi-worms. They have been able to harvest 3 bags of vermi cast every 2 to 3 months. They are now using vermi-compost, fermented plant juice, fermented fruit juice and organic pesticide (ginger, onion, garlic, and chili) in vegetable production.

Mr. Aguilar recognizes the value added of mushroom production and organic farming as alternative livelihood for farmers. He intends therefore to make these technologies permanent components of his sustainable integrated farming system to enable him to cater to the needs not only of his family but also of his fellow farmers and other community constituents.

Aside from being a farmer, Mr. Aguilar is a barangay kagawad and the President of Monte Calvario Smart Farmers Association (MOCSFA), a DA-assisted organization which was organized through the BAWP. He knows that out of the farmer-attendees of the CFS-BAWP in Buhi, he is one of those who practices the technologies learned on rice production, the only one using organic fertilizer and pesticide in vegetable production, and among the few farmers practicing organic vegetable production with vermi- composting facilities. With these data, Mr. Aguilar concluded that the CFS-BAWP is an immense help in upgrading the capability of farmers toward better quality lives.

CASE STUDY #2: Integrating Modern Rice Farm Practices in Bicol

Mr. Felimon Sarto together with his family in Barangay Sagrada, Buhi, Camarines Sur

Felimon Sarto or Pay Imon, 61, is a full-time rice farmer in Barangay Sagrada, Buhi, Camarines Sur. He is married to Milagros, 61 years old. They have 11 children, two of whom are in college pursuing agriculture courses. Pay Imon is a first-year high school drop-out while his wife is an elementary graduate. He is a respected leader in his community. He is Barangay Chairman and currently the Barangay secretary of Sagrada. He is also the President of the Integrated Sagrada Farmers' Association (ISFA) which was organized and registered to the DOLE through the initiative of BAWP.

He was introduced to the BAWP during the initial year of its implementation in 2012 when he was randomly selected as one of the respondents for the project's benchmark survey. He was eventually selected as one of the participants of the CFS project.

He acknowledges that there were remarkable changes in his rice production after attending the CFS. Before the CFS, he was using good seeds and inbred rice varieties in his three-hectare rice farm, but after attending the CFS, he shifted to the Green Super Rice (GSR) lines 1, 2, and 8 (due to high yield and its other good characteristics. The GSR is multi-trait rice lines suitable to drought, flood and in saline affected areas). Because of this, he gained additional 20 cavans per hectare for the wet and dry seasons. He reported an increase from 70 cavans to 90 cavans/ha during the wet season using GSR 1 and from 90 cavans to 110 cavans/ha during the dry season using GSR 2 and 8. His net income also increased from Php 20,000 to Php 35,000 since his cost of production was reduced with the use of home-made organic fertilizers and pesticides, which he also learned from the CFS.

Traditionally, he was using six bags of chemical fertilizers but after the CFS, he reduced the use by half and shifted to the use of home-made fermented plant juice and Indigenous Micro-Organisms (IMO). He also continued planting inbred rice in his half hectare farm during wet season since it is resistant to lodging. Because of the beneficial effects of the FPJ and IMO to his rice crop, Pay Imon continuously promotes the technology not only to the members of ISFA but also to other farmers within the barangay.

Currently, there are 32 farmer-adopters of the organic technology influencing around 245 hectares in the community. Pay Imon also produces vegetables using organic inputs.

With his additional income, he was able to start up a swine project with 2 breeders and 4 fatteners, and during his free time, he works on some upholstery projects.

CASE STUDY #3: Shifting to Organic Fertilizer by Adopting Vermi-culture Technology

Nilda Galon, 57, is a local farmer in Barangay Malawag, Nabua, Camarines Sur. She is a CFS graduate of BAWP and an active member of the Farmers Association in Barangay San Roque Madawon, Nabua.

Ms. Nilda Galon monitoring her vermiculture bed

She was informed about the BAWP on its 1st year of implementation in 2012 by the Agricultural Technician of Nabua

According to her, before the BAWP, she was an active participant in the seminars and trainings conducted by the Municipal Agriculture Office (MAO) of Nabua. She is also a member and the Business Manager of the Organic Farmer Association, Board member of Organic Vegetable Association and Auditor of the Corn Association of Nabua.

She equally indicates that after the CFS, she already knew how to record her farm expenses and how to properly apply chemical fertilizers and pesticide. She also learned that after harvesting, it is better to practice fallow period before planting for another season.

Vermiculture is one of the topics discussed during the CFS which coincidentally is also one of the priority projects of the MAO of Nabua. Having learned about Vermi-composting, Nay Nilda started engaging in Organic Agriculture and established a vermi-composting plot. She says that she started it with only a kilo of vermi- worms. She cultured the worms with proper proportions of nitrogen and carbon. She also used dry mango leaves, madre de cacao, ipil-ipil and manure as feeds for the worms (African Night crawler). The produced vermi-cast was then used as fertilizer in her farm. She used one sack of inorganic fertilizer instead of two, after applying vermi-cast.

She plants GSR 8 rice seeds that have superior rice grain quality per panicle. She equally uses NSIC 222, 134, and Vietnam variety of rice and she has had an increase in yield harvest.

The African Nightcrawler that produces vermicast

Nilda Galon, says she also uses and adapts the good practices options (GPOs) in the Climate Forecast and Extension Advisory (CLEA) provided by the project.

Aside from applying it in rice, she is also applying vermi-cast to her backyard fruits, ornamentals, and backyard vegetables such as string beans, gabi, and eggplants. She is also engaged in a business where she sells her harvested milled rice.

The money earned from farming, she invests in her piggery and part of it is used for the studies of her son.

She is thankful to the project for all the lessons shared during the CFS, and because of that she used and adopted everything she learned in her own farm.

CASE STUDY #4: Climate Field School Technologies Towards Better Quality of Life

Mr. Bayani Abarquez with his wife and his younger son

Mr. Bayani Abarquez, 47, is a farmer of Barangay Balangibang Polangui, Albay. With farming as his main source of income, he tries to meet the needs of his family of four. He is an innovative farmer who tried different technologies learned in the CFS implemented by the BAWP in partnership with the DA-RFO 5, LGU Polangui and Bicol University to improve his farming.

In 2013, Mr. Abarquez was invited to a meeting where he learned about the CFS from the Agricultural Technologists Mr. Jonel Llagas and Mr. Cesar D. Sandro Jr. As a farmer who wanted to improve on his skills and knowledge and Abarquez didn't hesitate to join the CFS.

The CFS, helped him to understand the differences between traditional and modern way of farming, especially the impact of climate change and weather on agriculture. Before attending the CFS he often used a lot of chemical pesticides and synthetic fertilizers and this did not improve his yield. He knew nothing about cropping calendar, synchronous planting and fallow period after harvest which led pests to infest his farm.

Planting of rice seedlings using mechanical rice transplanter at Mr. Abarquez's farm in Barangay Balangibang, Polangui, Albay

After attending CFS for two seasons, Mr. Abarquez was able to change his way of farming. Now, he uses hybrid rice varieties; he also uses the cropping and hazard calendars in deciding when to plant. He also practices synchronous planting and fallow period after harvest along with the other farmers in Barangay Balangibang, Polangui, Albay. He is now using mechanical transplanter in transplanting rice seedlings which has helped him to reduce the cost of labor in planting.

Though he still uses synthetic fertilizer, it is minimal with alternate application of organic foliar fertilizers and soil conditioner. Abarquez no longer uses chemical pesticide, but he instead practices the Integrated Pest Management and applies fermented juices made from sili, neem tree and madre de cacao to control pests in his farm. He has also tried the mechanical harvester and realized that it is more economical than the manual way of harvesting, unfortunately it is not available in the area.

Mr Abarquez's Sari-sari store and his two storey house in Barangay Balangibang, Polangui, Albay

With the new farming practices, Abarquez has realized a bumper harvest of 150-180 cavans/ha compared to 80 cavans/ha earlier. According to him, this is because of the new knowledge from the CFS. The proceeds from his farms have helped him to construct a two-storey house. He was also able to improve his Sari-sari store.

He has promised to continue to adopt what he learnt in the CFS as well as share the knowledge with other farmers in the community.

9 Recommendations

To ensure sustainability of CFS gains, it is recommended that the DA in the Philippines adopts the CFS as a research cum extension modality. Through the CFS, the DA and the MAOs can effectively educate farmers on CC and CCA to ensure that they can adapt to climate change and cushion its impacts on their farm productivity. The DA can conduct a nationwide TOT to agricultural technicians of LGUs using the CFS Modules developed by the BAWP. Sound monitoring and evaluation of the CFS should be carried out to ensure that the goals of the project and its impact on water and food security are achieved.

For the LGUs

- **Monitor farmer groups continuously** (especially those that are not yet well-established) and provide information and education assistance on new science applications including climate-related technologies.

- **Grant incentives** to further boost the sustainability and increase performance of farmer organizations.

- **Arrange for regular consultations** among SUCs, concerned agencies, and farmers' associations to ensure that farmers especially leaders are well-informed and updated on the latest innovations and climate-related information. This can be done by expanding the coverage of telecommunication networks in the countryside to enable quick feedback. Mechanisms in forging partnerships and formal tie-ups between farmer associations and concerned agencies have to be done through local policy formulation and/or legislation and given budget appropriations.

For State Universities and Colleges

Sustain the technical support through research and extension programs

Farmer organizations will continually be challenged by climate change and the extreme events, market failures and other unforeseen events that may need technologies from external sources aside from the LGUs alone. SUCs can link the organizations to the appropriate government and even non-government agencies to meet such challenges.

Establish a monitoring system

For regular and continuous conduct of farmers' meetings, effective monitoring and evaluation of organizations' programs and projects, record-keeping and reporting must be fully practiced by farmer organizations to strengthen their internal governance, accountability and viability.

For the Farmers / Farmer Organizations

Sustain the initiatives and projects that were established through the project

It is important for farmers to continue implementing the livelihood projects established through the CFS and to adopt the good agriculture practices learnt through the CFS for them to reap the benefits from the project, including better yield and income and being able to plant or become productive even during extreme climatic events.

Practice transparency and good governance in the farmers' organization

It is always important to ensure that farmers have the trust and confidence to its officers and other members so that the operation of the organization will be sustained. No amount of good projects will prosper with poor governance.

Research Collaborators / and their Contact details

Cely S. Binoya is currently the Executive Director of the Asia Pacific Association of Educators in Agriculture and Environment. She finished her Ph.D. in Extension Education at the University of the Philippines, Los Baños, Laguna in 1992 and took courses on Climate Science and Disaster Risk Management at the World Bank Institute and the Earthquakes and Megacities in 2010. She worked for 37 years (1978 – 2015) as faculty member of the CBSUA. She was Professor VI and Dean of the Graduate School when she retired. Her works are on climate risk management and disaster preparedness in agriculture and fisheries from 2009-2015 funded by FAO-DIPECHO. Email address: *celybinoya2@gmail.com*

Elena B. Delos Santos is the 11th Regional Executive Director of the Department of Agriculture Regional Field Office 5 (DA RFO-5), Regional Project Director of the World Bank funded Philippine Rural Development Project (PRDP), Regional Focal person of Bottom-Up Budgeting (BUB) and Co-Project Director of the BAWP. She finished her Bachelor's degree in Agriculture major in Animal Husbandry at CBSUA. She obtained a Master's Degree in Animal Science from UPLB and a Doctor's degree in Development Management from the Bicol University (BU). Email address: *ebdsa2002@yahoo.com*

Antonio P. Payonga is Dean of BU Graduate School. He was formerly Dean of Bicol University College of Agriculture and Forestry (BUCAF) and Director of the BU Extension Service Center. Dr. Payonga earned his Ph.D. in Agronomy from UPLB. He is lecturer and resource person in various topics such as agronomy, sustainable agriculture, farming systems, upland rice and organic farming. Under BAWP, Dr. Payonga serves as Co-Project Investigator and Upland Agriculture Specialist. Email address: *appayonga@bicol-u.edu.ph*

Rodel P. Tornilla is OIC-Regional Technical Director for Operations and Extension at the DARFO 5 and is the Extension Specialist of BAWP. He graduated cum laude at Camarines Sur State Agricultural College (CSSAC), now CBSUA at San Jose, Pili, Camarines Sur with a Bachelor of Science in Agriculture, Major in Agricultural Economics. He finished his Master's Degree in Applied Business Economics, Major in Food Systems Management at the University of Asia and the Pacific at Ortigas Center, Pasig City as an Expanded Human Resource Development Program (EHRDP) scholar. Email address: *rodel_tornilla@yahoo.com*

Annalyn O. Agua is a Project Assistant of BAWP. She earned her Bachelor's Degree in Environmental Science major in Pollution and Waste Management at the Central Bicol State University of Agriculture (CBSUA) and currently undergoing studies for a Master of Science in Disaster Risk Management in the same university. She previously worked as Research and Project Assistant of Central Bicol State University Development Organization, Inc. for the project Lake Buhi: State of the Environment; UNESCO- CBSUA project Strengthening the Management Board of the Mt. Isarog National Park (MINP) and Reviewing Existing Protection Mechanism; and FAO–CBSUA project Strengthening Capacities for Climate Risk Management and Disaster Preparedness in Selected Provinces of the Philippines (Bicol Region)". Email address: *olanoannalyn@gmail.com*

Sarrah D. Sambajon is a faculty member at BUCAF. She teaches agronomy, sustainable agriculture, farming systems, postharvest and organic farming. She is a Project Assistant of the BAWP. She earned her Bachelor of Science in Agriculture Major in Crop Science from thr BUCAF and finished her Master's Degree in Agronomy at BU. She has been involved in extension cum research projects of BU's Conservation Farming Villages (CFV) Project from 2009-2012. Email address: *sambajon.sd@gmail.com*

Kim Jonah O. Bolivar, is a Project Assistant of BAWP And a licensed Agriculturist. She finished her Bachelor's Degree in Agriculture major in Animal Science at CBSUA. She is also a National Certificate II passer for Animal Production. Email address: *kimjonahbolivar@gmail.com*

Edlynne Kaith P. Ravago, the Project Associate for Field Operation of BAWP, is a licensed forester. She graduated cum laude at BUCAF with a BS degree on Forestry

major in Agroforestry. She is currently taking up MS Resource Management major in Environmental Management at CBSUA. She previously worked as Forester at the Environment, Disaster Management and Emergency Response Office of the Provincial Government of Camarines Sur and as Research Associate for Climate Change and Disaster Risk Mainstreamed-Comprehensive Land Use Plan at People's Participation for the Advancement of Economic Prosperity Foundation Incorporated. Email address: *ekaithravago@gmail.com*

Agnes C. Rola is Professor at the University of the Philippines Los Baños (UPLB), former Dean of the College of Public Affairs and Development, UPLB, and member of the National Academy of Science and Technology-Philippines (NASTPHIL). She has degrees in Statistics (BS) and Agricultural Economics (MS) from the UP; and Ph.D. in Agricultural Economics (Major in Natural Resource Economics) from the University of Wisconsin Madison, USA. She has more than 30 years' research experience in sustainable agriculture and natural resource management and has authored more than 100 scientific publications on the economics, policy and institutional aspects of agricultural sustainability. Email address: *acrola@up.edu.ph*

Links to Supporting Documents / Materials

- Agnes C. Rola | University of the Philippines Los Baños, Los Baños... https://www.researchgate.net/profile/Agnes_Rola
- https://ph.usembassy.gov/tag/bicol-agri-water-project/
- http://www.manilatimes.net/us-completes-p76-m-bicol-agri-water-project/341007/
- https://www.usaid.gov/philippines/energy-and-environment/bawp
- http://bicol-u.edu.ph/bu/thebuzzette/news/butDJKQ35euhg
- http://www.bicolstandard.com/2017/07/us-funded-bicol-agri-water-project.html
- https://cpaf.uplb.edu.ph/index.php/2012-09-07-06-09-58/cpaf-updates/cpaf-news/324-from-beneficiaries-to-partners-ats-in-bicol-present-project-outputs

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Other Partners

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References

Cole, Daniel A. 2008. Climate Change, Adaptation, and Development, 26 UCLA J. ENVTL. L. & POL'Y 1, 3

Godtland, Erin M., Elisabeth Sadoulet, Alain de Janvry, Rinku Murgai, and Oscar Ortiz, 2004. "The Impact of Farmer Field Schools on Knowledge and Productivity: A Study of Potato Farmers in the Peruvian Andes," Economic Development and Cultural Change 53, no. 1 (October 2004): 63-92. http://www.journals.uchicago.edu/doi/full/10.1086/423253

Golez, Ronaldo. 2012. Agriculture and Development Notes on Climate Change Adaptation. Climate Field School: An Innovative Approach to Agricultural Adaptation**.** Vol. 2 No. 2 Dumangas, Iloilo

Gwary, G.M. Fatsuma A. Muhammad and Shettima B. Mustapha, 2015. "Review of Farmer Field Schools Approach to Extension Service Delivery: Utilization and Impact in Nigeria" World Journal of Agricultural Sciences 11 (4): 229-238, 2015. https://www.idosi.org/wjas/wjas11(4)15/8.pdf

K. Davis,E. Nkonya,E. Kato,D.A. Mekonnen,M. Odendo,R. Miiro,J. Nkuba. 2012, "Impact of Farmer Field Schools on Agricultural Productivity and Poverty in East Africa." World Development. Elsevier. http://www.sciencedirect.com/science/article/pii/S0305750X11001495

Khisa, Godrick Simiyu, James Okoth and Erin O´Brien. 2014. "Farmer Field Schools: Key Practices for DRR Implementers". FAO,

Reilly, J. M. and D. Schimmelpfennig. 1999. "Agricultural Impact Assessment, Vulnerability, and the Scope for Adaptation," Climatic Change, Vol. 43, No. 4, December, pp. 745-788.

Rola, A.C., J.B. Quizon and S.B. Jamias. 2002. Do Farmer Field School Graduates Retain and Share What They Learn?: An Investigation in Iloilo, Philippines. Journal of International Agricultural and Extension Education, Volume 9, No. 1 pp.65-76.

Schneider, S.H., S. et.al. 2007. Executive summary. In (book chapter): Chapter 19: Assessing Key Vulnerabilities and the Risk from Climate Change. In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds.). *Print version:* Cambridge University Press*, Cambridge, UK. This version: IPCC website.* ISBN 978-0-521-88010-7. Archived *from the original on 2 May 2010*. Retrieved 2010-04-06.

Subash Dasgupta and Indrajit Roy, 2011. Training Manual on Good Agricultural Governance: A resource guide focused on smallholder crop production. Food and Agriculture Organization of the United Nation, Regional Office for Asia and the Pacific, Bangkok, Thailand.

FAO, 2008. FFSs on Integrated Pest Management for Cotton in India. Rome Accessed July 25

Farmers and Climate Change: A Cross-National Comparison of Beliefs and Risk Perceptions in High Income Countries. http://www.researchgate.net/publication/275277952_Farmers_and_Climate_Change_A_Cross-National_Comparison_of_Beliefs_and_Risk_Perceptions_in_High-Income_Countries

Farmer Field School Guide Document: Planning for quality programmes. FAO, 2016. http://www.fao.org/3/a-i5296e.pdf

Farmer Field Schools in the Agricultural Extension Component (2006-2012): Integrated Crop Management LEARNING BY DOING LEARNING BY EXPERIENCE. Agricultural Extension Component (AEC) - Agricultural Sector Programme Support (Phase 2). April 2011 http://bangladesh.ipm-info.org/library/documents/aec_ffs_process_documentation.pdf

http://www.epa.gov/climatechange/impacts-adaptation/agriculture.html

https://en.wikipedia.org/wiki/Climate_change_adaptation#cite_note-2

http://www.climate.org/resources/climate-impacts/agriculture/index.html

http://www.r1phils.net/CRFS.html

http://ati.da.gov.ph/ati-6/features/8302017/enhanced-climate-smart-farmers%E2%80%99-field-school-ecsffs-fighting-good-fight-towards

https://reliefweb.int/report/world/helping-farmers-adapt-climate-change

https://www.oxfam.org.au/wp-content/uploads/2015/07/2015-12-CC-case-study_phil_FA.pdf

http://ati.da.gov.ph/ati-6/features/8302017/enhanced-climate-smart-farmers%E2%80%99-field-school-ecsffs-fighting-good-fight-towards

http://www.climatechange.searca.org/index.php/climate-change-adaptation-knowledge-showcases/1244-climate-field-school-an-innnovative-approach-to-agricultural-adaptation

https://public.wmo.int/en/resources/meteoworld/climate-field-schools-indonesia. Climate Field Schools in Indonesia. Meteoworld : September 2015

https://en.wikipedia.org/wiki/Farmer_Field_School

Asia-Pacific Association of Agricultural Research Institutions

Asia-Pacific Association of Agricultural Research Institutions (APAARI) was established in 1990 at the initiative of Food and Agriculture Organization of the United Nations and most of the National Agricultural Research Systems (NARS) of the Asia-Pacific region. Its mission is to promote the development of National Agricultural Research Systems in Asia-Pacific region through facilitation of inter-regional, inter-institutional and international partnerships.

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- Promote the exchange of scientific and technical information
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- Promote human resource development and capacity building
- Build up organizational and management capabilities of member institutions
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- Asia-Pacific Symposium on Molecular Breeding 1-3 October 2013 – Proceedings
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- Workshop on Climate-Smart Agriculture in Asia: Research and Development Priorities: Proceedings and Recommendations (2012)
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- Regional Workshop on Implementation of Suwon Agrobiodiversity Framework: Proceedings (2012)
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- Workshop on Moving Beyond Strategy to Improve Information and Knowledge Management for Agricultural Development in the Pacific Islands Countries and Territories: Proceedings (2012)
- Stakeholders' Interface on GM Food Crops : Proceedings and Recommendations (2011)
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- International Symposium on Sustainable Agricultural Development and Use of Agrobiodiversity in the Asia-Pacific Region (2010)
- APAARI-ADB Asia-Pacific Consultation on Agricultural Research for Development (AR4D) in Asia and the Pacific-The Way Ahead (2009)
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- Symposium on Global Climate Change : Imperatives for Agricultural Research in Asia-Pacific (2008)
- Expert Consultation on Agricultural Biotechnology for Promoting Food Security in Developing Countries (2008)
- Workshop on Development and Management of ARD Information Resources (2008)
- Asia-Pacific Regional Workshop on Agricultural Research for Development (2008) (for establishment of NGO Consortium-NAARAP)
- Expert Consultation to Review Progress of Agricultural Research Networks and Consortia in Asia-Pacific (2007)
- ICT/ICM Sensitization and Awareness Building Workshop for NARS Leaders and Senior Managers (2007)

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- ITC e-Choupal – Innovation for Large Scale Rural Transformation : A Success Stories (2014), Joyoti Chaliha and Shoma Bhattacharya
- Wax Apple Industry in Taiwan : Success Stories (2014), Chi Cho Huang *et al.*
- Agricultural Information and Knowledge for All : Success Stories on ICT/ICM in AR4D in Asia and the Pacific Region (2013)
- Linking Farmers to Market: A Success Story of Lettuce Export from Chinese Taipei (2012), Min-Chi Hsu *et al.*
- Biofuel Growers Market Network (2012), K. Narayan Gowda
- Success Stories on ICT/ICM in AR4D in Asia and the Pacific Region, Malcolm Hazelman and S. Attaluri
- Short Duration Mungbean: A New Success in South Asia (2010), M.L. Chadha
- Taro Improvement and Development in Papua New Guinea (2009), Abner Yalu *et al.*
- Cotton-Wheat Production Systems in South Asia: A Success Story (2008), C.D. Mayee *et al.*
- Linking Farmers to Market: Some Success Stories from Asia-Pacific Region (2008), Rosendo S. Rapusas *et al.*

- Rainbow Trout (Oncorhynchus mykiss) Culture in the Himalayan Kingdom of Nepal (2005/1), A.K. Rai *et al.*
- Sustaining the Green Revolution in India (2004/3), S. Nagarajan
- Lentil Improvement in Bangladesh (2004/1), Ashutosh Sarker *et al.*
- Success Story on the Control of Newcastle Disease in Village Chickens (2003/1), Robyn Alders
- Hybrid Rice in China - A Success Story (1994), Lou Xizhi and C.X. Mao
- Tilapia Farming in the Philippines - A Success Story (1994), Rafael D. Gurrero III
- Dairying in India - A Success Story (1994), R.P. Aneja

Status Reports

- Jackfruit Improvement in the Asia-Pacific Region: A Status Report (2012)
- Information and Communication Technologies/Management in Agricultural Research for Development in the Asia-Pacific Region : A Status Report (2011)
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- Commercialization of Bt-Corn in the Philippines (2005)
- Information and Communication Technologies in Agricultural Research for Development in the Asia-Pacific-Region (2004)

Other Publications

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- High Level Policy Dialogue on Investment in Agricultural Research for Sustainable Development in Asia and the Pacific : Abstracts of Presentations (2015)
- High Level Policy Dialogue on Investment in Agricultural Research for Sustainable Development in Asia and the Pacific : Scoping Paper (2015)
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- 12th Asian Maize Conference 'Maize for Food, Feed, Nutrition and Environmental Security' : Abstracts (2014)
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